eTendering System Government of Kerala

Tender Details

Date : 02-May-2023 02:09 PM

Print

Basic Details

Organisation Chain	ANERT		
Tender Reference Number	ANERT-TECH/137/2023-T6		
Tender ID	2023_ANERT_574308_1		
Tender Type	Open Tender	**Form of contract**	EPC Contract
Tender Category	Works	**No. of Covers**	2
General Technical Evaluation Allowed	No	**ItemWise Technical Evaluation Allowed**	No
Payment Mode	Online	**Is Multi Currency Allowed For BOQ**	No
Is Multi Currency Allowed For Fee	No	**Allow Two Stage Bidding**	No

Payment Instruments

	S.No	Bank Name
Online Bankers	1	SBI MOPS

Cover Details, No. Of Covers - 2

Cover No	Cover	Document Type	Description
1	Fee/PreQual/Technical	.pdf	PQ Documents
		.pdf	Technical Bid
		.pdf	Pre Agreement and Signed Tender Document
2	Finance	.xls	Financial Bid
		.pdf	Financial Bid

Tender Fee Details, [Total Fee in ₹ * - 11,800]

Tender Fee in ₹	11,800		
Fee Payable To	Nil	**Fee Payable At**	Nil
Tender Fee Exemption Allowed	Yes		

EMD Fee Details

EMD Amount in ₹	5,00,000	**EMD through BG/ST or EMD Exemption Allowed**	Yes
EMD Fee Type	fixed	**EMD Percentage**	NA
EMD Payable To	Nil	**EMD Payable At**	Nil

Work /Item(s)

Title	Request for Selection of agency for the Design, Supply, Installation, Testing, Commissioning and Maintenance of Public Electric Vehicle Charging Station at various locations in the Solar City of Thiruvananthapuram (funded by SCTL)				
Work Description	Request for Selection of agency for the Design, Supply, Installation, Testing, Commissioning and Maintenance of Public Electric Vehicle Charging Station for ANERT at various locations in the Solar City of Thiruvananthapuram				
Pre Qualification Details	Please refer Tender documents.				
Independent External Monitor/Remarks	NA				
Tender Value in ₹	10,00,00,000	**Product Category**	Electrical Works	**Sub category**	NA
Contract Type	Tender	**Bid Validity(Days)**	90	**Period Of Work(Days)**	45
Location	Thiruvananthapuram	**Pincode**	695001	**Pre Bid Meeting Place**	NA
Pre Bid Meeting Address	NA	**Pre Bid Meeting Date**	NA	**Bid Opening Place**	Online
Should Allow NDA Tender	No	**Allow Preferential Bidder**	No		

Critical Dates

Publish Date	02-May-2023 01:00 PM	**Bid Opening Date**	18-May-2023 03:30 PM
Document Download / Sale Start Date	02-May-2023 01:00 PM	**Document Download / Sale End Date**	17-May-2023 03:00 PM
Clarification Start Date	NA	**Clarification End Date**	NA
Bid Submission Start Date	02-May-2023 01:00 PM	**Bid Submission End Date**	17-May-2023 03:00 PM

Tender Documents

NIT Document

S.No	Document Name	Description	Document Size (in KB)
1	Tendernotice_1.pdf	NIT and Abstract	286.88

Work Item Documents

S.No	Document Type	Document Name	Description	Document Size (in KB)
1	Tender Documents	EVCITender.pdf	Tender Document	1574.24
2	BOQ	BOQ_847873.xls	Financial Bid	366.50

Tender Inviting Authority

Name	CEO ANERT
Address	ANERT HQ, Thiruvananthapuram - 695033

AGENCY FOR NEW & RENEWABLE ENERGY RESEARCH AND TECHNOLOGY (ANERT)
Department of Power, Government of Kerala
Thiruvananthapuram, Kerala – 695 033;
www.anert.gov.in , projects@anert.in

E-TENDER DOCUMENT

Request for Selection of agency for the Design, Supply, Installation, Testing, Commissioning and Maintenance of Public Electric Vehicle Charging Station for ANERT at various locations in the Solar City of Thiruvananthapuram (funded by Smart City Thiruvananthapuram Ltd)

Ref. No.: ANERT-TECH/137/2023-T6

PART – 1: GENERAL CONDITIONS

Date of Publishing of Bids : - 02/05/2022

Last Date of Submission of Bids : - 17/05/2022

CONTENTS

E-TENDER NOTICE

Competitive e-tenders in two cover system with Earnest Money Deposit (EMD) and Price Bid in accordance with the ANERT approved technical specifications are invited from reputed Manufacturers/System Integrators with relevant experience for the ***Request for Selection of agency for the Design, Supply, Installation, Testing, Commissioning and Maintenance of Public Electric Vehicle Charging Station for ANERT at various locations in the Solar City of Thiruvananthapuram (funded by Smart City Thiruvananthapuram Ltd)***. The e-tender documents can be downloaded from the e-tendering website of Govt. of Kerala. Tender form will not be available in any other form.

Thiruvananthapuram CEO

02/05/2023

TENDER ABSTRACT

Ref. No.	**ANERT-TECH/137/2023-T6**
Name of Work	**Request for Selection of agency for the Design, Supply, Installation, Testing, Commissioning and Maintenance of Public Electric Vehicle Charging Station for ANERT at various locations in the Solar City of Thiruvananthapuram (funded by Smart City Thiruvananthapuram Ltd)**
Download of Tender Form	http://www.etenders.kerala.gov.in
Last date of submission of Tender	17/05/2023 @ 3.00 PM
Date and Time of opening the Tender	18/05/2023 @ 3.30 PM
Estimated Cost	**Rs. 10,00,00,000/-**
Cost of Tender form	**Rs. 11,800/- (Including GST)**
EMD	**Rs. 5,00,000/- (Refundable)**
Warranty period	5 years from the date of Commissioning the system.
Availability of Tender Forms	Website http://www.etenders.kerala.gov.in
Place of opening of tender	Office of CEO, ANERT Law College Road, Vikas Bhavan. PO, Thiruvananthapuram - 695 033, Kerala

Thiruvananthapuram
02/05/2023

Sd/-
CEO

GENERAL TERMS AND CONDITIONS FOR E-PROCUREMENT

This e-Tender is being published for the Request for Selection of agency for the Design, Supply, Installation, Testing, Commissioning and Maintenance of Public Electric Vehicle Charging Station for ANERT at various locations in the Solar City of Thiruvananthapuram (funded by Smart City Thiruvananthapuram Ltd). The tender is invited in two cover system through e-procurement portal of Government of Kerala (www.etenders.kerala.gov.in). Prospective bidders willing to participate in this tender shall necessarily register themselves with above mentioned e-procurement portal.

The tender timeline is available in the critical date section of this tender published in www.etenders.kerala.gov.in

1. ONLINE BIDDER REGISTRATION PROCESS:

1.1 Bidders should have a Class III or above Digital Signature Certificate (DSC) to be procured from any Registration Authorities (RA) under the Certifying Agency of India. Details of RAs will be available on www.cca.gov.in. Once, the DSC is obtained, bidders have to register on www.etenders.kerala.gov.in website for participating in this tender. Website registration is a one-time process without any registration fees. However, bidders have to procure DSC at their own cost.

1.2 Bidders may contact e-Procurement support desk of Kerala State IT Mission over telephone at 0471- 2577088, 2577188, 2577388 or 0484 – 2336006, 2332262 - through email: helpetender@gmail.com/etendershelp@kerala.gov.in for assistance in this regard

2. ONLINE TENDER PROCESS:

The tender process shall consist of the following stages:

i. Downloading of tender document: Tender document will be available for free download on www.etenders.kerala.gov.in. However, tender document fees shall be payable at the time of bid submission as stipulated in this tender document.

ii. Pre-bid meeting: (not applicable)

iii. Publishing of Corrigendum: All corrigenda shall be published on www.etenders.kerala.gov.in and shall not be available elsewhere.

iv. Bid submission: Bidders have to submit their bids along with supporting documents to support their eligibility, as required in this tender document on www.etenders.kerala.gov.in. No manual submission of bid is allowed and manual bids shall not be accepted under any circumstances.

v. In case bidder encounters any technical issues pertaining to e-Procurement system while acting on the tender, computer screen shot of the error message with date & time stamp on the web-browser along with the query shall be e-mailed by the bidder to the help desk **(helpetender@gmail.com/ etendershelp@kerala.gov.in)**, for resolution of the problem. At the same time, problem must be intimated to the concerned Tender Inviting Authority via email.

vi. The time taken to ascertain, evaluate and suggest a solution for the problem reported by bidder may vary from case to case. Hence bidders are advised to submit the bid **at least 2 working days before the due date** and time of bid submission to avoid any last-minute issues that may come up.

vii. Opening of Bid and Bidder short-listing: The single cover bids will be opened, evaluated and shortlisted as per the eligibility. Failure to submit the required documents online will attract disqualification. Price bids of the eligible bidder's will open the same day of opening and the work will be awarded.

3. DOCUMENTS COMPRISING BID:

3.1 (a) The First Stage - Part-I Pre- Qualification cum Technical Bid with Commercial terms without Price Bid

Technical proposal shall contain the scanned copies of the following documents which every bidder has to upload:

Envelop -1 shall contain, Part-I (this document in PDF form)/scanned copies of:

i. Tender documents downloaded (signed with office seal)

ii. Summary of Bid qualification requirement (Annexure A)

iii. Agreement in the prescribed format (Annexure B) on Govt. of Kerala stamp paper worth Rs.200/-

iv. Copy of Registration Certificate of the bidder firm
v. Copy of GST Certificate
vi. Copy of PAN card
vii. List of credit rating done, to prove the experience in executing similar orders, as specified, if any
viii. Documents to prove the annual Turnover of the bidder along with a certificate from Chartered Accountant regarding net worth. (Capital + Reserves)
ix. Copy of the work orders and certification from the purchase regarding execution of the order, to prove the experience in executing similar orders, as specified
x. Bill of Material
xi. Details of the technical offer, including test certificates issued in the name of the bidder
xii. Declaration by the bidder (format as in Annexure – E)
xiii. Declaration of relationship with ANERT employee (format as in Annexure - F)

3.1 (b) The Second Stage (Financial Cover as per two cover system):

Envelop -2: shall contain the Price Schedule as per BOQ in Excel format for this tender to be downloaded from e-tender website, duly digitally signed by the tenderer/authorized signatory of the tender.

3.2 The department doesn't take any responsibility for any technical snag or failure that has taken place during document upload.

3.3 The Bidder shall complete the Price bid as per format given for download along with this tender.

Note: The blank price bid should be downloaded and saved on bidder's computer without changing file-name otherwise price bid will not get uploaded. The bidder should fill in the details in the same file and upload the same back to the website.

3.4 Fixed price: Prices quoted by the Bidder shall be fixed during the bidder's performance of the contract and not subject to variation on any account. A bid submitted with an adjustable/ variable price quotation will be treated as non - responsive and rejected.

4. TENDER DOCUMENT FEES AND EARNEST MONEY DEPOSIT (EMD)

4.1 The Bidder shall pay, a tender document fee of Rs. 11,800/- and Earnest Money Deposit or Bid Security of Rs. 5,00,000. The Bid security is required to protect the purchaser against risk of Bidder's conduct, which would warrant the forfeiture of security.

4.2 Bidders who are registered as or under MSME / MSE / NSIC / Udhog Aadhar OR Central/State PSE are exempted from paying EMD and Tender Fee.

4.3 Online Payment modes: The tender document fees can be paid in through e-Payment facility provided by the e-Procurement system. Bidders can make payment only via Internet banking facility

State Bank of India Multi Option Payment System (SBI MOPS Gateway): Bidders are required to avail Internet Banking Facility in any of below banks for making tender remittances in eProcurement System.

A) Internet Banking Options (Retail)			
1	Allahabad Bank	32	Kotak Mahindra Bank
2	Axis Bank	33	Lakshmi Vilas Bank
3	Andhra Bank	34	Mehsana Urban Co-op Bank
4	Bandan Bank	35	NKGSB Co-operative Bank
5	Bank of Bahrain and Kuwait	36	Oriental Bank of Commerce
6	Bank of Baroda	37	Punjab and Maharashtra Cooperative Bank
7	Bank of India	38	Punjab National Bank
8	Bank of Maharashtra	39	Punjab and Sind Bank
9	Bassein Catholic Co-operative Bank	40	RBL Bank
10	BNP Paribas	41	Saraswat Cooperative Bank
11	Canara Bank	42	ShamraoVithal Cooperative Bank
12	Catholic Syrian Bank	43	South Indian Bank
13	Central Bank of India	44	Standard Chartered Bank
14	City Union Bank	45	State Bank of India
15	Corporation Bank	46	Syndicate Bank
16	Cosmos Bank	47	Tamilnad Mercantile Bank
17	DCB Bank	48	Tamilnadu Cooperative Bank
18	Dena Bank	49	The Kalyan Janata Sahakari Bank
19	Deutsche Bank	50	TJSB Bank
20	Dhanalaxmi Bank	51	UCO Bank
21	Federal Bank	52	Union Bank of India

22	HDFC Bank	53	United Bank of India
23	ICICI Bank	54	Vijaya Bank
24	IDBI Bank	55	YES Bank
25	Indian Bank		
26	Indian Overseas Bank		
27	IndusInd Bank		
28	Jammu & Kashmir Bank		
29	Janata Sahakari Bank		
30	Karnataka Bank		
31	Karur Vysya Bank		
B) Internet Banking Options (Corporate)			
1	Bank of Baroda	21	Laxmi Vilas Bank
2	Bank of India	22	Oriental Bank of Commerce
3	Bank of Maharashtra	23	Punjab & Maharashtra Coop Bank
4	BNP Paribas	24	Punjab & Sind Bank
5	Canara Bank	25	Punjab National Bank
6	Catholic Syrian Bank	26	RBL Bank
7	City Union Bank	27	Shamrao Vitthal Co-operative Bank
8	Corporation Bank	28	South Indian Bank
9	Cosmos Bank	29	State Bank of India
10	Deutsche Bank	30	Syndicate Bank
11	Development Credit Bank	31	UCO Bank
12	Dhanalaxmi Bank	32	Union Bank of India
13	Federal Bank	33	UPPCL
14	HDFC Bank	34	Vijaya Bank
15	ICICI Bank	35	Axis Bank
16	Indian Overseas Bank		
17	Janta Sahakari Bank		
18	Jammu & Kashmir Bank		
19	Karur Vysya Bank		
20	Kotak Bank		

During the online bid submission process, bidder shall select ***SBI MOPS*** option and submit the page, to view the ***Terms and Conditions*** page. On further submitting the same, the e-Procurement system will re-direct the bidder to MOPS Gateway, where two options namely ***SBI*** and ***Other Banks****** will be shown. Here, Bidder may proceed as per below:

a) *SBI Account Holders* shall click ***SBI*** option to with its Net Banking Facility., where bidder can enter their internet banking credentials and transfer the Tender Fee and EMD amount.

b) *Other Bank Account Holders* may click ***Other Banks*** optionto view the bank selection page. Here, bidders can select from any of the 54 Banks to proceed with its Net Banking Facility, for remitting tender payments.

**Transaction Charges for Other Banks vide SBI Letter No. LHO/TVM/AC/2016-17/47 – 1% of transaction value subject to a minimum of Rs. 50/- and maximum of Rs. 150/-*

** Bidders who are using Other Banks option under SBI MOPS Payment Gateway, are advised by SBI to make online payment 72 hours in advance before tender closing time.*

5. SUBMISSION PROCESS:

5.1 For submission of bids, all interested bidders have to register online as explained above in this document. After registration, bidders shall submit their Technical bid and Financial bid online on www.etenders.kerala.gov.in along with online payment of tender document fees and EMD.

5.2 For page-by-page instructions on bid submission process, please visit www.etenders.kerala.gov.in and click "Bidders Manual Kit" link on the home page.

5.3 It is necessary to click on "Freeze bid" link/ icon to complete the process of bid submission otherwise the bid will not get submitted online and the same shall not be available for viewing/ opening during bid opening process.

6. VALIDITY

6.1 The tender offer shall be kept valid for acceptance for a period of 3 months from the date of opening of offers. The offers with lower validity period are liable for rejection. Further, the tenderer may extend the validity of the Bids without altering the substance and prices of their Bid for further periods, if so required

7. DEVIATIONS

7.1 The offers of the Tenderers with Deviations in Commercial terms and Technical Terms of the Tender Document are liable for rejection.

8. BLACK LIST

8.1 All the intending tenderers shall agree that in the event of the documents furnished with the offer being found to be bogus or the documents contain false particulars, they shall be blacklisted for future tenders/ association with ANERT and EMD shall be forfeited against any losses incurred by ANERT.

9. BIDDER'S LOCATION

9.1 The tenderers are requested to furnish the exact location of their factories/godown with detailed postal address and pin code, telephone and fax nos. etc. in their tenders to arrange inspection by ANERT, if considered necessary.

9.2 All communication shall be made to the registered email of the bidder in the e-tendering systems and ANERT shall not be responsible for non-receipt or delay of any such communication.

10. CORRUPT AND FRAUDULENT PRACTICES

ANERT requires compliance with its policy in regard to corrupt and fraudulent/prohibited practices as set forth in this proposal. In further pursuance of this policy, the selected service Provider(s) shall permit ANERT or its representatives to inspect the accounts, records and other documents relating to the submission of the Proposal and execution of the contract, in case of award, and to have the records inspected by ANERT.

11. CONFLICT OF INTEREST

i. The service Provider(s) is required to provide professional, objective, and impartial services, at all times holding ANERT‟s interests paramount, strictly avoiding conflicts with other assignments or its own corporate interests, and acting without any consideration for future work. The supplier has an obligation to disclose to ANERT any situation of actual or potential conflict that impacts its capacity to serve the best interest of ANERT. Failure to disclose such situations may lead to the disqualification of the supplier or the termination of its Contract and/or sanctions by the Government.

ii. Relationship with the ANERT staff: a service Provider (including its subsidiaries /partners) that has a close business or family relationship with a professional staff of the ANERT who are directly or indirectly involved in any part of the preparation of the Terms of Reference for the assignment, the selection process for the Contract, or the supervision of the Contract, may not be awarded a Contract, unless the conflict stemming from this relationship has been resolved in a manner acceptable to ANERT throughout the selection process and the execution of the Contract. Any other types of conflicting relationships as indicated in the TENDER

12. CONFIDENTIALITY

i. From the time the Proposals are opened to the time the Contract is awarded, the agency (ies) should not contact any of the officials of ANERT on any matter related to its Technical and/or Financial Proposal. Information relating to the evaluation of Proposals and award recommendations shall not be disclosed to the agency (ies) who submitted the Proposals or to any other party not officially concerned with the process, until the publication of the Contract award information.

ii. Any attempt by the agency (ies) or anyone on behalf of the Suppliers to influence improperly ANERT in the evaluation of the Proposals or Contract award decisions may result in the rejection of its Proposal and may be subject to the application of prevailing Government sanctions procedures.

iii. Notwithstanding the above provisions, from the time of the Proposals‟ opening to the time of Contract award publication, if a agency (ies) intends to contact ANERT on any matter related to the selection process, it should do so only in writing.

iv. The Bids should be submitted only through the e-tender portal www.etenders.kerala.gov.in. Agency (ies) shall upload all the necessary documents in the e tender portal before the last date & time for online submission. Proposal received after the submission deadline will be treated as non-responsive and will be excluded from further evaluation process.

v. Proposals must be direct, concise, and complete. ANERT will evaluate bidder's proposal based on its clarity and the directness of its response to the requirements of the project as outlined in this tender document. Bidders shall furnish the required information on their technical and financial proposals in the enclosed

formats only. Any deviations in format or if the proper information is not provided properly, the tender will be liable for rejection. Tender Evaluation committee may seek clarification, if required, while evaluating the proposal.

vi. The technical bid opening date, time and the address are as stated in the tender document. The Financial Proposal shall remain securely stored online till the technical evaluation is completed and the results intimated to all successful bidders

13. APPLICABLE LAW

The work order shall be governed by the laws and procedures established by Government of Kerala, within the frame work of applicable legislation and enactment made from time to time concerning such commercial dealings. Any default in the terms and conditions of the document by the service provider will lead to rejection of work order.

14. AMENDMENT OF TENDER DOCUMENT

At any time prior to the deadline for submission of the tender, ANERT may for any reason, modify the tender document. The amendment document/ corrigendum shall be notified through the website www.etenders.kerala.gov.in and such amendments shall be binding on all the bidders.

15. COMMENCEMENT OF SERVICE

The successful bidder should sign the contract agreement within 7 days of issue of work order. The successful bidder should start the services as defined in the scope of work within 15 days of Issue of work order.

16. GOVERNMENT OF KERALA – CORRUPT AND FRAUDULENT PRACTICES

ANERT follows the policy of the Government of Kerala for anti-corruption and fraudulent practices to maintain sound procurement principles of open competition, economy and efficiency, transparency, and fairness. ANERT requires the agency (ies) to observe the following Government manuals (amended from time-to-time) during the selection process and in execution of such contracts The Kerala Financial Code (KFC), 2008 (7th Edition, 1st Edition was in 1963), The Stores Purchase Manual (SPM), 2013.

17. BID QUALIFICATION REQUIREMENTS

17.1.1 Every tenderer should submit along with his e-tender an Earnest Money Deposit (EMD). This may be done electronically from any of the Nationalized/Schedule Banks. The EMD of the disqualified tenderers will be returned automatically through e-procurement system. The EMD of the successful tenderers may be adjusted towards the security deposit. No interest shall be paid for the earnest money deposited.

17.1.2 An agreement in Rs.200/- Kerala stamp paper as per the format given in Annexure B must be submitted along with e-tender document.

17.1.3 Declaration regarding the use of components – EVCI. The bidder must use Electric Vehicle Charging Infrastructure with in the approved component list of ANERT or EVCI meeting the technical requirements mentioned in this tender. A detailed BoM in the letter head of the bidder is to be provided along with the bid.

17.1.4 The bidder should have service centres/authorised service providers in Thiruvananthapuram district of Kerala. Detailed list with address, contact details and proof has to be submitted. If the bidder does not have such facility at the time of tendering, an undertaking should be submitted along with the tender on Kerala stamp paper worth Rs. 200/- agreeing to set up such facility and intimate the same within 15 days of letter of intent. Urja Mithra service centres supported by ANERT can also be included as service centres provided the bidders make separate agreements with them.

17.1.5 Price Bid in excel format, for this tender to be downloaded from e-tender website, duly digitally signed by the tenderer/authorized signatory of the tender.

17.2 **Eligibility Requirement**

17.2.1 The detail of eligibility requirements is provided in the table below. The bidders are required to furnish the required supporting documents along with the Technical Bid.

S. No.	Criteria	Documents Required
1.1	The Bidder should have any of the following legal status: a) Body incorporated in India under the Companies Act, 2013 including any amendment thereto; OR b) Body incorporated in India under the Limited Liability Partnership (LLP) Act, 2008 including any amendment thereto; OR c) Firm registered under Partnership Act, 1932 in India; OR d) Sole Proprietor In case of JV, all the members must fulfill this requirement and submit the documents as per the Tender Document.	a) In case of Company – Copy of Registration/ Incorporation Certificate b) In case of LLP – Copy of Deed of Partnership c) In case of Partnership – Copy of Deed of Partnership d) In case of Sole Proprietor – Duly notarized Undertaking from Sole proprietor
1.2	The Bidder must have the required GST Registration	Copy of GST registration certificate with legible GSTIN.
1.3	The Bidder must have valid PAN Number	Copy of Pan Card
1.5	The bidder should be having unblemished record and must not be blacklisted or declared ineligible for corrupt & fraudulent practices by "any state/ central government" department/ company / entity" as on date of bid opening.	The bidder shall provide an Undertaking as per the format provided as Format A.

10.3 Qualification Requirement

The details of qualification requirements are provided in the table below. The bidders are required to furnish the required supporting documents along with the Technical Bid.

S. No.	Criteria	Documents Required
1.1.	**Technical Criteria**	
	The bidder must have completed installation of cumulative 300 kW capacities EVCI in Public Charging Station with DC fast chargers of min. 50kW capacity. AND Bidder / The Electrical contractor authorized by the bidder must have successfully commissioned Electrical infrastructure for HT Connections (11 kV or above) having a cumulative capacity of at least 2 MVA in India including supply of 11kV Cable, RMU, 11/0.415 kV Transformer of min, 250kVA and above.	The details of projects executed during period mentioned above should be listed. Copy of work orders and a certificate issued by the SNA/ Govt. Organization/ SECI/PSUs towards the satisfactory work completion to be furnished by the bidder.
1.2.	**Financial Criteria**	
1.2.1.	The Bidder should have positive net worth in at least 2 years out of the last five Financial Years (FY 17-18, FY18-19, FY19-20 & FY20-21 & FY 21-22).	1. Certificate fulfilling required financial criteria in the name of Bidder duly certified by Practicing Chartered Accountant as per the format provided Format B, duly mentioning UDIN 2. Firm's Annual Audit Report, Balance sheet, Profit & Loss and Income Tax Returns / CA certificate for last Five years i.e. F.Y: FY 17-18, FY18-19, FY19-20 & FY20-21 & FY 21-22
1.2.2.	Minimum Average Annual Turnover (MAAT) during any 2 best out of last five financial years (FY 17-18, FY18-19, FY19-20 & FY20-21 & FY 21-22) of the bidder shall not be less than 12 Cr.	

CONDITIONS OF CONTRACT

18. GENERAL CONDITIONS

18.1 The tenders should be submitted online at www.etenders.kerala.gov.in

18.2 The tenders should be as per the prescribed form which should be downloaded from the e-tender website. The cost of tender forms should be paid online, and once paid will not be refunded. Tender forms are not transferable. Tenders that are not in the prescribed form are liable to be rejected.

18.3 Intending tenderers should submit their tenders on or before the due date and time mentioned in the tender abstract. Late tender will not be accepted.

18.4 The rates quoted should be only in Indian currency. Tenders in any other currency are liable to rejection. The rates quoted should be for the unit specified in the schedule attached.

18.5 Tenders subject to conditions will not be considered. They are liable to be rejected on that sole ground.

18.6 Every tenderer should send along with his tender an Earnest Money Deposit. This may be paid online at the e-tenders website.

18.7 If any tenderer withdraws from his e-tender before the expiry of the period fixed for keeping the rates firm for acceptance, the earnest money if any, deposited by him, will be forfeited.

18.8 The final acceptance/rejection of the tenders rests entirely with CEO, ANERT who do not bind themselves to accept the lowest or any tender.

18.9 In the case of materials of technical nature, the successful tenderer should be prepared to guarantee satisfactory performance for a period of guarantee under a definite penalty. Communication of acceptance of the e-tender normally constitutes a concluded contract. Nevertheless, the successful tenderer shall also execute an agreement for the due fulfilment of the contract within the period to be specified in the letter of acceptance. The contractor shall have to pay all stamp duty, Lawyer's charges and other expenses incidental to the execution of the agreement. Failure to execute the agreement within the period specified will entail the penalties set out below:

a) The successful tenderer shall sign a tripartite agreement with ANERT & Smart City Thiruvananthapuram Ltd within the period specified in the letter of acceptance of this tender. The amount of stamp duty for the agreement must be in compliance with G.O.(P) No.113/2019/TD. dtd 24.07.2019 with respect to public works. They are to deposit a sum equivalent to 3% of the value of the contract as security for the satisfactory fulfilment of the contract less the amount of money deposited by him along with his tender. The amount of security may be deposited in the manner prescribed to be specified in the work order issued by ANERT.

b) There will be no exemption for MSE's in depositing this security amount. If the successful tenderer fails to deposit the security and execute the agreement as stated above, the earnest money deposited by him will be forfeited to ANERT and contract arranged elsewhere at the defaulter's risk and any loss incurred by ANERT on account of the purchase will be recovered from the defaulter who will however not be entitled to any gain accruing thereby.

c) In cases where a successful tenderer, after having made partial supplies fails to fulfil the contracts in full, all or any of the materials not supplied may at the discretion of the Purchasing Officer be purchased by means of another tender/quotation or by negotiation or from the next higher tenderer who had offered to supply already, and the loss if any caused to ANERT shall thereby together with such sums as may be fixed by ANERT towards damages be recovered from the defaulting tenderer.

d) If the contractor fails to deliver all or any of the stores or perform the service within the time/period(s) specified in the contract, the purchaser shall without prejudice to its other remedies under the contract, deduct from the contract prices, as liquidated damages, a sum equivalent to 0.5 % of the delivered price of the delayed stores or unperformed services for each week of delay until actual delivery or performance, up to a maximum deduction of 10% of the contract price of the delayed stores and services. Once the maximum is reached, the purchaser may consider termination of the contract at the risk and cost of the contractor.

18.10 The Security deposit shall, subject to the conditions specified herein be returned to the contractor within three months after the expiration of the contract but in the event of any dispute arising between ANERT and the contractor, ANERT shall be entitled to deduct out of the deposits or the balance thereof, until such dispute is determined the amount of such damages, costs, charges and expenses as may be claimed. The same may also be deducted from any other sum which may be due at any time from ANERT to the contractor. In all cases where there are guarantee for the goods supplied, the security deposit will be released only after the expiry of the guarantee period.

18.11 (a) All payments to the contractors will be made by SCTL/ANERT in due course

(b) All incidental expenses incurred by SCTL/ANERT for making payments outside the State in which the claim arises shall be borne by the contractor.

18.12 Payments will be made only after the supply, Installation and Commissioning of the items and certification by the competent Technical personnel of ANERT.

18.13 The contractor shall not assign or make over the contract on the benefits or burdens thereof to any other person or body corporate. The contractor shall not underlet or sublet to any person or persons or body corporate the execution of the contract or any part thereof without the consent in writing of the purchasing officer who shall have absolute power to refuse such consent or to rescind such consent (if given) at any time if he is not satisfied with the manner in which the contract is being executed and no allowance or compensation shall be made to the contractor or the subcontractor upon such rescission. Provided always that if such consent be given at any time, the contractor shall not be relieved from any obligation, duty or responsibility under this contract.

18.14 In case the contractor becomes insolvent or goes into liquidation, or makes or proposes to make any assignment for the benefit of his creditors or proposes any composition with his creditors for the settlement of his debts, carries on his business or the contract under inspection or behalf of or his creditors or in case any receiving order(s) for the administration of his estate are made against him or in case the contractor shall commit any act of insolvency or in case in which under any clause or clauses any act of insolvency or in case in which under any clause(s) of this contract the contractor shall have rendered himself liable to damages

amounting to the whole of his security deposits, the contract shall, thereupon, after notice given by the Purchasing Officer to the contractor, be determined and ANERT may complete the contract in such time and manner and by such persons as ANERT shall think fit. But such determination of the contract shall be without any prejudice to any right or remedy of ANERT against the contractor or his sureties in respect of any breach of contract committed by the contractor. All expenses and damages caused to ANERT by any breach of contract by the contractor shall be paid by the contractor to ANERT and may be recovered from him under the provisions of the Revenue Recovery Act in force in the State.

18.15 In case the contractor fails to supply and deliver any of the said articles and things within the time provided for delivery of the same, or in case the contractor commits any breach of any of the covenants, stipulations and agreements herein contained, and on his part to be observed and performed, then and in any such case, it shall be lawful for ANERT (if they shall think fit to do so) to arrange for the purchase of the said articles and things from elsewhere of on behalf of ANERT by an order in writing under *the* hand of the CEO put an end to this contract and in case ANERT shall have incurred sustained or been put to any costs, damages or expenses by reason of such purchase or by reason of this contract having been so put an end to or in case any difference in price, compensation, loss, costs, damages, expenses or other moneys shall then or any time during the continuance of this contract be payable by the contractor to ANERT under and by virtue of this contract, it shall be lawful for ANERT from and out of any moneys for the time being payable or owing to the contractor from ANERT under or by virtue of this contract or otherwise to pay and reimburse to ANERT all such costs, damages and expenses they may have sustained, incurred or been put to by reason of the purchase made elsewhere or by reason of this contract having been so put an end to as aforesaid and also all such difference in price, compensation, loss, costs, damages, expenses and other moneys as shall for the time being payable by the contractor aforesaid.

18.16 Any sum of money due and payable to the contractor (including security deposit returnable to him) under this contract may be appropriated by the CEO or any other person authorised by ANERT and set off against any claim of ANERT for the payment of a sum of money arising out of or under any other contract made by the

contractor with ANERT or any other person authorised by ANERT. Any sum of money due and payable to the successful tenderer or contractor from ANERT shall be adjusted against any sum of money due to ANERT from him under any other contracts.

18.17 Every notice hereby required or authorised to be given may be either given to the contractor personally or left at his residence or last known place of abode or business, or may be handed over to his agent personally, or may be addressed to the contractor by post at his usual or last known place of abode or business and if so addressed and posted, shall be deemed to have been served on the contractor on the date on which in the ordinary course of post, a letter so addressed and posted would reach his place of abode or business.

18.18 The tenderer shall undertake the installation and commissioning of the system according to the standards and specification.

18.19 No representation for enhancement of rate once accepted will be considered.

18.20 The prices quoted should be inclusive of GST and all other expenses which are or may become payable by the contractor under existing or future laws or rules of the country of origin/supply or delivery during the course of execution of the contract.

18.21 Special conditions, if any, of the tenderers attached with the tenders will not be applicable to the contract unless they are expressly accepted in writing by the purchaser.

18.22 The tenderer should send along with this tender an agreement executed and signed in Kerala Stamp Paper of value Rs.200/-. A specimen form of agreement is given as Annexure B to this tender. Tenders without the agreement in stamped paper will be rejected outright.

18.23 **Conditions in the technical document, technical specifications and special conditions of this tender document would override these general conditions, wherever applicable.**

18.24 ANERT, by notice sent to the Supplier, may terminate the contract, in whole or in part, at any time for its convenience. The notice of termination shall specify that termination is for ANERT's convenience, the extent to which performance of the Supplier under the contract is terminated, and the date upon which such termination becomes effective.

18.25 E-tender shall be opened at the time and date announced in the tender notice, and the price bid will be evaluated on the same day.

18.26 In case any difference or dispute arises in connection with the contract, all legal proceedings relating to the matter shall be instituted in the Court within whose jurisdiction the CEO, ANERT voluntarily resides.

18.27 The Courts situated at the place where the headquarters of ANERT is situated viz, Thiruvananthapuram alone will have jurisdiction to entertain civil suits and all other legal pertaining to this contract.

19. SPECIAL CONDITIONS

19.1 Each bidder should submit only one (1) bid. Any bidder who submits/participates in more than one bid for the work shall be disqualified.

19.2 The tenders will be opened in the presence of bidders present at the date and time advised in the Bidding Document. If the due date for receiving and opening the tender happens to be declared holiday, then the tender will be received and opened on the very next day, for which no prior intimation will be given.

19.3 If the bidder has NOT submitted the requisite EMD OR Agreement, OR if the price bid is not submitted along with the tender, such tenders will be summarily rejected.

19.4 **During the tender evaluation, ANERT may seek more clarifications/details from any or all of the tenderers, if felt necessary.**

19.5 The price bids of the tenderers, which submitted the required documents only will be opened and the L1 bidder will be awarded the work of supply and installation of items after fulfilling all the requirements.

19.6 **ANERT reserves the right, in the interest of completion of work within the time limit, to award portion/portions of the Work order to next higher bidders, called for negotiation in the increasing order of their price offers, if they agree to supply at the L1 price.**

19.7 **The rate quoted should be all inclusive including delivery of materials at the locations to be specified, and the cost of materials and labour for the civil works, installation and commissioning, warranties, fee for approval from the Electrical Inspectorate if any, GST and all other expenses.**

19.8 **The price quotes should be inclusive of initial cost of supply, installation and commissioning, support during the warranty period of 5-years.**

19.9 The tender offer shall be kept valid for acceptance for a period of 13 months from the date of opening of bid. The offers with lower validity period are liable for rejection.

19.10 The evaluation of the price bid will be based on the grand total of all-inclusive amount quoted excluding GST.

AGENCY FOR NEW & RENEWABLE ENERGY RESEARCH AND TECHNOLOGY (ANERT)
Department of Power, Government of Kerala
Thiruvananthapuram, Kerala – 695 033;
www.anert.gov.in , projects@anert.in

E-TENDER DOCUMENT

Request for Selection of agency for the Design, Supply, Installation, Testing, Commissioning and Maintenance of Public Electric Vehicle Charging Station for ANERT at various locations in the Solar City of Thiruvananthapuram (funded by Smart City Thiruvananthapuram Ltd)

Ref. No.: ANERT-TECH/432/2021-PE2(EV)

PART – 2: SCOPE OF WORKS

Date of Publishing of Bids : - 24/01/2022

Last Date of Submission of Bids : - 10/02/2022

SCOPE

20. INVITATION TO BID

20.1 **ANERT is the State Agency for Renewable Energy in Kerala** having its Headquarters at Thiruvananthapuram, Kerala and various district level offices **This tender has been issued by the ANERT for the selection of agency for the Design, Supply, Installation and Commissioning of Public Electric Vehicle Charging Station at various locations in the Solar City of Thiruvananthapuram.**

20.2 In order to meet the requirements, ANERT proposes to invite bids from Manufacturers of SPV modules / System Integrators of Solar Power Plants and provide services as per details/**scope of work** mentioned in this tender document.

20.3 Bidder shall mean any entity (i.e. juristic person) who meets the **eligibility criteria** of this tender and willing to provide the Services as required in this bidding document. The interested Bidders who agree to all the terms and conditions contained in this document may submit their Bids with the information desired in this bidding document.

20.4 Address for submission of Bids, contact details including email address for sending communications are given in this tender document.

20.5 This document shall not be transferred, reproduced or otherwise used for purpose other than for which it is specifically issued.

20.6 Interested Bidders are advised to go through the entire document before submission of Bids to avoid any chance of elimination. The eligible Bidders desirous of providing services to ANERT are invited to submit their technical proposal in response to this tender. The criteria and the actual process of evaluation of the responses to this tender and the selection of Bidder will be entirely at ANERT's discretion. This tender seeks proposal from Bidders who have the necessary experience, capability & expertise to provide ANERT the proposed Services adhering to its requirements outlined in this tender.

21. SCOPE OF WORK

The scope of works includes Design, Engineering, Supply, Construction, Erection, Testing and Commissioning of 13 Nos of Electric Vehicle Charging Station (EVCS) at various locations within Thiruvananthapuram Corporation limits as part of Solar City, Thiruvananthapuram. Bidders are required to participate in both, provided they satisfy the pre-qualification criteria.

21.1 **Electric Vehicle Charging Station (EVCS)**

An Electric Vehicle Charging Station which will serve as a public charging infrastructure shall include a Fast charger for charging 4 wheelers. The type of chargers required for the public charging station shall comprise the following;

Charger Type	Charger Connectors	Power Rating (kW)	No of Charging Points/ Guns at a single site	Qty
Fast	Combined Charging System (CCS)	Min 120 kW for CCS	2/2 CG (Max output of 120kW to be provided only if one Gun is used)	9
Fast	Combined Charging System (CCS)	Min 240 kW or 2 x 120 kW CCS	2/2 CG	4

Scope of the Implementing Agency includes but not limited to–

A. Site assessment, Preparation, and Design:
   i. The selected bidder shall undertake detailed site assessment (as required) to identify suitable site design for the deployment of Charging infrastructure. The selected bidder shall verify the load available at each site basis the site assessment.
   ii. The successful bidder shall, undertake the site survey in accordance with foundation requirement of the inlet / outlet / bypass connections, drainage system etc. other open area, connection etc to be cheeked properly.
   iii. After completion of survey contractor shall, at his own cost, charges and expenses prepare Design & Drawings in accordance with the scope, Specification,

Standards, site conditions and submit layout drawings including Mechanical, Electrical.

iv. If during the scrutiny of detailed design calculations and working drawings, any changes therein which are found necessary in the opinion of the concerned Engineer shall be incorporated without altering the offer.

v. The Tenderer shall be responsible for ensuring that any existing utility on, under or above the Project Site is kept in continuous satisfactory use, if necessary, by the use of suitable temporary or permanent diversions.

vi. The site levelling, refilling or any other requirements will be under the scope of the bidder and hence bidders are required to visit the site before quoting

vii. AII debris and other waste material derived from site activities shall be disposed off by the contractor at his own cost. The cost of this work shall be part of the quoted offer and no separate payment shall be made on this account.

B. Supply of Charger and installation:

i. The bidder shall procure, install, test and commission the charging infrastructure, including necessary auxiliary equipment such as canopy, barricading, etc. required for the Charging Infrastructure.

ii. Construction of platform is in the scope of successful bidder.

iii. The Canopy for the EVCS as per the approved design of ANERT shall be provided by the Bidder. The Canopy shall include the following:

a. Hood canopy structure on the top of the EV Charger with sufficient LED panel lights for illumination during evening hours.

b. An auto day-light sensor enabled or remotely through ON/OFF using GPRS.

c. ACP sheet of minimum thickness of 4mm shall be used for the canopy structure. The facia of canopy shall also be of lighted through LED. ACP false ceiling shall be provided.

d. ACP clad steel pipes shall be used for supporting the canopy structure.

e. Hood structure should be supplied with pre-branding as approved by ANERT.

f. The hood canopy structure should be painted & rust free.

g. Proper wiring conduits or channels should be used to avoid the theft of electricity.

h. LED panel lights should be 12V/24V DC operated & will be powered from the EV charger power supply
i. Bollards around each EV station to protect chargers from vehicle impacts, concrete/MS painted bollards as per site requirement should be used of appropriate thickness (atleast 5 inches)
j. Minimum four bollards should be used at the front/side/rear of charger.
k. The bidder should put up relevant signage/markings for identifying the parking spot. Also, signages should be placed at the 1 KM and 300 m mark from both sides of the approach roads.
l. Vehicle parking space marking is in the scope of bidder.

C. Charger design, engineering and testing: The bidder shall be completely responsible for design, engineering and testing of EV charging station including the power infrastructure. All proposed chargers have to be tested and approved by ARAI / ICAT / NABL accredited laboratory. The Test certificate should be enclosed along with the proposal ANERT reserves the right to carry out PDI (Pre-Dispatch Inspection) of the proposed chargers by bidder, if required.
D. Permits and Approvals: All the necessary permits and approvals including CEIG, if any, required for successful commissioning of the EV charging station shall be in the scope of the bidder. The bidder shall comply with the State EV Policy in site planning, permissions, operationalization and billing.
E. Maintenance: The bidder shall take complete responsibility of Maintenance of the charging infrastructure including all the infrastructure developed and deployment of necessary staff, as a part of the Contract, from the date of signing of Contract till the end of the contract period.
F. Power Connection: The bidder shall be responsible for a new HT Electrical power connection from the Discom - KSEBL, and towards any charges for the new power connections. The cost of electricity shall be borne by the bidder. ANERT shall facilitate necessary assistance and documentation from DISCOM for this purpose. Exclusive transformer with related substation equipment, panels & associated cables, Battery Management system, necessary DC connection gear, Fire protection & safety equipment etc. Installation of panel board with all accessories like MCCB,

Earth leakage relay, CT meters, Busbars etc cabling between panel board and machines, Earthing as per IS standards etc are under the scope of Agency.

G. Charging Management System (CMS): The charging station shall be operated through the cloud-based solution technology owned by ANERT. Charging stations will also be hosted on the CMS of ANERT and the bidder shall ensure that there is OCPP integration capabilities between software system of the bidder and ANERT. To enhance Charger utilization, the bidder should ensure OCPP integration with multiple CMS of Third-Party vendor, if required and approved by ANERT. Furthermore, the bidder should ensure that ANERT receives real time notifications and on-demand reports on all charging stations.

H. The successful bidder is required to provide Broadband connection through BSNL / other service providers for uninterrupted internet access during the entire period of warranty. The charges for the same are to be borne by the bidder.

I. Branding: ANERT shall provide guidelines and norms for branding on EV chargers and same shall be disclosed with selected bidders. The co-branding shall be done considering proper representation of ANERT.

J. Energy Meter: The bidder shall responsible for installation of energy meter through DISCOMs at input point of power supply for obtaining actual energy consumption of EVCI. The power connection costs shall comply to the latest grid code of the DISCOM.

K. Insurance: Cost towards the Insurance during Construction and O&M period shall be borne by the bidder. The insurance agency would be selected by bidder at its own discretion. The insurance shall be a comprehensive business liability insurance in nature for any and all type of vendor, customer and or third- party liabilities including covering legal costs against lawsuits

L. Warranty of the Equipment: A copy of the warranty certificates of the installed equipment (EVSE) shall be submitted to ANERT within 03 days from the date of commissioning of EVSE. Equipment shall carry the standard warranty as per Industry standards.

M. Type of Charger: The bidder is free to install any the type of charger (s) based on the land availability and electrical power connection. The chargers installed at any site shall comply to the FAME Guidelines and Ministry of Power (MoP) guidelines/standards dated 1st October, 2019 including amendments, if any.

N. Availability of chargers: The bidder must maintain charger availability for customers at minimum 95% uptime at all the times.

O. Installation of CCTV equipment along with data connectivity for real time access and playback for a period of 4 weeks must be provided in all EV Charging Stations.

P. The selected party agrees to support in the tracking and verification of Carbon Emission Reductions attributable to Chargers deployed by them as part of this contract. All carbon credits shall be owned by ANERT/Smart City Thiruvananthapuram Ltd

Q. EVSE shall be interoperable and vendor neutral and type independent to meet the requirement of major EV and battery manufacturers and complying with relevant national standards and regulations

R. Training: The bidder shall provide training to ANERT personnel before handing over. The firm should provide manuals and training materials to the officials concerned. Also the details and literature of various components of the EV PCS shall be handed over to ANERT.

22. SCHEDULE OF SUPPLY

22.1 The items should be delivered and installed at sites as specified by ANERT below, under prior intimation and supervision of ANERT.

SN	Site	Machine Capacity
1	TVM Corporation - Putharikandam Ground	1 x 120 kW (2 x 60 kW CCS gun) with 160 kVA transformer with RMU
2	Municipal Corporation Office, Palayam	
3	Corporation Crematorium (Santhi Kavadam)	
4	Saphalyam Shopping Complex	
5	Corporation Market, Palayam	
6	Corporation Garage, Fort	
7	Govt. Public Office, Vellayambalam	
8	Govt. Medical College Campus,Trivandrum	
9	Shanghumukham Beach	
10	KSRTC bus Stand, Enchakkal	

SN	Site	Machine Capacity
11	KSRTC Bus Stand, Peroorkada	1 x 240KW (2 x 120 kW CCS) with 250 kVA transformer with RMU
12	KSRTC bus Stand, Vizhinjam	
13	KSRTC Garage, Fort	

22.2 The supply and installation of the entire system shall be completed within **45 days from the issue of work order.** The successful bidder is bound to complete the work within the stipulated period.

22.3 The extension of time of completion that can be granted at a time shall will be 25% of the original time. The maximum extension that can be granted for a work shall be limited to half the original time of completion.

22.4 When the contract period has to be extended wholly or partly due to default on the part of the bidder, the Agreement Authority may sanction extension of time after imposing fine as mentioned below;

Period	Rate of Fine
First Extension	1% of the PAC subject to a minimum of Rs. 1000/- and maximum of Rs. 50000/-.
Second Extension	2% of the PAC subject to a minimum of Rs. 2000/- and maximum of Rs. 100000/-

22.5 Penalty for delay in supply and installation after the extended time period will be imposed at 0.5 % per week up to a maximum 10 %. In case of delay in supply and installation even after this time period, Director, ANERT may cancel the contract and take recourse to other action as deemed appropriate.

23. SELECTION PROCESS FOR BIDDER

There are two bid-opening events:

a) Pre-Qualification cum Technical Bid

b) Commercial Bid

The Commercial Bids of only those bidders will be opened who score equal to or more than qualifying marks in Technical Bid as decided by ANERT.

23.1 PRE-QUALIFICATION PROCESS

a. The Bidders Pre-Qualification Proposal will be evaluated as per the requirements specified in the document and adopting the pre-qualification criteria spelt out. The Bidder is required to submit all required documentation in support of the pre-qualification criteria specified.

b. The Bidder shall meet all the mandatory compliance requirements. Failure in meeting the mandatory compliance requirements will result in disqualification of the Bidder.

c. An agreement in Rs.200/- Kerala stamp paper as per the format given in Annexure B must be submitted online

23.1.1 Pre-Qualification Criteria

#	Pre-Qualification criteria	Documents required
1	The bidder, as a single legal entity, must be incorporated and registered in India under the Indian Companies Act 1956 / 2013 of Indian Companies Act OR A Limited Liability Partnership (LLP) registered under the LLP Act, 2008 or Indian Partnership Act 1932	a. Copy of Certificate of Incorporation or Certified copy of Partnership Deed. b. Service Tax Registration certificate
2	The bidder should have Minimum Average Annual Turnover (MAAT) during any 2 best out of last five financial years (FY 17-18, FY18-19, FY19-20 & FY20-21 & FY 21-22) of the bidder shall not be less than 12 Cr.	Copy of audited Balance Sheet and Profit and Loss statement with the signature and seal of the Statutory auditors
3	The bidder should not have been blacklisted by any Private/PSU/Central Govt/State Govt. or any other Organisation or agencies in India at the time of submission of the bid.	Letter from authorized signatory on the letter head regarding non blacklisting

23.2 TECHNICAL QUALIFICATION

a. ANERT will review the Technical bids to determine whether the technical bids are substantially responsive. Bids that are not substantially responsive are liable to be disqualified at ANERT's discretion.

b. The bidder's technical solutions proposed in the bid document will be evaluated as per the requirements specified in this document

c. Each Technical Bid will be assigned a technical score out of a maximum of 100 marks. Only the bidders who get an aggregate Technical score of 50% or more will qualify for commercial evaluation stage. Failing to secure minimum marks shall lead to technical rejection of the Bid and Bidder

23.2.1 Technical Evaluation Criteria *(Integrated Solar Roofing System)*

The Bidder's technical proposal will be evaluated as per the requirements specified and adopting the following technical evaluation framework.

#	Evaluation Criteria	Criteria	Supporting Documents	Max Marks
1	Average Annual Turnover (MAAT)	• Average Annual Turnover (MAAT) during any 3 best out of last five Financial Years (FY17-18, FY18-19, FY19-20, FY 20-21 & FY 21-22). of the bidder ***> 30 Cr - 25 Marks*** ***> 30 Cr and < 25 Cr - 20 Marks*** ***> 25 Cr and < 15 Cr - 15 Marks*** ***< 15 Cr - 10 Marks***	CA Certificate	20
2	Experience	• Supply & Installation of Public Electrical vehicle charging stations in India with DC fast chargers of min.50kW capacity having cumulative installation ***> 2000 kW = 20 Marks*** ***> 200kW & < 1000 kW = 15 Marks*** ***> 1000kW & < 500 kW = 10 Marks*** ***< 500kW = 5 Marks***	Commissioning Certificate from the Authority who has placed the contract.	20
		• Supply, Installation & Commissioning of HT Connection (11 kV or above) in India with RMU, 11/0.415kV Transformer of min, 250kVA capacity having cumulative installation ***> 5 MVA - 15 Marks*** ***> 3 MVA and < 5 MVA: 10 Marks*** ***< 3 MVA: 5 Marks***	Commissioning Certificate from the Authority who has placed the contract.	15

4	Design (Civil & Structural)	Design document along with detailed technical proposal including aesthetically designed 3D View complying technical specification ***Durability = 8*** ***Functionality = 7*** ***Attractiveness = 10***	Design and 3D Model of the EV Charging Station proposed	30
5	Compliance to Technical Requirements	Bidders with maximum compliance to the technical Requirement specifications will be awarded 15 marks.	Technical Requirement / Specification wise Compliance statement on bidder letter head	15
Total				**100**

23.3 Commercial Qualification

The Bidders shall quote for the entire scope of contract on an "overall responsibility" basis such that the total contract value covers all obligations of the Bidder mentioned in or to be reasonably inferred from the Bidding documents in respect of providing the services.

Prices quoted by the Bidder shall remain firm during the entire contract period and shall not be subject to variation on any account except change in applicable tax rates. A Bid submitted with an adjustable price quotation will be treated as non-responsive and rejected.

23.3.1 Commercial Evaluation Criteria

a. The commercial bids for the technically qualified bidders will then be opened on the notified date and time and reviewed to determine whether the commercial bids are substantially responsive. Bids that are not substantially responsive are liable to be disqualified at ANERT's discretion.
b. Commercial Bids that are not meeting the condition mentioned above shall be liable for rejection

c. The Normalized commercial score of the technically qualified bidders will be calculated, while considering the Total Contract Value given by each of the Bidders in the Commercial Bid as follows:

Normalized Commercial Score of a Bidder = $\frac{Lowest\ Bidding\ Parameter\ Value}{Bidder's Bidding\ Parameter\ value}$ x 100

Example: -

Bidders	Commercial Bid	Calculation	Normalized Commercial Score
Bidder - 1	1000	(1000/1000)*100	100
Bidder – 2	1500	(1000/1500)*100	66.67
Bidder - 3	2000	(1000/2000)*100	50

24. EVALUATION PROCESS

ANERT shall evaluate the responses and scrutinize the supporting documentary evidence. Inability to submit the requisite supporting documents, may lead to rejection. The decision of ANERT in the evaluation of proposals shall be final. No correspondence will be entertained outside the process of evaluation. Each of the responses/Proposals shall be evaluated as per the criteria and requirements specified in this tender document.

An Evaluation Committee will be constituted to evaluate the technical and financial proposals and recommend award of the works. The proposals will be evaluated in three stages.

24.1 Stage 1: - Pre-Qualification Cum Technical Bid

a. Each of the Pre-Qualification condition mentioned in Section23.1 is MANDATORY. In case the Bidder does not meet any one of the conditions, the bidder will be disqualified.
b. Response to the Pre-Qualification Requirements shall be evaluated in accordance with the requirements specified in this document; A checklist has to be created with proper page-wise indexing of all supporting documents
c. ANERT will review the technical bids of the short-listed bidders to determine whether the technical bids are substantially responsive. Bids that are not substantially responsive are liable to be disqualified.

d. The bidders' technical solutions proposed in the bid document will be evaluated as per the requirements specified in the document and technical evaluation framework as mentioned in Section 23.2.1
e. In case of no response by the bidder to any of the requirements with regard to the contents of the Technical Bid, he shall not be assigned any marks for the same.
f. If the numbers of eligible candidates are deemed to be low, ANERT can extend/cancel the invitation to bid or call for a new one. Eligible applicants may be required to make presentations before a selection committee on their technical proposal.
g. Each Technical Bid will be assigned a technical score out of a maximum of 100 marks. Only the bidders who get an aggregate technical score of 60% or more will qualify for commercial evaluation stage. Failing to secure minimum marks shall lead to technical rejection of the Bid and Bidder.

24.2 Stage 2: - Commercial Bid

a. The bid should include all taxes, duties, fees, levies, works contract tax and other charges as may be applicable in relation to the activities proposed to be carried out.
b. The taxes quoted in the offer should be as per the prevailing tax rates. Any subsequent increase in the tax rates or introduction of new tax will not be paid by ANERT. Similarly, if any benefits arising due to downward revision in tax rates, or any exemptions availed by the Bidders organization should be passed on to ANERT.

24.3 Stage 3: Final score calculation through QCBS

a. The Evaluation criteria proposed to be adopted will be Quality cum Cost Based System (QCBS) where Technical Bid Score will get a weightage of 60% and Commercial Bid Score a weightage of 40%.
b. The bidder would be technically evaluated out of 100 marks. All the bidders who secure overall minimum of 60% (60 Marks out of 100 across all the components together) will be considered as technically qualified.

c. The Bid having the Lowest Commercial bid shall be termed as the Lowest Evaluated Bid and awarded 100 marks. The Normalised Commercial score of all other bidders will be calculated as mentioned in section 23.1.

d. The Final score of each bidder will be calculated in accordance with their combined Technical (S_T) and Financial (S_F) scores which shall be determined using the following formula:

Final Bidding Score, $\mathbf{S = (S_T * W_T) + (S_F * W_F)}$

Where W_T and W_F are weights assigned to Technical Bid and Financial Bid that will be 60:40 respectively.

e. The bidder achieving the highest Combined Technical and Financial score will be considered the successful Applicant and work shall be awarded to them.

f. In the event of a tie (two or more bidders attaining the same final score), the following rule shall apply in their order of preference for ranking: -

i. The bidder with the highest Weighted Technical Score ($S_T * W_T$) gets the higher ranking

"If Tied even after"

ii. The bidder with the highest Weighted Financial Score ($S_F * W_F$) gets the higher ranking.

"If Tied even after"

iii. The bidders will be considered as equally good and shall be called upon for another round of negotiations and the winning bid will be chosen based on mutually agreed terms thereafter failing which the tender will be re-tendered.

g. ANERT is not bound to accept the best evaluated bid or any bid and reserves the right to accept any bid, wholly or in part.

h. In the event of the highest ranked applicant fails to deliver as promised or is deemed to be ineligible due to legal, financial or personnel factors coming to the notice or arising subsequent to the award of the consultancy, the next ranked applicant will be invited to take up the assignment at the price quoted by the L1 bidder or at the rate quoted by them after negotiations.

Example:

Bidders	Technical Score (S_T)	Normalized Commercial Score (S_F)	Final Score ((S_T * W_T) + (S_F * W_F))	Status
Bidder - 1	72.06	100	[(72.06 * 0.6) + (100 * 0.4)] = 83.24	L2
Bidder – 2	95	66.67	[(95 * 0.6) + (66.67 * 0.4)] = 83.69	L1
Bidder - 3	45			Rejected
Bidder - 4	95	46.51	[(95 * 0.6) + (46.51 * 0.4)] = 75.60	L3
Bidder - 5	94	67.11	[(95 * 0.6) + (67.1 * 0.4)] = 83.24	L2

W_T = 60%; W_F = 40%

In the above example, the bidder -2 has the highest combined score; hence, the bidder will be the L1 and shall be awarded the contract. The bidder – 3 is rejected, since he has not met the required Technical qualification and the commercial bid will not be opened.

Suppose a circumstance in which the L1 bidder, in the example above – Bidder – 2 is the L1 bidder, he has opted out of the process. The L2 will be awarded the contract, but there is a tie between Bidder – 1 & Bidder – 5. In such a situation, the bidder with the highest Technical Score will be eligible for awarding of contract. Hence, Bidder – 5 will be awarded the contract in view of having a higher Technical Score as compared to Bidder – 1.

25. SPECIAL CONDITIONS

i. Each bidder should submit only one (1) bid. Any bidder who submits/participates in more than one bid shall be disqualified.

ii. If the bidder has NOT submitted the requisite tender fee and EMD as specified by ANERT is not submitted along with the RFP, such bids will be summarily rejected

iii. During the technical evaluation period, ANERT may seek more clarifications/details from any or all of the participants, if felt necessary.

26. RIGHTS TO ACCEPT/REJECT ANY OR ALL PROPOSALS

ANERT reserves the right to accept or reject any proposal, and to annul the RFP process and reject all Bids at any time prior to award of Contract, without thereby

incurring any liability to the affected Bidders or any obligation to inform the affected Bidders of the grounds for ANERT's action.

27. FAILURE TO AGREE WITH THE TERMS & CONDITIONS /CONTRACT

Failure of the Bidder to agree with the Terms & Conditions of the RFP shall constitute sufficient grounds for the annulment of the award of contract and seizure of EMD amount. The contract may be awarded to the next most responsive bid of other Bidder.

28. PAYMENT

28.1 No advance payment will be given. All the documents submitted should be certified by the concerned District Office of ANERT. This will be applicable for works issued through individual (combined) work order for installations.

28.2 The terms of payment shall be:

i. Upon delivery of the EV charging machine at the respective site/warehouse, 50 % of the contract value will be released as first part payment. The supplier shall submit the invoice for the materials (including serial numbers and delivery chalan) duly certified by the concerned District Office along with a report regarding the supply of materials.

ii. On completion of the installation of the EVCS (On completion of platform and canopy and other civil works), 20% of the contract value shall be released as second part payment. The supplier shall submit the invoice for the materials supplied and all documents related including the Project Completion Report to the completion of the work certified by the district office shall be submitted for the release of the amount. The PCR submitted will be used for conducting the pre-commissioning tests.

iii. Upon delivery of Transformer along with RMU and extension of HT line to the EVCS and other Electrical works, 15% of the contract value will be released.

iv. On commissioning of the EVCS, 5% of the contract value will be released after performing the Pre-commissioning tests and enabling CMS communication. All documents related to the completion of the work including commissioning report and commissioning certificate issued by the electrical utility shall be submitted for the release of the amount.

v. The balance 10% shall be retained as performance security and will be released in equal part of 2% after each year of operation till the completion of the 5th year of warranty. For each of these payment release, reports on revenue generated, energy consumed, down time due to machine failure etc must be provided as per the Service Level Agreement.

vi. The security deposit of 3% furnished along with the contract agreement shall be released on successful completion of supply, installation and commissioning.

28.3 Income tax, contribution to workers' welfare fund and other statutory deductions shall be made from the payment as per prevailing norms.

29. PERFORMANCE SECURITY

The successful bidder has to remit an amount @ 3% of the total amount quoted by the bidder as performance security deposit in terms of Bank Guarantee/Deposit having validity for 3 months from the date of agreement. The bank guarantee/deposit will be released/refunded to the successful bidder after completion of the contract period after deducting the penalties if any.

30. WARRANTY

The EVCS shall be provided with Five (5) years comprehensive on-site warranty and maintenance services, under the Contract. The Contractor shall be responsible for supply of all spare parts and consumables, repairs / replacement of any defective equipment(s) at his own cost as required from time to time during the warranty period. The Contractor shall replace/repair all the associated equipments / components getting faulty/damaged at its own cost so as to maintain the chargers availability throughout the contract period. During contract period, contractor to undertake all best practices to

i. reduce downtime
ii. maintain the charger safe for operations
iii. maintain the aesthetics.

The rates quoted by the bidder shall be inclusive of replacement cost of spares and consumables as well as services cost.

31. SERVICE AND MAINTENANCE (Service Level Requirement)

A. The Operation and Maintenance shall be comprehensive. The maintenance service provided shall ensure project functioning of the EVCS as a whole. All preventive / routine maintenance and breakdown / corrective maintenance required for ensuring maximum uptime shall have to be provided. Accordingly, the Comprehensive Operation & Maintenance shall have two distinct components as described below:

   a. Preventive / Routine Maintenance: This shall be done by the Contractor regularly and shall include activities such as cleaning and checking the health of the EV CCS, tightening of all electrical connections, and any other activity including the associated civil works, wear and tear that may be required for proper functioning of the EVCS as a whole. This is to be done on quarterly basis.

   b. Breakdown / Corrective maintenance: Whenever a fault occurs, the Contractor has to attend to rectify the fault & the fault must be rectified within the 12 hours of the complaint. The Contractor must maintain all the records pertaining to all such faults and necessary measures taken. The date of Comprehensive Operation & Maintenance Contract period shall begin from the COD. However, operation of the Project means operation of system as per tender documents and workmanship in order to keep the project trouble free covering the O&M period.

B. Contractor shall maintain a Complaint log book, which shall include the timing of logging of complaint including unique Complaint number, time of closure of complaint & it's Root Cause Analysis.

C. Bidder is requested to provide the list of all the spares and consumables required to maintain the facility for O&M period. Contractor agrees to supply such spare parts and consumables, as recommended or otherwise required for the effective and hassle-free operation and maintenance of the Facilities. However, the Contractor, with its previous experience, is to provide a list of spares and consumables including specifications, supplier details and indicative price, as recommended by him and OEM. The Contractor shall keep and maintain the inventory of such spares and

consumables for the hassle-free operation during the complete O&M period without additional cost to ANERT.

D. Also, at the end of penultimate year of the O&M contract, Contractor shall supply a list of all recommended spares and consumables as per the operational requirement of the Project and with reference to the mean time between failures (MTBF), along with detailed specifications, supplier details and tentative cost for future purchase. The price of such spare parts and consumables shall include the breakup of taxes and duties as applicable towards purchase and supply of spare parts and consumables. ANERT, at its discretion, will purchase the spare and consumables as required for future operation. However, the Contractor shall replenish the mandatory spares and consumables at his cost prior to the completion of the O&M period.

31.1 **Availability Conditions**

The charger shall be available for charging and shall communicate with the remote servers with an availability of 90% during Warranty period. The Contractor must ensure that all chargers (13 sites) are always maintained in working condition. The uptime includes the working condition of the charger, which shall be monitored online with the CMS.

31.2 **Problem Categorization**

Problems for EVCS shall be categorized into following severity levels

Category	Definition
Severity 1 – Urgent	i Complete system failure except due to upstream outage (i.e. loss of power at DISCOM tapping point) ii Loss, failure or malfunction of any major subsystem including communication loss of chargers
Severity 2 – Serious	Failure of any sub-system which does not immediately cause adverse effect on system availability
Severity 3 – General/ Technical Help	Request for information, technical configuration assistance, “how to” guidance, and enhancement requests.

31.3 Problem Resolution

Severity	Initial Response Time (Working Hours)	Initial Response Time (Non Working Hours)	Action Resolution Time	Action
1	15 minutes	30 minutes	24 hours	An urgent or emergency situation requiring continuous attention from necessary support staff until system operation is restored
2	15 minutes	2 Hours	48 Hours	Attempt to find a solution acceptable to Employer (dependent on reproducibility), as quickly as practical.
3	2 hours	1 day	5 days	Report on the problem/query is to be furnished.

31.4 System Availability and Maintenance Charges

The non-availability hours for availability calculation shall be counted from the end of the allowed Action Resolution time. A standardized digital register shall be maintained for each site containing full details of each outages, actions taken by Employer to correct the problem, applicable Severity level, time of reporting to the contractor support engineer/support, allowed Response time as per the Response times defined in above section, actual Resolution time, and signature of Engineer-incharge as well as the contractor's support engineer of the site.

31.5 Availability Calculations

Availability computation shall be done on per quarter yearly basis per site. The formula to be used for availability computation shall be as under:

Availability yearly (per site) = $[\boldsymbol{THQ} - (\boldsymbol{S1\ x\ 1} + \boldsymbol{S2\ x 0.8})] * \mathbf{100}\%\ \boldsymbol{THQ}$

Total downtime hours= ***S1 + S2 x 0.8***

Quarterly Downtime percentage= ***(S1 +S2 x 0.8) x100% /THQ***

Where THQ is total hours in the quarter

S1 is the total non-available hours in Severity Level-1

S2 is the total non-available hours in Severity Level-2

31.6 **Availability during Warranty Period**

During warranty period the availability constraints included herein shall be required to be met by the contractor (i.e. 90% availability). In case of downtime calculated is beyond allowable limit (i.e. 10%), the warranty period shall be increased by the corresponding time period of excess downtime.

31.7 **Payment of Maintenance Charges**

In the event of availability below a certain level, the maintenance charges would be proportionately reduced as follows:

Availability of Chargers	**Deduction as % of the total retention amount**
> 90%	NIL
Less than 90%	Deduction of 1% of the apportioned retention amount to be released charges for every 2% or part there of decrease in availability under 92%. The maximum deduction shall be limited to 50% of the maintenance charges to be paid for that year.

32 TECHNICAL REQUIREMENTS (ELECTRIC VEHICLE CHARGING STATION)

A. General Requirement

Following specifications are applicable to all the EV chargers.

	Parameter	Description
1	Energy Transfer Mode	Conductive
	System Structure	
1	Connector Guns	Each gun should be isolated from each other with proper insulation
2	Environmental conditions	Outdoor use
3	Power supply	EV charging station connected to A.C. mains
	Input Requirements	
1	AC Supply System	3-Phase, 5 Wire AC system (3Ph+N+E)
2	Nominal Input voltage	3Ø, 415V (+6% and -10%) as per IS 12360
3	Input Frequency	50Hz ±1.5Hz
4	Input Supply Failure backup	Battery backup for minimum 01 hour for control system and billing unit, to enable activities such as billing, to be provided. The data logs should be synched with CMS during back-up time, in case battery drains out. CMS service provider shall be identified by ANERT.
Cable and Connector Requirement		
1	Charging Cable to EV	5 Meter, Straight Cable. Suitable arrangement for storage of cable assembly and connectors (when not in use) should be provided at a height of 0.5 – 1.5 m above ground level.
2	Cable and Connector Type	The cables as well as connectors shall be suitable for delivering required electrical supply without derating and within permissible temperature increase, as specific to the corresponding connector and applicable standard. The charging cable and connector should be permanently attached to the charger
3	Cable for supply to charger	3 or 4 core cables for each charger of adequate size and suitable length (as per site requirement) shall be supplied
	Marking	

	Parameter	Description
1	Marking Requirements	The EV Charger shall bear the markings in a clear manner as per clause No. 11.14.3 of AIS 138 Part 1.
2	Logo	Frontside of charger shall be free from logo, design, marking etc. For identification of connector type required marking is to be given at output & storage point. Colour combination of charger to be approved by ANERT.
User Interface & Display Requirements		
1	ON- OFF (Start-Stop) switches	Simple Push button type or through Touch Screen
2	Emergency stop switch	Simple Push button type in Red Colour, visible and easily accessible (Mushroom head type)
3	Visual Indicators	Error indication, Presence of input supply indication, State of charge process indication
4	Graphical User Interface	The Graphical User Interface (GUI) shall be designed in a user-friendly manner from a customer perspective.
5	Support Language	English (Mandatory), Other Languages (Optional)
6	Display Messages	EVSE (also referred as EV charger) should display appropriate messages for user during the various charging states like: • Vehicle plugged in & out • Duration since start of charge, kWh. • User authorization status • Idle / Charging in progress: SOC • Fault conditions • Metering Information: Energy Units consumed
7	Authentication	As per OCPP 1.6 or above. Further, for higher version of OCPP in future, the charger must have capability to support the higher version after due firmware upgradation during warranty and AMC period without any additional cost to ANERT.
8	Authorisation	• OTP • RFID Card Necessary functionalities to operate the charger with RFID card both in online and offline (w.r.t. communication) mode with backend service arranged by ANERT. Properly visible card reader to be inbuilt in the charger.

	Parameter	Description
		Charger supplier shall inform RF protocol (the protocol should be widely used type like ISO 14443 Type A/Type B (13.56 MHz), PSAM & ESAM ISO7816) to ANERT.
9	Display	Min 6 inches with 720 x 480 pixels TFT LCD/LED Screen, user interface with touch screen or keypad. Toughened unbreakable glass to be used for display screen
10	Memory	Facility to store at least 1-month data or min 1000 charging logs, with suitable facility to extract the details online and also at site.
Communication Requirement		
1	Communication between EVSE and Vehicle	As specified by corresponding connector protocol PLC Communication for CCS II connector IEC-61851-1 based communication for Type II AC (PWM control)
2	Communication interface between charger and central management system (CMS)	Ethernet (Standard), GPRS {Dual SIM card provision, Wi-Fi (Optional) The modem is to be kept inside charger unit while ensuring avoidance of signal loss.
3	Communication between EVSE and Central Server	Open Charge Point Protocol (OCPP) 1.6 protocol or higher versions compatible to OCPP 1.6 Metering: Grid responsive metering
Mechanical Requirements		
1	Mechanical Stability	Shall not be damaged by mechanical impact as defined in • Section 11.11.2 of IEC 61851-1 for 122 kW charger • Section 11.11.2.3 of AIS 138 for AC 001
2	Mechanical Impact	Shall not be damaged by mechanical impact as defined in • Section 11.11.3 of IEC 61851-1 for 122 kW charger • Section 11.11.2.2 of AIS 138 for AC 001
3	Mounting	• In case of 122 kW charger: Floor Mounting Pillar Type • In case of AC 001: Provision like Wall / Pole Mount / Pillar type arrangement with Stand/Wall arrangement as per site & approval of Engineer In-charge.
4	Ingress Protection	IP 54 or better
5	Cooling	Air Cooled

	Parameter	Description	
6	Dimension(W*H*D)/Weight	as per manufacturer design	
Performance Requirements for DC Charger			
1	Converter Efficiency	≥ 94 %	
2	Power factor	≥ 0.99 (Full load)	
3	Current & Voltage THD	< 5%	
Type Testing (Clause no. of AIS 138 Part 1)			
1	Safety Functions Verification	Earth Presence Detection (Socket – EVSE)	6.4.1.1
		Earth Continuity Check (EVSE – EV)	6.4.1.2
		Over current and Short-Circuit Protection	6.4.1.5
		Leakage Current (RCD)	6.4.1.6
		Dielectric withstand Voltage	11.6.1
2	Mechanical Stability	Mechanical Impact	11.11.2.2
		IP Testing	11.11.2.4
3	Climatic Environmental Tests	Ambient Air Temperature	11.11.1.2
		Ambient Air Humidity	11.11.1.4
4	EMC Verification	Immunity to Electrostatic Discharges	11.11.3.2
		Supply voltage dips and interruptions	11.11.3.2
		Fast transient bursts	11.11.3.2
		Voltage Surges	11.11.3.2
		Radiated electromagnetic disturbances Electrical Field (30 MHz – 1000 MHz)	11.11.3.3

B. 240 kW (CCS-II + CCS-II) | 120 kW (CCS-II + CCS-II)

The power rating of the Charger should be minimum 120 kW (2 Guns of *CCS II each of 60 kW capacity and capable of charging at 120 kW, if only a single gun is used*). In case of parallel operation, the wattage should not go lower than the power rating defined for each output. Required specification summary is given below:

#	Parameter	Description
General Requirements		
1	EVSE Type	Single Unit with 2 Guns as under: CCS-II-60 kW, CCS-II-60 kW (Cumulative capacity - 120 kW) CCS-II – 240 kW or 2 x 120 kW
2	Charging mode	CCS-II – Type-2/Combo-2 – Mode 4 (DC Charging)
3	Reliability and Serviceability	Modularity, self-diagnostic features, fault codes and easy serviceability in the field
System Structure		
1	Regulation Method	Regulated D.C. EV charging station with combination of CVC (Constant Voltage Charging) or CCC (Constant Current Charging) but not simultaneously
2	DC output voltage rating	200-500V or higher CCS-II
4	Charge control communication	Communicate by digital and analog signals
5	Interface inter-operability	Inter-operable with any EV supporting CCS-II or AC Type-2 (for each gun respectively)
Output Requirements		
1	Output Connector Compatibility	CCS-II: As per IEC 61851-23/-24, IEC 62196-3, DIN 70121
Performance Requirements		
1	DC Output voltage and current tolerance	DC Output current regulation in Constant Current Charging (CCC): ± 2.5 A for the requirement below 50 A, and ± 5 % of the required value for 50 A or more DC Output voltage regulation in Constant Voltage Charging (CVC): Max. 2 % for the max rated voltage of the EVSE
2	Control delay of charging current in CCC	DC output current Demand Response Time: <1 s Ramp up rate: 20 A/s or more Ramp Down rate: 100 A/s or more
3	Descending rate of charging current	EVSE should be able to reduce DC current with the descending rate of 100 A/s or more
4	Periodic and random deviation (current ripple)	DC output current ripple limit of EVSE: 1.5 A below 10 Hz, 6 A below 5kHz, 9A below 150 kHz
5	Periodic and random deviation (voltage ripple)	Max. ripple voltage: ±5V. Max slew rate: ±20 V/ms
6	End of Charging	Once the charging stops, the connector shall be released only after successful payment/acknowledgement is received.

#	Parameter	Description
Protection & Safety Requirements		
1	Safety Parameters	Over current, under voltage, over voltage, Residual current protection, Surge protection, short circuit, Earth fault at output, Input phase reversal, Emergency shut-down with alarm, Over temperature, Effective earth continuity between the enclosure and the external protective circuit, as per IEC 61851

EVSE shall have provision of emergency switching, protection against uncontrolled reverse power flow from vehicle. The specific requirements defined in Section 102.2 of IEC 61851-23 shall be applicable except for *Rated outputs and maximum output power*: The rating shall be as per clause from Section 101.2.1.1 of IEC 61851-23; however, the temperature range shall be as specified in this TS instead.

Specific Requirements:

- Double-pole breaking RCD (IEC 60309) of less than 30mA (As per section 7.4 of AIS 138 Part 1) should be provided for leakage current protection.
- Limiting Output Current: Circuit breaker for each outlet should limit the output current to 15A. Breaker should be reset to resume normal operation.
- Output selection: The breaker inside to be energized in sequence - one round of all three phases before the second round.
- Socket readiness: An LED to indicate that the socket is ready.

C1. Input Requirement

i. A.C. Supply System is 3 phase, 5 wire AC system (3 phases + N + PE)
ii. Nominal Input Voltage is 415V (+6% and -10%) as per IS 12360.
iii. Input Frequency is 50Hz ± 1.5 Hz
iv. Input Supply Failure back-up: Battery backup for minimum 1 hour for the control System and billing unit. Data logs should be synchronized with CMS during back up time, in case battery drains out.

C2. Output Requirements

The Charger shall have two outputs, compliant with CCS type 2

The maximum rated output of the Charger shall be limited to 120 kW, where in only one output shall charge the EVSE at a time capable of delivering full load. While both guns are operating, the power shall be limited to 60 kW each. The parameters such as DC voltage & current levels, efficiency, power factor etc. shall comply with the applicable IEC61851 series of standards for DC Conductive Charging Systems.

C3. Cable Requirements

The charging cable shall be at the EVSE side. The cable assembly, length, storage etc. shall comply with IEC61851.

C4. Mechanical Requirements

i. Ingress Protection: The minimum IP degrees for ingress of objects is IP 54
ii. Mechanical Impact: As per IEC 61851-1 Section 11.11.2
iii. Mechanical Stability: The EVSE - DC shall be installed as intended by the manufacturer's installation instructions. A force of 500 N shall be applied for 5 min in the horizontal direction to the top of the EVSE - DC in each of the four directions or in the worst possible horizontal direction. There shall be neither deterioration of the Electric vehicle charging neither station nor deformation at its summit greater than
    a. 50 mm during the load application.
    b. 10 mm alter the load application.
iv. Cooling: Air cooled or forced cool for protection and safety of equipment from any fire hazards.

C5. Protection Requirements

ii. Protection against Electric Shock: Hazardous live parts shall not be accessible. Exposed conductive parts shall not become a hazardous live part under normal conditions (operation as intended use and in the absence of a fault), and under single-fault conditions. Protection against electric shock is provided by the application of appropriate measures for protection both in normal service and in case of a fault. For systems or equipment on board the vehicle, the

requirements are defined in AIS-038 (Rev.1) - For systems or equipment external to the vehicle, the requirements are defined in IEC 60364-4-41.

iii. Accessibility to live parts: When connected to the supply network, the EVSE shall not have any accessible hazardous live part, even after removal of parts that can be removed without a tool. All accessible parts (eg. metal enclosures) must be prevented from becoming hazardous live. Compliance is checked by inspection and according to the requirements of IS/IEC 60529 (IPXXB).

iv. Disconnection of EV: One second after having disconnected the EV from the supply (mains), the voltage between accessible conductive parts or any accessible conductive part and earth shall be in compliance with IS 13252/IEC 60950. If the voltage is greater than 42.4 V peak (30 Vrms) or 60 V D.C., or the energy is 20 J or more, a warning label shall be attached in an appropriate position. Compliance is checked by inspection and by test.

v. Disconnection of EVSE: Conditions for the disconnections of the EVSE from the supply mains are identical to Clause (ii) of 2.1.2.6.

vi. Fault protection: Protection against indirect contact shall consist of one or more recognized provision(s). According to IEC 60364-4-41, recognized individual provisions for fault protection are:

   a. Supplementary or reinforced insulation
   b. Protective equipotential bonding
   c. Protective screening
   d. Automatic disconnection of supply
   e. Simple separation

      i. Supplementary measures: To avoid indirect contact in case of failure of the basic and/or fault protection or carelessness by users, additional protection against electric shock shall be required.

      ii. An RCD (IAN < 30 mA) shall be provided as a part of the EV conductive supply equipment for earthed systems. The RCD shall have a performance at least equal to Type A and be in conformity with standard IEC 60364-4-41

iii. Where power supply circuits that are galvanically separated from mains and are galvanically isolated from earth, electrical isolation between the isolated circuits and earth, and between the isolated circuits and exposed conductive parts of vehicle and EVSE shall be monitored.

iv. When a fault condition related to the electrical isolation is detected, the power supply circuits shall be automatically de-energized or disconnected by the EVSE.

v. Effective earth continuity between the enclosure and the external protective circuit, as per AIS 138 Part 1 Section 6.4.1.2

C6.Environmental Requirements

i. Ambient Temperature Range: 0 to 55°C as per 11.11.1.2 of IEC-60068-2-14.
ii. Ambient Humidity: 5 to 95% as per IEC 60068-2-30.
iii. Ambient Pressure: 86 kpa to 106 kpa as per IEC 60529.
iv. Storage temperature: 0 to 60°C

C7.Communication Requirements

The conductive digital communication between DC EVSE and EV shall comply with the IEC-6185124:2014

C8.Internet of Things - EVSE

The Electric Vehicle Station Equipment shall be IOT enabled. The details about uptime, availability, charge status, power consumption etc as per OCPP 1.5 protocol shall be provided. The EVSE shall be provided with GPRS communication for EVSE to communicate with CMS. The GPRS services shall be provided by the successful bidder during the warranty and AMC period.

C9.User Authentication Mechanism

The EV Charging units shall have user authentication mechanism with the help of which the Charging Stations shall be enabled for unmanned operation along with digitized cashless payment solutions. The important features /requirements are

i. The user authentication mechanism shall be through both mobile application and

radio frequency identification (RFID) card reader type.

ii. The user must be able to charge the vehicle only after the authorization of the Vehicle through RFID / Mobile app.

iii. Once the user is authorized, user must agree to pay the amount which is auto-deducted from the linked payment account.

iv. Only after the payment authorization, the charging process shall be initiated.

v. The RFID card reader shall be integrated type and shall be compatible with NFC technology.

vi. The successful bidder shall also provide supporting RFID Cards/Tags for each of the charging stations.

The user authentication mechanism shall strictly follow the OCPP 1.6 or above. The EVSE thus supplied shall be future proof to be operated as an unmanned EV Charging Station.

C. 240 kW / 2 Nos of 120 kW (CCS) for Electric Bus Charging

240 kW Electric Vehicle (EV) Off-Board DC Charger with CCS-II Protocol for Electric Buses with DUAL Output (each output rated for 120kW) along with connectors and necessary communication system and metering system, complete in all respect. The Required specification summary is given below:

#	Parameter	Description
General Requirements		
1	EVSE Type	Single Unit with 2 Guns as under: CCS-II – 240 kW or 2 x 120 kW
2	Charging mode	CCS-II – Type-2/Combo-2 – Mode 4 (DC Charging)
3	Reliability and Serviceability	Modularity, self-diagnostic features, fault codes and easy serviceability in the field
System Structure		
1	Regulation Method	Regulated D.C. EV charging station with combination of CVC (Constant Voltage Charging) or CCC (Constant Current Charging) but not simultaneously
2	DC output voltage rating	200-500V or higher CCS-II

#	Parameter	Description
4	Charge control communication	Communicate by digital and analog signals
5	Interface inter-operability	Inter-operable with any EV supporting CCS-II or AC Type-2 (for each gun respectively)
Output Requirements		
1	Output Connector Compatibility	CCS-II: As per IEC 61851-23/-24, IEC 62196-3, DIN 70121
Performance Requirements		
1	DC Output voltage and current tolerance	DC Output current regulation in Constant Current Charging (CCC): ± 2.5 A for the requirement below 50 A, and ± 5 % of the required value for 50 A or more DC Output voltage regulation in Constant Voltage Charging (CVC): Max. 2 % for the max rated voltage of the EVSE
2	Control delay of charging current in CCC	DC output current Demand Response Time: <1 s Ramp up rate: 20 A/s or more Ramp Down rate: 100 A/s or more
3	Descending rate of charging current	EVSE should be able to reduce DC current with the descending rate of 100 A/s or more
4	Periodic and random deviation (current ripple)	DC output current ripple limit of EVSE: 1.5 A below 10 Hz, 6 A below 5kHz, 9A below 150 kHz
5	Periodic and random deviation (voltage ripple)	Max. ripple voltage: ±5V. Max slew rate: ±20 V/ms
6	End of Charging	Once the charging stops, the connector shall be released only after successful payment/acknowledgement is received.
Protection & Safety Requirements		
1	Safety Parameters	Over current, under voltage, over voltage, Residual current protection, Surge protection, short circuit, Earth fault at output, Input phase reversal, Emergency shut-down with alarm, Over temperature, Effective earth continuity between the enclosure and the external protective circuit, as per IEC 61851

EVSE shall have provision of emergency switching, protection against uncontrolled reverse power flow from vehicle. The specific requirements defined in Section 102.2 of IEC 61851-23 shall be applicable except for *Rated outputs and maximum output power*: The rating shall be as per clause from Section 101.2.1.1 of IEC 61851-23; however, the temperature range shall be as specified in this TS instead.

Specific Requirements:

- Double-pole breaking RCD (IEC 60309) of less than 30mA (As per section 7.4 of AIS 138 Part 1) should be provided for leakage current protection.
- Limiting Output Current: Circuit breaker for each outlet should limit the output current to 15A. Breaker should be reset to resume normal operation.
- Output selection: The breaker inside to be energized in sequence - one round of all three phases before the second round.
- Socket readiness: An LED to indicate that the socket is ready.

C1. Input Requirement

a. A.C. Supply System is 3 phase, 5 wire AC system (3 phases + N + PE)

b. Nominal Input Voltage is 415V (+6% and -10%) as per IS 12360.

c. Input Frequency is 50Hz ± 1.5 Hz

d. Input Supply Failure back-up: Battery backup for minimum 1 hour for the control System and billing unit. Data logs should be synchronized with CMS during back up time, in case battery drains out.

C2. Output Requirements

The Charger shall have two outputs, compliant with CCS type 2

The maximum rated output of the Charger shall be limited to 120 kW, where in only one output shall charge the EVSE at a time capable of delivering full load. While both guns are operating, the power shall be limited to 60 kW each. The parameters such as DC voltage & current levels, efficiency, power factor etc. shall comply with the applicable IEC61851 series of standards for DC Conductive Charging Systems.

C3. Cable Requirements

The charging cable shall be at the EVSE side. The cable assembly, length, storage etc. shall comply with IEC61851.

C4. Mechanical Requirements

i. Ingress Protection: The minimum IP degrees for ingress of objects is IP 54

ii. Mechanical Impact: As per IEC 61851-1 Section 11.11.2

iii. Mechanical Stability: The EVSE - DC shall be installed as intended by the manufacturer's installation instructions. A force of 500 N shall be applied for 5 min in the horizontal direction to the top of the EVSE - DC in each of the four directions or in the worst possible horizontal direction. There shall be neither deterioration of the Electric vehicle charging neither station nor deformation at its summit greater than

a. 50 mm during the load application.

b. 10 mm alter the load application.

iv. Cooling: Air cooled or forced cool for protection and safety of equipment from any fire hazards.

C5.Protection Requirements

i. Protection against Electric Shock: Hazardous live parts shall not be accessible. Exposed conductive parts shall not become a hazardous live part under normal conditions (operation as intended use and in the absence of a fault), and under single-fault conditions. Protection against electric shock is provided by the application of appropriate measures for protection both in normal service and in case of a fault. For systems or equipment on board the vehicle, the requirements are defined in AIS-038 (Rev.1) - For systems or equipment external to the vehicle, the requirements are defined in IEC 60364-4-41.

ii. Accessibility to live parts: When connected to the supply network, the EVSE shall not have any accessible hazardous live part, even after removal of parts that can be removed without a tool. All accessible parts (eg. metal enclosures) must be prevented from becoming hazardous live. Compliance is checked by inspection and according to the requirements of IS/IEC 60529 (IPXXB).

iii. Disconnection of EV: One second after having disconnected the EV from the supply (mains), the voltage between accessible conductive parts or any accessible conductive part and earth shall be in compliance with IS 13252/IEC 60950. If the voltage is greater than 42.4 V peak (30 Vrms) or 60 V D.C., or the energy is 20 J or more, a warning label shall be attached in an appropriate position. Compliance is checked by inspection and by test.

iv. Disconnection of EVSE: Conditions for the disconnections of the EVSE from the supply mains are identical to Clause (ii) of 2.1.2.6.

v. Fault protection: Protection against indirect contact shall consist of one or more recognized provision(s). According to IEC 60364-4-41, recognized individual provisions for fault protection are:

f. Supplementary or reinforced insulation
g. Protective equipotential bonding
h. Protective screening
i. Automatic disconnection of supply
j. Simple separation

vi. Supplementary measures: To avoid indirect contact in case of failure of the basic and/or fault protection or carelessness by users, additional protection against electric shock shall be required.

vii. An RCD (IAN < 30 mA) shall be provided as a part of the EV conductive supply equipment for earthed systems. The RCD shall have a performance at least equal to Type A and be in conformity with standard IEC 60364-4-41

viii. Where power supply circuits that are galvanically separated from mains and are galvanically isolated from earth, electrical isolation between the isolated circuits and earth, and between the isolated circuits and exposed conductive parts of vehicle and EVSE shall be monitored.

ix. When a fault condition related to the electrical isolation is detected, the power supply circuits shall be automatically de-energized or disconnected by the EVSE.

x. Effective earth continuity between the enclosure and the external protective circuit, as per AIS 138 Part 1 Section 6.4.1.2

C6.Environmental Requirements

i. Ambient Temperature Range: 0 to 55°C as per 11.11.1.2 of IEC-60068-2-14.
ii. Ambient Humidity: 5 to 95% as per IEC 60068-2-30.
iii. Ambient Pressure: 86 kpa to 106 kpa as per IEC 60529.
iv. Storage temperature: 0 to 60°C

C7. Communication Requirements

The conductive digital communication between DC EVSE and EV shall comply with the IEC-6185124:2014

C8. Internet of Things - EVSE

The Electric Vehicle Station Equipment shall be IOT enabled. The details about uptime, availability, charge status, power consumption etc as per OCPP 1.5 protocol shall be provided. The EVSE shall be provided with GPRS communication for EVSE to communicate with CMS. The GPRS services shall be provided by the successful bidder during the warranty and AMC period.

C9. User Authentication Mechanism

The EV Charging units shall have user authentication mechanism with the help of which the Charging Stations shall be enabled for unmanned operation along with digitized cashless payment solutions. The important features /requirements are

i. The user authentication mechanism shall be through both mobile application and radio frequency identification (RFID) card reader type.
ii. The user must be able to charge the vehicle only after the authorization of the Vehicle through RFID / Mobile app.
iii. Once the user is authorized, user must agree to pay the amount which is auto-deducted from the linked payment account.
iv. Only after the payment authorization, the charging process shall be initiated.
v. The RFID card reader shall be integrated type and shall be compatible with NFC technology.
vi. The successful bidder shall also provide supporting RFID Cards/Tags for each of the charging stations.

The user authentication mechanism shall strictly follow the OCPP 1.6 or above. The EVSE thus supplied shall be future proof to be operated as an unmanned EV Charging Station.

D. Test Certificates

The Chargers should be type tested as per AIS 138 (listed above) at ARAI (Automotive Research Association of India) or International Centre for Automotive Technology (ICAT) or accredited laboratory of National Accreditation Board for Testing and Calibration Laboratories (NABL) or any Internationally Accredited Laboratory. The type test report shall be submitted for review and approval by employer on or before Factory Acceptance Test (FAT). Type test certificate of charger with different combination of guns or higher capacity shall also be acceptable meeting requirements of this specification.

33. CIVIL AND ELECTRICAL WORKS

Construction of platform and extension of power supply to EVSE and supply of canopy will be under the scope of successful bidder.

The successful bidder shall provide the drawings for the platform required for installing the Charging Unit(s) showing dimensions and get approved before start of works;

The following works will come under the scope of the contractor:

- Construction of Platform
- Extension of supply to EVSE – New connections if any required will be provided by ANERT.
- Canopy for the charging station.
- Vehicle stoppers to avoid vehicle - charger collision.
- There shall be suitable illumination, 2x8 Amps power sockets for the shelter.
- All the metal parts shall be painted with anti-rust blue paint.
- The front of the shelter shall be provided with a name board as approved by ANERT.
- Marking of parking space for 2nos of 4wheeler vehicles with sufficient space between the vehicles.
- Extension of Power Supply to the CS is to be done by the successful bidder. Also, the successful bidder shall ensure proper safety measures while executing the line works. ANERT shall not be responsible for an undesired incident that occurs because of not ensuring safety the successful bidder.

Also the charging station created shall be subjected to the inspection and approval of the Electrical Inspectorate, Government of Kerala and KSEBL before commissioning.

- ANERT will not be responsible for any damage caused due to negligence of the contractor during the execution of the works.
- The EV Charging Stations must be installed so that any socket outlet of supply is at least 800 mm above the finished ground level.
- The EV Charging Stations must use the armored type cable from EV Charging Station to the Electric Vehicle and the maximum length of the cable shall be limited to 05 metres.

33.1 TECHNICAL DETAILS OF CIVIL & STRUCTURAL WORKS:

A. Soil investigation and Land Development

i. Soil investigation shall be carried out with minimum one Trial pit and two bore holes (150mm Diameter, 10m depth into virgin soil or to refusal whichever occurs earlier) per each EV station and topographical survey needs to be carried at 2m x 2m grids for plan area and 5m beyond the plot boundary.

ii. Site grading for Parking area shall be provided with Interlocking tiles with minimum thickness of 75mm with 300mm thickness sand cushion below and proper sloping towards peripheral drains.

iii. Minimum Plot area and Roof Canopy Area requirements for EV station
   a. For One Car - Plot Area- Length 6.5m and Width 2.4m per Car / Canopy Area- Length 5.7m and Width 2.4m per Car
   b. For One Bus- Plot Area -Length 8m and Width 4.5m per Bus / Canopy Area - Length 6m and Width 4.5m per Bus

iv. Minimum height clearance of canopy shall be 3m for car and 5m for bus from finished ground level.

B. Roof Canopy Arrangement

i. The Roofing system shall serve as the roof for the EV charger and hence a waterproof roofing is expected. The rainwater falling on the roof is to be drained such that no water falls on the vehicles parked for charging.

ii. Roof shall be provided with Seamless steel color coated sheet of minimum thickness 0.5mm TCT suitable for solar module fixing as well as to serve as roof covering for charging vehicles.
iii. Stainless steel clip lock shall be used for module fixing with roof.
iv. Canopy structure shall be connected to foundations using base plate and foundation bolts.
    - The base plates and stiffeners shall be welded to the main leg. The welds shall be continuous fillet type welds.
    - The minimum thickness of members considered are as follows:

      Main leg members - 5 mm
      Bracing - 5 mm
      Gusset/Stiffener plates - 5 mm
v. Permanent barrier posts galvanized (610g/sq.m) tubular pipe structure of grade minimum Yst. 240 conform to IS:1161 shall be provided in front side of EV chargers to allow a safe distance between EV charger and vehicles.

C. Foundation for Canopy Structure and other structures:

i. Finished ground level shall be minimum 300mm above existing ground level/ nearest road level whichever is higher.
ii. All the Foundations shall be designed based on soil investigation report.
iii. Canopy Structure pedestal shall be minimum 500mm above Finished ground level. EV charger and LT panel Foundations plinth shall be minimum 300 mm above finished ground level.
iv. Factor of safety for stability against overturning, sliding and uplift shall be considered as per IS 456.
v. Exposed surface of concrete shall be plastered in CM 1:3 with 12mm thick.
vi. Exposed surface of concrete shall be painted with 2 two coats of distemper paint.

D. EV charger, Transformer and Double Pole Foundation:

i. Block/Pedestal type foundation shall be provided for the EV charger, transformer, and LT panel with suitable structural base frame and mounting arrangement.

ii. Double pole structure for Transformer shall be provided with Muffing and Foundation depth shall be minimum 1/6th the height of Pole.

E. Chain – link Fence and Gate for Transformer:

i. Fencing shall be provided around Transformer with 1No. of Gate.
ii. The Minimum height of fence shall be 1.5m above the FGL.
iii. Toe walls of 230mm thickness brick masonry with CM 1:5 & 12mm thickness plastered with CM 1:4. Toe wall shall be minimum 200mm above the formation level with 75mm thick PCC coping (1:3:6) and shall extend minimum 300mm below the formation level
iv. Foundation of fence post shall be of minimum 400mm x400mm x 500mm below ground level (PCC 1:3:6)
v. All fence posts shall be of 50 x 50 x 6 MS angles spaced at 1.5m center to center distance.
vi. Vertical and horizontal flats of size minimum 50mmX4mm thickness shall be provided at an interval of 300mm throughout the length and height of the fence
vii. Edge of the fence and at center of fence shall be provided with minimum 50X50X6 MS angles
viii. All gates shall be of structural steel of minimum 1.5 meters width.
ix. All structural steel sections shall be painted with synthetic enamel paint.

F. Gravel Spreading for Transformer

i. A layer of 100mm thickness of stone aggregate of 40mm nominal size shall be spread uniformly over compacted soil in LT Transformer area.
ii. Buried Cable Trench shall be covered with RCC protection slab

G. CIVIL AND STRUCTURAL DESIGN PARAMETERS

LIST OF INDIAN STANDARDS TO BE FOLLOWED: The under mentioned codes are basic codes to be referred for civil design of EV charging stations

- IS 456 - 2000: Indian Standard Code of Practice for Plain and Reinforced Concrete.
- IS 800 - 2007: Indian Standard Code of Practice for General Construction in Steel.
- IS 875 (Part 1)-1987: Indian Standard Code of Practice for Design loads (other than

Earthquake) for buildings and structures. (Dead Loads)

- IS 875 (Part 2)-1987: Indian Standard Code of Practice for Design loads (other than Earthquake) for buildings and structures (Live Loads)
- IS 875 (Part 3)-2015: Indian Standard Code of Practice for Design loads (other than Earthquake) for buildings and structures. (Wind Loads)
- IS 1893 (Part-1 & 4) - 2005: Criteria for Earthquake resistant design of structure (General Provisions & Buildings).
- IS 13920 - 2016: Ductile Detailing of Reinforced Concrete Structures subjected to Seismic Forces (where applicable).
- SP – 34-1987 for detailing of concrete structures.
- IS 808 -1989: Dimensions for Hot rolled Steel Beams, Column, Channel and Angle section

H. MATERIALS:

i. R.C.C.

- Ordinary Portland Cement Grade 43 conforming to IS 8112 or Portland Pozzolana Cement conforming to IS: 1489
- Grade of RCC shall be Minimum M25 & PCC shall be 1:4:8. minimum PCC shall be 75mm thick below foundations.
- Reinforcing steel shall be HYSD/TMT Bars of Grade Minimum Fe500 conforming to IS: 1786.

ii. CANOPY STRUCTURAL STEEL

- Structural steel shall be of mild steel conforming to IS: 2062 -2011. Minimum Grade shall be E250A in accordance to IS: 808 – 1989. Grade for Structural pipes shall be Minimum Yst:240MPa and shall conform to IS:1161- 2014
- Cold form steel shall conform to IS:811- 1987 and minimum thickness shall be 1.5mm.
- All fastening bolts and nuts shall be hexagonal type & mild steel property class 5.6 and shall conform to IS: 1367 (part II) - 2002, IS: 1367 (part III) – 2002 and IS: 1367 (part IV) – 1994.

- All foundation bolts shall be mild steel (property class 4.6) and shall conform to IS: 1367 (Part- 6) - 1994 & IS: 5624 - 1993 and material grade shall be as per IS: 2062 (Grade E250A).
- All nuts shall conform to IS: 1363 Part 3 -2002 of property class 5.
- All plain washers shall conform to IS: 2016.
- All spring washers shall conform to IS: 3063.
- Minimum diameter of fastening bolts for steel structures shall be 12 mm.
- EV station canopy supporting structure shall be hot dip galvanized with a minimum coating thickness of 610 g/sqm.
- All foundation bolts shall be hot dip galvanized to its full length in accordance with IS: 5624 /1367 with minimum coating thickness of 610 g/sqm.
- Fastening bolts & nuts shall be hot dip galvanized with a minimum coating thickness of 305 g/sqm.

I. UNIT WEIGHTS OF MATERIALS:

- PCC - 24 kN/cum
- RCC - 25 kN/cum
- Structural Steel - 78.5 kN/cum
- Cold formed Steel - 78.5 kN/cum

J. LIVE LOADS:

Live Loads shall be 0.75kN/sqm as per IS 875 (Part -2) 1987 for Canopy structure along with Solar PV panels loads.

K. DEAD LOADS:

Dead loads of EV charger and LT panel shall be considered for foundation design.

L. WIND LOADS

- Basic wind speed shall be 39m/s as per IS: 875(Part -3) 2015
- Risk Coeff. K1 = As per Clause 6.3.1
  K2 = As per Clause 6.3.2
  K3 = As per Clause 6.3.3

K4 = As per Clause 6.3.4

- Other factors as per IS: 875 (Part -3) 2015 for Buildings

M. EARTHQUAKE FORCES:

- Seismic Zone shall be Zone III as per IS 1893(Part -1) 2005
- Importance Factor = 1.5 for EV charging Canopy structure

N. LOAD COMBINATION WITH LOAD FACTORS:

Load combinations with Partial safety factors for limit state of design is considered as per IS: 456-2000, IS: 800-2007 & IS: 1893-2005.

O. DESIGN PARAMETERS

General design parameters considered are as follows:

- Clear cover for concrete (As per IS: 456-2000)
- Footing = 50 mm
- Column/Pedestal = 40 mm
- Foundation shall be designed for critical load combination load reference with
- IS: 1904 / IS: 1080 / IS: 2950.
- Columns are designed for Axial/bending for critical load combination using standard/ In-house programs.
- The structures shall be detailed as per IS 800, IS: 13920 & SP: 34.

P. STRUCTURAL ANALYSIS – Canopy Structure

The Canopy Structure shall be analyzed using STAAD Pro./relevant software.

Q. STRUCTURAL DESIGN

The structural member's viz., Structural steel members, Columns & Footings shall be designed for the most critical forces using Limit State Design method of IS 800 and IS 456 respectively.

33.2 TECHNICAL DETAILS OF ELECTRICAL WORKS:

All the electrical HT & LT works required to be done as part of the service line for the EVCS must be in compliance with norms set forth by the Electrical Inspectorate and the utility KSEBL. The bidder shall obtain all necessary approvals of the aforesaid agencies and follow the technical specifications for Distribution Transformer, RMU, HT Cable, Bus bar etc. The specifications are attached as annexure – G.

A. Earth protection system for charging stations:

i. Co-ordination of various protective devices shall be required.
ii. All EV charging stations shall be provided with an earth continuity monitoring system that disconnects the supply in the event that the earthing connection to the vehicle becomes ineffective.
iii. Earthing of all EV charging stations shall be TN system as per IS 732.
iv. Detection of the electrical continuity by the protective conductor: A protective earth conductor shall be provided to establish an equipotential connection between the earth terminal of the supply and the conductive parts of the vehicle. The protective conductor shall be of sufficient rating to satisfy the requirements of IEC 60364-5-54.

B. **Requirement to prevent fire for EVs Charging Stations:**

Firefighting system for EVs Charging Stations shall be as per relevant provisions of CEA (Measures Relating to safety and Electric Supply) Regulations 2010.

i. Enclosure of charging stations shall be made of fire-retardant material with self-extinguishing property and free from Halogen.
ii. Fire detection, alarm and control system shall be provided as per relevant IS.

C. Testing of EVs charging stations

i. All apparatus of EV Charging Station shall have the insulation resistance value as stipulated in the relevant IEC 61851-1.
ii. Any testing as specified in the manufacturer's instructions for the RCD and the EV charging station.

34. LABELLING OF EV PCS

The PCS shall be labeled with ANERT logo on the front panel of Canopy. The logo will be furnished to the successful bidder before the issue of delivery instructions. The logo shall be of vinyl sticker type. Further the platform for vehicle shall be painted indicating the electric vehicle parking space with symbols/ logos as shown below:

Inside of the shelter painting/name board shall be made to indicate the "Bay" numbering for each parking space. Example: Bay - 1, Bay - 2 etc.

35. Smart Meters

The EV Charging Stations shall be provided with Smart Energy Meters for measurement of Electrical Energy Consumption. The 3 Phase, 4 Wire LT CT Operated Smart Energy Meter shall comply with the applicable IS16444:2017 (part 2) and IS15959:2017 (part 3) standards. The general meter specifications shall comply with the IS14697:1999 Class 0.5S accuracy and shall be tamper proof complying with IP65 rating. The type test certificates shall be submitted along with the GTP for approval. The same shall be verified by KSEB during the pre-dispatch inspection and the testing shall be arranged by the bidder at meter manufacturer facility/ NABL accredited laboratories

36. INSURANCE

35.1 The power plant must be insured at every stage of operation – from Material dispatch, storage, completion of installation and till 5 years after commissioning. The insurance coverage on handing over of the system must include all conditions of **Standard Fire and Special Perils Policy (Material Damage)**.

35.2 The insurance premium for the 5 years of warranty is to be paid by the bidder. Only the system components are to be insured. On handing over of the system, the original insurance policy is to be handed over to the authorised person at the site of installation and a copy to ANERT District Office. The annual premium payment receipt must be handed to the authorised person at the site of installation.

FORMAT FOR COVERING LETTER

(This letter to be submitted on the official letter head of the tenderer, signed by the authorised signatory.)

Sir,

I/We hereby e-tender to supply, under annexed terms and conditions of contract, the whole of the articles referred to and described in the attached specification and quantity decided by the Agency for New & Renewable Energy Research and Technology (ANERT), at the rates quoted against each item.

I am/We are remitting herewith the required amount of Rs. ..... towards the cost of e-tender and Earnest Money Deposit by electronic payment vide transaction No ..... dtd.....

Yours faithfully,

Place:

Date:

Signature

Name

Designation

(Office Seal)

FORMAT A – UNDERTAKING FOR NO BLACKLISTING & NO BANNING

(To be provided on Rs.200 Non-Judicial Stamp paper. In Case of JV the following format is to be provided by Each Member of the Joint Venture on their respective letterhead, signed by respective authorized Signatory along with Authorized Signatory for which POA is attached with Bid))

Undertaking for No Blacklisting & No Banning

To

The CEO
ANERT

Sub: Request for Selection of agency for the Design, Supply, Installation, Testing, Commissioning and Maintenance of Public Electric Vehicle Charging Station for ANERT at various locations in the Solar City of Thiruvananthapuram (funded by Smart City Thiruvananthapuram Ltd)

I / We hereby declare that presently our Company/Limited Liability Partnership/ Partnership Firm/ Sole Proprietorship is having unblemished record and is not declared ineligible for corrupt/fraudulent practices by any State/Central Government/PSU on the date of Bid Submission.

I / We further declare that presently our Company/Limited Liability Partnership/ Partnership Firm/ Sole Proprietorship is not blacklisted and not declared ineligible for reasons other than corrupt/fraudulent practices by any State/Central Government/PSU on the date of Bid Submission.

If this declaration is found to be incorrect then without prejudice to any other action that may be taken, our security may be forfeited in full and the tender if any to the extent accepted may be cancelled.

(Signature & Seal of Authorized Signatory for which POA attached)

Name of Authorized Signatory:

Designation:

Date:

Place:

FORMAT B – CERTIFICATE OF BIDDER'S FINANCIAL QUALIFICATION

(On Letterhead of the respective entity for which the below details are provided.)

Financial Qualification Certificate

(Rupees in Lakhs)

S/N	Financial parameters	FY 16-17	FY 17-18	FY 18-19	FY 19-20	FY 20-21
1.	**Net Worth**					
a)	Paid up Capital					
b)	Free Reserves and Surplus*					
c)	Misc expenses to the extent not written off					
	Net Worth (a+b-c)					
2.	**Annual Turnover ****					

** Free Reserve and Surplus shall be Exclusive of Revaluation Reserve, written back of Depreciation Provision and Amalgamation.*

*** Annual total Income/ turnover as incorporated in the Profit and Loss Account excluding non-recurring income, i.e., sale of fixed asset etc.*

It is certified that all the figures are based on audited accounts read with auditors report and Notes to Accounts etc.

(Signature & Seal of Authorized Signatory

Name of Authorized Signatory:
Designation:
Date:
Place:

Certifying Chartered Accountant:
Name of Firm:
UDIN No:
Date:
Place:

Note:

1. *In addition to above certificate from Chartered Accountant, Bidder is required to submit Firm's Annual Audit Report, Balance sheet, Profit & Loss and Income Tax Returns / CA certificate for last Five years i.e., F.Y: 2015-16, 2016-17, 2017-18, 2018-19 & 2019-20.*

ANNEXURE A – SUMMARY OF BID QUALIFICATION REQUIREMENTS

(To be filled in by the bidder)

<table>
<tr><td>1.</td><td>Name of the bidder</td><td colspan="6"></td></tr>
<tr><td>2.</td><td>Address in full</td><td colspan="6"></td></tr>
<tr><td>3.</td><td>Contact Details
Mobile
: Land
Phone Fax
Email</td><td colspan="6"></td></tr>
<tr><td>4.</td><td>Name and Designation of the authorised signatory</td><td colspan="6"></td></tr>
<tr><td>5.</td><td>Whether the bidder is a bonafide manufacturer/ integrator of the item tendered (Yes/No)?</td><td colspan="6"></td></tr>
<tr><td>6.</td><td>Details of EMD submitted along with the bid in favour of CEO ANERT</td><td colspan="6"></td></tr>
<tr><td rowspan="3">7.</td><td rowspan="3">Total number and Aggregate capacity of EVCS
(Proof to be enclosed)</td><td>Year / Criteria</td><td>2018</td><td>2019</td><td>2020</td><td>2021</td><td>2022</td></tr>
<tr><td>Number of systems</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Capacity (kW)</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>8.</td><td>Annual turnover of the firm during last five years (Rs.)
(Proof to be enclosed)</td><td colspan="6">2021-22 .....
2020-21 .....
2019-20 .....
2018-19 .....
2017-18 .....</td></tr>
</table>

9.	No. of service centres /Authorised service providers in Kerala (Proof to be enclosed)	
10.	Whether Bidder was/is De-barred by ANERT (Yes/No)? If ' Yes' period of De-Barring:	
11.	Agreement submitted (Yes/ No)?	

Documentary evidence for the bid qualification requirements are submitted along with this document and the details furnished above are true and correct.

Signature
of authorised signatory

Name

Designation

Date:

(office seal)

ANNEXURE B - AGREEMENT

ARTICLES OF AGREEMENT executed on this the . . . . day of . . . . Two thousand and . . . .between the **Agency for New & Renewable Energy Research and Technology** (hereinafter referred to as **ANERT**) of the one part and Sri . . . . (Name and Address of the tenderer) hereinafter referred to as "the Bounden") of the other part.

WHEREAS in response to the Notification No. . . . . dated . . . . the bounden has submitted to ANERT a e-tender for the ***Request for Selection of agency for the Design, Supply, Installation, Testing, Commissioning and Maintenance of Public Electric Vehicle Charging Station for ANERT at various locations in the Solar City of Thiruvananthapuram (funded by Smart City Thiruvananthapuram Ltd)*** specified therein subject to the terms and conditions contained in the said e-tender.

AND WHEREAS the bounden has furnished to ANERT a sum of Rs. . . . . .. as Earnest Money Deposit for execution of an agreement undertaking the due fulfilment of the contract in case his e-tender is accepted by ANERT. NOW THESE PRESENTS WITNESS and it is hereby mutually agreed as follows: -

In case the e-tender submitted by the bounden is accepted by ANERT and the contract for . . . . is awarded to the bounden, the bounden shall within Fifteen days of acceptance of this e-tender, execute an agreement with ANERT incorporating all the terms and conditions under which ANERT accepts this e-tender.

In case the bounden fails to execute the agreement as aforesaid incorporating the terms and conditions governing the contract, ANERT shall have power and authority to recover from the bounden any loss or damage caused to ANERT by such breach as may be

determined by ANERT by appropriating the moneys inclusive of Earnest Money deposited by the bounden and if the Earnest Money is found to be inadequate the deficit amount may be recovered from the bounden and his properties movable and immovable in the manner hereinafter contained.

All sums found due to ANERT under or by virtue of this agreement shall be recoverable from the bounden and his properties movable and immovable under the provisions of the Revenue Recovery Act for the time being in force as though such sums are arrears of land revenue and in such other manner as ANERT may deem fit.

In witness whereof Sri . . . . . (Name and Designation) for and on behalf of the Agency for New & Renewable Energy Research & Technology and Sri . . . . the bounden have hereunto set their hands the day and year shown against their respective signature.

Signed by Sri	Signed by Sri . . . . .
(Date)	(Date) . . . .
in the presence of witnesses	in the presence of witnesses
1.	1.
2.	2.

ANNEXURE C – BIDDER'S TECHNICAL INFORMATION SUMMARY (EVCS)

TECHNICAL PARTICULARS OF COMPONENTS

Technical information to be provided			
Sl. No.	**Brief Description**	**Name and address of the manufacturer/ Make/ Description**	**Standards to which it complies as per test certificate**
1	**CCS – 120 kW (2 x 60 kW)**		
	• Test certificate No: • Date of Test certificate and validity • Date of interoperability certificate from ARAI • Lab from which test certificate is obtained: • Copy of test certificate enclosed (Yes/No)?		
2	**CCS – 240 kW (2 x 120 kW)**		
	• Test certificate No: • Date of Test certificate and validity • Date of interoperability certificate from ARAI • Lab from which test certificate is obtained: • Copy of test certificate enclosed (Yes/No)?		
3	Any other equipment required to complete the installation		

- Bidders are to clearly mention the name and address of the manufacturer of each component quoted by them.
- Also attach test certificates in full of relevant equipment. Attach the above information in this format & upload as additional attachments in cover 2
- Bidder must submit valid test certificates of charging station equipment offered. Bids without valid IEC test certificates will be rejected.

Signature
of authorised signatory

Name

Designation

Date:

(office seal)

ANNEXURE D – DECLARATION BY THE BIDDER

e-Tender Notification No: ....., dtd …….. for Request for Selection of agency for the Design, Supply, Installation, Testing, Commissioning and Maintenance of Public Electric Vehicle Charging Station for ANERT at various locations in the Solar City of Thiruvananthapuram (funded by Smart City Thiruvananthapuram Ltd)

To

The CEO, ANERT

We, the undersigned, declare that:

1. We have examined and have no reservations to the Bidding Document, including Addenda No.: ..... (if any)
2. We offer to supply in conformity with the Bidding Document and in accordance with the delivery schedule
3. Our Bid shall be valid for a period of 13 months from the date fixed as deadline for the submission of tenders in accordance with the Bidding Document, and it shall remain binding upon us and may be accepted at any time before the expiration of that period;
4. If our Bid is accepted, we commit to submit a Security Deposit in the amount of 5 percent of the Contract Price for the due performance of the Contract;
5. We are not participating, as Bidders, in more than one Bid in this bidding process;
6. Our firm, its affiliates or subsidiaries, including any subcontractors or suppliers for any part of the Contract, has not been declared ineligible by the ANERT or Government of Kerala;
7. We understand that this Bid, together with your written acceptance thereof included in your notification of award, shall constitute a binding contract between us, until a formal Contract is prepared and executed.
8. Our firm has obtained the certifications from MNRE or NABL approved Test laboratories that the goods and services are satisfying the technical criteria specified in the bid.

Signature

Date

Name

ANNEXURE E – DECLARATION OF RELATIONSHIP WITH ANERT EMPLOYEE

(to be signed and submitted by the bidder along with the bid)

Tender Notification No.: ……..
Request for Selection of agency for the Design, Supply, Installation, Testing, Commissioning and Maintenance of Public Electric Vehicle Charging Station for ANERT at various locations in the Solar City of Thiruvananthapuram (funded by Smart City Thiruvananthapuram Ltd)

To

The CEO
ANERT

Name of the ANERT employee with Designation:

Name of the bidder related to the employee:

This is to put on record that Shri/Smt ……..

currently working as …….. in ANERT is related to ……., who is the bidder in the bid. We are aware of the Anti-corruption policy of ANERT and will observe the highest standards during the procurement and the execution of contract and shall retain from corrupt, fraudulent, collusive or coercive practices on competing for the contract.

Signature

Name

Date

ANNEXURE G – TECHNICAL SPECIFICATIONS FOR ELECTRICAL

The detailed specifications followed by KSEBL are attached. Bidders are required to cross check if any modifications are made by the DISCOM at their own risk.

SUPPLY CHAIN MANAGEMENT
THIRUVANANTHAPURAM

SPECIFICATION
Distribution Transformer 11kV/433V, 100, 160, 250 & 500 kVA

APPLICABLE TO KSEBL	**Rev#0.2**	DOC. NO.: **SCM-SPEC/XD/DT2**
		EFF. DATE: **17-11-2021**

Number of Pages: 50

Technical Committee

1. Chief Engineer- SCM
2. Deputy Chief Engineer -SCM
3. Executive Engineer TMR Thirumala
4. Executive Engineer TMR Pallom
5. Executive Engineer TMR Angamaly
6. Executive Engineer TMR Shoranur
7. Executive Engineer TMR Kannur
8. Executive Engineer(D)-O/o CE-SCM
9. Executive Engineer RITU Kochi

(i) Document Approval & Control Status

	Compiled by	Verified by	Approved by
Name	**Mrs. Anitha Sugathan**	**Mr. Sunil.K**	**Mr. Sanal Kumar K**
Position	Assistant Executive Engineer (O/o Chief Engineer, Supply Chain Management)	Executive Engineer(D) (O/o Chief Engineer, Supply Chain Management)	Chief Engineer (Supply Chain Management)
Date	31-3-2021	31-3-2021	31-3-2021
Signature	**Sd/-**	**Sd/-**	**Sd/-**

(ii) Revision Approval & Control Status

	Revised by	Verified by	Approved by
Name	**Mrs. Anitha Sugathan**	**Mrs. Binu.N**	**Mrs. Presannakumari S**
Position	Assistant Executive Engineer (O/o Chief Engineer, Supply Chain Management)	Executive Engineer(D) (O/o Chief Engineer, Supply Chain Management)	Chief Engineer (Supply Chain Management)
Date	17-11-2021	17-11-2021	17-11-2021
Signature	**Sd/-**	**Sd/-**	**Sd/-**

(iii) Amendments and History

Sec. #	*Rev. #*	*Date*	*History of Change*
Clause 22 FITTINGS	**0.1**	**17-6-2021**	**Drain cum sampling valve is included in fittings as item xiv**
Clause 22 FITTINGS	**0.2**	**17-11-2021**	**Deleted “For transformers above 200kVA” in item xv and xix**

1. Purpose

Purpose of this document is to document updates & history, upkeep and publish the specifications related to **Distribution Transformer 11kV/433V, 100,160, 250 & 500 kVA** in a professional manner.

2. Scope

The Scope of this document is to inform and alert all relevant stakeholders including KSEBL., Public, KSERC etc regarding the current specifications and historical changes adopted in specifications of **Distribution Transformer 11kV/433V, 100,160, 250 & 500 kVA** used in field by KSEBL.

3. Responsibility

Executive Engineer(M), Office of Chief Engineer, Supply Chain Management shall compile and take necessary steps to publish the specification in KSEBL website and shall inform relevant stakeholders regarding updates and revisions.

4. Procedure For Revision

Modifications if any, in the technical Specification will be incorporated as **Revisions**. Any changes in values, minor corrections in pages, incorporation of small details etc. will be considered as Minor Modification. **The Revisions due to minor modifications will be assigned as Rev No. 0.1, 0.2 etc.**

A complete updation of the technical specification will be considered as Major modification. **The Revisions due to major modifications will be assigned as Rev No. 1.0, 2.0 etc.**

All the details regarding the revisions (both minor and major) will be incorporated in **“(ii)- Amendments and history”** above.

The concerned officers, in consultation with the Technical Committee will review and suggest changes required and the revision suggestion will be approved by **Chief Engineer- SCM.** Those who notice any discrepancy or have any suggestion regarding revision , may bring the matter to the attention of Chief Engineer -SCM in writing or through e-mail id: **cescm@kseb.in**

CONTENTS

TECHNICAL SPECIFICATION FOR 11 kV/433-250V, 100, 160, 250 & 500 kVA (OUTDOOR TYPE), BEE ENERGY EFFICIENCY LEVEL 2 (1 STAR) 3-PHASE DISTRIBUTION TRANSFORMERS

1. SCOPE:

i) This specification covers design, engineering, manufacture, assembly, stage testing, inspection and testing before supply and delivery at site of oil immersed, naturally cooled 3-phase 11 kV/433 - 250 V normal distribution transformers for outdoor use.

ii) 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 and / or the commercial order or not.

iii) 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 as well as staff engaged in operation and maintenance of equipment.

iv) All outdoor apparatus, including bushing insulators with their mountings, shall be designed so as to avoid any accumulation of water.

2. STANDARDS:

2.1 The major materials used in the transformer shall conform in all respects to the relevant/specified Indian Standards and international Standards with latest amendments thereof as on bid opening date, unless otherwise specified herein. Some of the applicable Indian Standards are listed as hereunder:

2.2

Indian Standards	Title	International Standards
IS -2026	Specification for Power Transformers	IEC 76
IS 1180 (Part-I): 2014	Outdoor Type Oil Immersed Distribution Transformers upto and including 2500kVA, 33kV-Specification	
IS 12444	Specification for Copper wire rod	ASTM B-49
	Guidelines for Specifications of Energy Efficient Outdoor type Three phase and Single phase Distribution Transformers by Central Electricity Authority	
IS-335	Specification for Transformer/Mineral Oil	IEC Pub296

IS-5	Specification for colors for ready mixed paints	
IS -104	Ready mixed paint, brushing zinc chromate, priming	
IS-2099	Specification for high voltage porcelain bushing	
IS-649	Testing for steel sheets and strips and magnetic circuits	
IS-3024	Cold rolled grain oriented electrical sheets and strips	
IS -4257	Dimensions for clamping arrangements for bushings	
IS -7421	Specification for Low Voltage bushings	
IS -3347	Specification for Outdoor Bushings	DIN 42531 to 33
IS -5484	Specification for Al Wire rods	ASTM B - 233
IS -9335	Specification for Insulating Kraft Paper	IEC 554
IS -1576	Specification for Insulating Press Board	IEC 641
IS -6600	Guide for loading of oil Immersed Transformers	IEC 76
IS -2362	Determination of water content in oil for porcelain bushing of transformer	
IS -6162	Paper covered Aluminium 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.	
	CBIP Manual on Transformer: Publication:317	

3. SERVICE CONDITIONS:

3.1 The Distribution Transformers to be supplied against this Specification shall be suitable for satisfactory continuous operation under the following climatic conditions as per IS 2026 (Part-I).

i) Location : At various locations in the country
ii) Maximum ambient air temperature (^{0}C) : 55

iii) Minimum ambient air temperature(^{0}C) : -5

iv) Maximum average daily ambient air temperature (^{0}C) : 40

v) Maximum yearly weighted average ambient temperature(^{0}C) : 32

vi) Maximum altitude of 1000 meters above mean sea level

vii) Maximum Annual Rainfall (mm) : 5000

viii) Average Annual Rainfall (mm) : 3107

ix) Specified operation range of temperature : 0^0C to 55^0C

x) Limit of range of operation of temperature: 10^0 C to 60 ^{0} C

xi) Limit of temperature range for storage and transport: -10^0C to 70^0C

xii) Relative humidity (%) : 50-99

xiii) Average no. of thunderstorm days/annum (Isoceraunic level): 50

xiv) Average number of dust storm days per annum: 5

xv) Average number of rainy days per annum : 120-140

xvi) No. of months during which tropical monsoon conditions prevail Moderately hot and humid climate, conducive to rust and fungus growth: 5

The equipment shall generally be for use in moderately hot and humid tropical climate, conducive to rust and fungus growth unless otherwise specified.

4. PRINCIPAL PARAMETERS:

4.1 The transformers shall be suitable for outdoor installation with three phase,50Hz,11kV system in which the neutral is effectively earthed and they should be suitable for service with fluctuations in supply voltage upto plus 12.5% to minus 12.5%.

(i) The transformers shall conform to the following specific parameters:

Sl. No.	Item	11 kV Distribution Transformers
1	System voltage (Max.)	12 kV
2	Rated Voltage (HV)	11 kV
3	Rated Voltage (LV)	433 -250 V*
4	Frequency	50 Hz +/-5%*
5	No. of Phases	Three
6	Connection HV	Delta

7	Connection LV	Star (Neutral brought out)
8	Vector group	Dyn-11
9	Type of cooling	ONAN

Audible sound levels (decibels) at rated voltage and frequency for liquid immersed distribution transformers shall be as below (NEMA Standards):

kVA rating	Audible sound levels(decibels)
51-100	51
101-300	55
301-500	56

5. TECHNICAL REQUIREMENTS:

5.1 CORE MATERIAL

5.1.1 The core shall be stack / wound type of high grade Cold Rolled Grain Oriented 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.

5.1.2. The bidder should offer the core for inspection and approval by the purchaser during manufacturing stage. CRGO steel for core shall be purchased only from the approved vendors, list of which is available at http://apps.powergridindia.com/ims/ComponentList/Power-former%20upto%20420%20kV-CM%20List.pdf

5.1.3. 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.**

5.1.4 No-load current up to 200kVA shall not exceed 3% of full load current and will be measured by energising the transformer at rated voltage and frequency. Increase of 12.5% of rated voltage shall not increase the no-load current by 6% of full load current.

AND

No-load current above 200kVA and upto 2500kVA shall not exceed 2% of full load current and will be measured by energising the transformer at rated voltage and frequency. Increase of 12.5% of rated voltage shall not increase the no-load current by 5% of full load current.

5.1.5. Please refer to "**Check-list for Inspection of Prime quality CRGO for Transformers**" attached at Annexure-VII. It is mandatory to follow the procedure given in this Annexure.

6. WINDINGS:

Material:

6.1. HV and LV windings shall be wound from Double Paper / Super enamel (SE) covered Aluminum conductor.

6.2. LV winding shall be such that neutral formation will be at top.

6.3. The winding construction of single HV coil wound over LV coil is preferable.
6.4. Inter layer insulation shall be Nomex /Epoxy dotted Kraft Paper.
6.5. Proper bonding of inter layer insulation with the conductor shall be ensured. Test for bonding strength shall be conducted.
6.6. Dimensions of winding coils are very critical. Dimensional tolerances for winding coils shall be within limits as specified in Guaranteed Technical Particulars (GTP Schedule I).
6.7. The core/coil assembly shall be securely held in position to avoid any movement under short circuit conditions.
6.8. Joints in the winding shall be avoided. However, if jointing is necessary the joints shall be properly brazed and the resistance of the joints shall be less than that of parent conductor. In case of foil windings, welding of leads to foil can be done within the winding.

7. TAPPING RANGES AND METHODS:

7.1. No tappings required for transformers upto 100 kVA rating.

7.2. The tapping shall be as per provisions of IS: 1180 Part-I (2014).

7.3. Tap changing shall be carried out by means of an externally operated self-position switch and when the transformer is in de-energised 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.

8. OIL:

8.1. The insulating oil shall comply with the requirements of IS 335:2018. Use of recycled oil is not acceptable. The specific resistance of the oil shall be as per IS 335:2018.

8.2. Oil shall be filtered and tested for break down voltage (BDV) and moisture content before filling.

8.3. The oil shall be filled under vacuum.

8.4. 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.

9. INSULATION LEVELS:-

Sl.No.	Voltage (kV)	Impulse Voltage (kV Peak)	Power Frequency Voltage (kV)
1	0.433	-	3
2	11	75	28

10. LOSSES:

10.1 The transformer of HV voltage up to 11kV, the losses shall be as below.

Rating of the Transformer	Total losses (no-load + load losses at 75^0C) at 50% of rated load (watts)	Total losses at 100% of rated load (watts)
100 kVA	475	1650
160 kVA	670	1950
250 kVA	980	2930
500 kVA	1510	4300

10.2 The above losses are maximum allowable and there would not be any positive tolerance. Bids with higher losses than the above specified values would be treated as non-responsive. However, the manufacturer can offer losses less than above stated values. Offers with losses lower than the maximum allowable losses will be evaluated on total owning cost basis in accordance with methodology given in Annexure -I.

11. TOLERANCES:

11.1. No positive tolerance shall be allowed on the losses offered in GTP for both 50%and 100% loading values and for all types of losses.

12. PERCENTAGE IMPEDANCE:- The percentage impedance of transformers at 75^{0}C for different ratings upto 200kVA shall be as per Table 3 and for ratings beyond 200kVA shall be as per Table 6 of IS 1180(Part-1):2014.

13. Temperature rise: The temperature rise over ambient shall not exceed the limits given below:

13.1 The permissible temperature rise shall be as per IS: 1180 (Part-I):2014.

13.2 The transformer shall be capable of giving continuous rated output without exceeding the specified temperature rise. **Bidder shall submit the calculation sheet in this regard.**

14. PENALTY FOR NON PERFORMANCE:

14.1. During testing at supplier's works if it is found that the actual measured losses are more than the values quoted by the bidder, the purchaser shall reject the transformer and he shall also have the right to reject the complete lot.

14.2. Purchaser shall reject the entire lot during the test at supplier's works, if the temperature rise exceeds the specified values.

14.3. Purchaser shall reject any transformer during the test at supplier's works, if the impedance values differ from the guaranteed values including tolerance.

15. INSULATION MATERIAL:

15.1. Electrical grade insulation epoxy dotted Kraft Paper/Nomex and pressboard of standard make or any other superior material subject to approval of the purchaser shall be used.

15.2. All spacers, axial wedges / runners used in windings shall be made of pre-compressed Pressboard-solid, conforming to type B 3.1 of IEC 641-3-2. In case of cross-over coil winding of HV all spacers shall be properly sheared and dovetail punched to ensure proper locking. All axial wedges / runners shall be properly milled to dovetail shape so that they pass through the designed spacers freely. Insulation shearing, cutting, milling and punching operations shall be carried out in such a way, that there should not be any burr and dimensional variations.

16. TANK:

16.1.1 Transformer tank construction shall conform in all respect to clause 15 of IS 1180(Part-1): 2014.

16.1.2 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.

16.1.3 All joints of tank and fittings shall be oil tight and no bulging should occur during service.

16.1.4 Inside of tank shall be painted with varnish/hot oil resistant paint.

16.1.5 The top cover of the tank shall be slightly sloping to drain rain water.

16.1.6 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/Hook Type.

16.1.7 Manufacturer should carry out all welding operations as per the relevant ASME standards and submit a copy of the welding procedure and welder performance qualification certificates to the customer.

16.2 PLAIN TANK:

16.2.1 The transformer tank shall be of robust construction, elliptical in shape and shall be built up of electrically tested welded mild steel plates of thickness of 5.0 mm for the bottom and top and not less than 3.15 mm for the sides for distribution transformers of more than 25 kVA and upto and including 100 kVA and 6mm and 4mm respectively above 100kVA. Tolerances as per IS1852 shall be applicable. Under operating conditions the pressure generated inside the tank should not exceed 0.4 kg/ sq. cm positive or negative. There must be sufficient space from the core to the top cover to take care of oil expansion.

16.2.2 Under operating conditions the pressure generated inside the tank should not exceed 0.4kg/sq.cm positive or negative. There must be sufficient space from the core to the top cover to take care of oil expansion. The space above the oil level in the tank shall be filled with dry air or nitrogen conforming to commercial grade of IS 1747 for DT upto 63 kVA. For DT of 63 kVA and above rating, conservator shall be provided.

(i) The tank shall be reinforced by welded flats on all the outside walls on the edge of the tank.

(ii) Permanent deflection: The permanent deflection, when the tank without oil is subjected to a vacuum of 525 mm of mercury for rectangular tank and 760 mm of mercury for round tank, shall not be more than the values as given below: (All figures are in mm)

Horizontal length of flat plate	Permanent deflection
Up to and including750	5.0
751 to 1250	6.5
1251 to 1750	8.0
1751 to 2000	9.0

16.2.3 The tank shall further be capable of withstanding a pressure and a vacuum as per IS 1180 (Part 1): 2014 (Fourth Revision) and subsequent amendments.

16.2.4 The radiators can be tube type or fin type or pressed steel type to achieve the desired cooling to limit the specified temperature rise.

17. CONSERVATOR:

i. Transformers of rating 63 kVA and above with plain tank construction, the provision of conservator is mandatory.

ii. When a conservator is provided, oil gauge and the plain or dehydrating breathing device shall be fitted to the conservator which shall also be provided with a drain plug and a filling hole [32 mm (1¼")] normal size thread with cover. In addition, the cover of the main tank shall be provided with an air release plug.

iii. The dehydrating agent shall be silica gel. The moisture absorption shall be indicated by a change in the colour of the silica gel crystals which should be easily visible from a distance. Volume of breather shall be suitable for 500g of silica gel conforming to IS 3401 for transformers upto 200 kVA and 1kg for transformers above 200kVA.

iv. The capacity of a conservator tank shall be designed keeping in view the total quantity of oil and its contraction and expansion due to temperature variations. The total volume of conservator shall be such as to contain 10% quantity of the oil. Normally 3% quantity the oil shall be contained in the conservator.

v. The cover of main tank shall be provided with an air release plug to enable air trapped within to be released, unless the conservator is so located as to eliminate the possibility of air being trapped within the main tank.

vi. The inside diameter of the pipe connecting the conservator to the main tank should be within 20 to 50 mm and it should be projected into the conservator so that its end is approximately 20 mm above the bottom of the conservator so as to create a sump for collection of impurities. The minimum oil level (corresponding to -5 ^{0}C) should be above the sump level.

18. SURFACE PREPARATION AND PAINTING:

(i) GENERAL

18.1.1 All paints, when applied in a normal full coat, shall be free from runs, sags, wrinkles, patchiness, brush marks or other defects.

18.1.2 All primers shall be well marked into the surface, particularly in areas where painting is evident and the first priming coat shall be applied as soon as possible after cleaning. The paint shall be applied by airless spray according to manufacturer's recommendations. However, where ever airless spray is not possible, conventional spray be used with prior approval of purchaser.

18.2. CLEANING AND SURFACE PREPARATION:

a) After all machining, forming and welding has been completed, all steel work surfaces shall be thoroughly cleaned of rust, scale, welding slag or spatter and other contamination prior to any painting.

b) Steel surfaces shall be prepared by shot blast cleaning (IS9954) to grade Sq. 2.5 of ISO 8501-1 or chemical cleaning including phosphating of the appropriate quality (IS 3618).

c) Chipping, scraping and steel wire brushing using manual or power driven tools cannot remove firmly adherent mill-scale. These methods shall only be used where blast cleaning is impractical. Manufacturer to clearly explain such areas in his technical offer.

18.3 PROTECTIVE COATING:

18.3.1 As soon as all items have been cleaned and within four hours of the subsequent drying, they shall be given suitable anti-corrosion protection.

18.4 PAINT MATERIAL:

i. Following are the types of paint which may be suitably used for the items to be painted at shop and supply of matching paint to site: Heat resistant paint (Hot oil proof) for inside surface

ii. For external surfaces one coat of thermo setting powder paint or one coat of epoxy primer followed by two coats of synthetic enamel/polyurethene base paint. These paints can be either air drying or stoving.

18.5 PAINTING PROCEDURE:

i) All prepared steel surfaces should be primed before visible re-rusting occurs or within 4 hours, whichever is sooner. Chemical treated steel surfaces shall be primed as soon as the surface is dry and while the surface is still warm.

ii) Where the quality of film is impaired by excess film thickness (wrinkling, mud cracking or general softness) the supplier shall remove the unsatisfactory paint coating and apply another coating. As a general rule, dry film thickness should not exceed the specified minimum dry film thickness by more than 25%.

DAMAGED PAINTWORK:

18.6.1 Any damage occurring to any part of a painting scheme shall be made good to the same standard of corrosion protection and appearance as that was originally applied.

18.6.2 Any damaged paint work shall be made good as follows:

18.6.2.1 The damaged area, together with an area extending 25 mm around its boundary, shall be

cleaned down to bare metal.

18.6.2.2 A priming coat shall be immediately applied, followed by a full paint finish equal to that originally applied and extending 50 mm around the perimeter of the original damage.

18.6.2.3 The repainted surface shall present a smooth surface. This shall be obtained by carefully chamfering the paint edges before and after priming.

18.6.2.4 The paint shade shall be as per Annexure-Paint which is attached herewith.

18.7 DRY FILM THICKNESS:

18.7.1 To the maximum extent practicable the coats shall be applied as a continuous film of uniform thickness and free of pores. Overspray, skips, runs, sags and drips should be avoided. The different coats may or may not be of the same colour.

18.7.2 Each coat of paint shall be allowed to harden before the next is applied as per manufacturer's recommendation.

18.7.3 Particular attention must be paid to full film thickness at the edges.

18.7.4 The requirements for the dry film thickness (DFT) of paint and the materials to be used shall be as given below:

Sl. No.	Paint type	Area to be painted	No. of coats	Total dry film thickness (min.) (microns)
1.	Thermo setting powder paint	Inside Outside	01 01	30 60
2.	**Liquid paint** a) Epoxy (primer) b) P.U. Paint (Finish coat) c) Hot oil paint/ Varnish	 Outside Outside Inside	 01 02 01	 30 25 each 35/10

The color of the finishing coats shall be dark admiral gray conforming to No. 632 of IS-5 of 1961/ No. 541 (Light Brown)

18.8 TESTS FOR PAINTED SURFACE:

18.8.1 The painted surface shall be tested for paint thickness.

18.8.2 The painted surface shall pass the cross hatch adhesion test and impact test as acceptance tests and Salt spray test and Hardness test as type test as per the relevant ASTM standards.

Note: Supplier shall guarantee the painting performance requirement for a period of not less than 5 years.

19. BUSHINGS:

19.1 HV bushings are to be mounted on the top cover of the tank on collars/turrets and not directly on tank cover. The LT bushing shall be mounted on the side of the tank.

19.2 For 11 kV-12 kV class bushings and for 0.433 kV - 1 kV class bushings shall be used.

19.3 Bushing can be of porcelain/epoxy material. Polymer insulator bushings conforming with relevant IEC can also be used.

19.4 Dimensions of the bushings of the voltage class shall conform to the Standards specified and dimension of clamping arrangement shall be as per IS 4257.

19.5 Minimum external phase to phase and phase to earth clearances of bushing terminals shall be as follows:

Voltage	**Clearance**	
	Phase to phase	**Phase to earth**

11 kV	255mm	140mm
LV	75mm	40mm

19.6 Arcing horns shall be provided on HV bushings.

19.7 Brazing of all interconnections, jumpers from winding to bushing shall have cross section larger than the winding conductor. All the Brazes shall be qualified as per ASME, section–IX.

19.8 The bushings shall be of reputed make supplied by those manufacturers who are having manufacturing and testing facilities for insulators.

19.9 The terminal arrangement shall not require a separate oil chamber not connected to oil in the main tank.

20.0 TERMINAL CONNECTORS:

20.1 The LV and HV bushing stems shall be provided with suitable terminal connectors as per IS 5082 so as to connect the jumper without disturbing the bushing stem. Connectors shall be with eye bolts so as to receive conductor for HV. Terminal connectors shall be type tested as per IS 5561.

21. TERMINAL MARKINGS:- High voltage phase windings shall be marked both in the terminal boards inside the tank and on the outside with capital letter 1U, 1V, 1W and low voltage winding for the same phase marked by corresponding small letter 2U, 2V, 2W. The neutral point terminal shall be indicated by the letter 2N. Neutral terminal is to be brought out and connected to local grounding terminal by an earthing strip.

22. FITTINGS:

The following standard fittings shall be provided :

i. Rating and terminal marking plates, non-detachable.
ii. Earthing terminals with lugs - 2 Nos.
iii. Lifting lugs for main tank and top cover
iv. Terminal connectors on the HV/LV bushings (For bare terminations only).
v. Thermometer pocket with cap-1 No.
vi. Air release device
vii. HV bushings - 3 Nos.
viii. LV bushings -4 Nos.
ix. Pulling lugs
x. Stiffener
xi. Radiators - No. and length may be mentioned (as per heat dissipation calculations)/corrugations.
xii. Arcing horns on HT side - 3 No .
xiii. Prismatic oil level gauge.
xiv. Drain cum sampling valve
xv. One filter valve on upper side of the transformer
xvi. Oil filling hole having p. 1-¼ '' thread with plug and drain plug on the conservator.
xvii. Silica gel breather
xviii. Base channel 75mmx40mm upto 100kVA and 100mm X 50 mm above 100 kVA, 460 mm long with holes to make them suitable for fixing on a platform or plinth.
xix. Pressure relief device or Explosion vent
xx. Oil level gauge
-5 ˚C and 90˚C marking for non-sealed type Transformers

23.FASTENERS:

23.1 All bolts, studs, screw threads, pipe threads, bolt heads and nuts shall comply with the appropriate Indian Standards for metric threads, or the technical equivalent.

23.2 Bolts or studs shall not be less than 6 mm in diameter except when used for small wiring terminals.

23.3 All nuts and pins shall be adequately locked.

23.4 Wherever possible bolts shall be fitted in such a manner that in the event of failure of locking resulting in the nuts working loose and falling off, the bolt will remain in position.

23.5 All bolts/nuts/washers exposed to atmosphere should be as follows.

a) Size 12 mm or below – Stainless steel

b) Above 12 mm- steel with suitable finish like electro galvanized with passivation or hot dip galvanized.

23.6 Each bolt or stud shall project at least one thread but not more than three threads through the nut, except when otherwise approved for terminal board studs or relay stems. If bolts and nuts are placed so that they are inaccessible by means of ordinary spanners, special spanners shall be provided.

23.7 The length of the screwed portion of the bolts shall be such that no screw thread may form part of a shear plane between members.

23.8 Taper washers shall be provided where necessary.

23.9 Protective washers of suitable material shall be provided front and back of the securing screws.

24. OVERLOAD CAPACITY:

24.1 The transformers shall be suitable for loading as per IS 6600.

25. TESTS:

25.1 All the equipment offered shall be fully type tested by the bidder or his collaborator as per the relevant standards including the additional type tests. The type test must have been conducted on a transformer of same design **during the last five years** at the time of bidding. The bidder shall furnish attested copy of type test reports along with the offer. In case the offered transformer is not type tested, the bidder will conduct the type test as per the relevant standards including the additional type tests at his own cost in CPRI/NABL accredited laboratory in the presence of employers representative(s) without any financial liability to employer in the event of order placed on him.

25.2 Special tests other than type and routine tests, as agreed between purchaser and bidder shall also be carried out as per the relevant standards.

25.3 The requirements of site tests are also given in this clause.

25.4 The test certificates for all routine and type tests for the transformers and also for the bushings and transformer oil shall be submitted with the bid.

25.5 The procedure for testing shall be in accordance with IS1180 (Part-1): 2014 / 2026 as the case may be except for temperature rise test.

25.6 Dispatch of each of the completely assembled transformers shall be subjected to the routine tests at the manufacturer's works.

26. ROUTINE TESTS:

26.1. Ratio, polarity, phase sequence and vector group.

26.2. No Load current and losses at service voltage and normal frequency.

26.3. Load losses at rated current and normal frequency.

26.4. The test certificates for all routine and type tests for the transformers and also for the bushings and transformer oil shall be submitted after the receipt of order.

26.5. Impedance voltage test.

26.6. Resistance of windings at each tap, cold (at or near the test bed temperature).

26.7. Insulation resistance.

26.8. Induced over voltage withstand test.

26.9. Separate source voltage withstand test.

26.10. Neutral current measurement-The value of zero sequence current in the neutral of the star winding shall not be more than 2% of the full load current.

26.11. Oil samples (one sample per lot) to comply with IS 1866.

26.12. Measurement of no load losses and magnetizing current at rated frequency and 90%, 100% and110% rated voltage.

26.13. Pressure and vacuum test for checking the deflection on one transformer of each type in every inspection.

27. TYPE TESTS TO BE CONDUCTED ON ONE UNIT:

In addition to the tests mentioned in clause 26 following tests shall be conducted:

27.1. Temperature rise test for determining the maximum temperature rise after continuous full load run. The ambient temperature and time of test should be stated in the test certificate.

27.2. Impulse voltage test: with chopped wave of IS 2026 part-III. BIL for 11 kV shall be 75 kV peak.

27.3. Short circuit withstand test: Thermal and dynamic ability.

27.4. Air Pressure Test: As per IS –1180 (Part-1):2014.

27.5. Magnetic Balance Test.

27.6. Un-balanced current test: The value of unbalanced current indicated by the ammeter shall not be more than 2% of the full load current.

27.7. Noise-level measurement.

27.8. Measurement of zero-phase sequence impedance.

27.9. Measurement of Harmonics of no-load current.

27.10 Transformer tank shall be subjected to specified vacuum. The tank designed for vacuum shall be tested as per IS 1180 (Part 1): 2014 (Fourth Revision) and subsequent amendments.The permanent deflection of flat plates after the vacuum has been released shall not exceed the values specified below:

Horizontal length of flat plate (in mm)	Permanent deflection (in mm)
Upto and including 750	5.0
751 to 1250	6.5
1251 to 1750	8.0
1751 to 2000	9.0

27.11. Transformer tank together with its radiator and other fittings shall be subjected to pressure as per IS 1180 (Part 1): 2014 (Fourth Revision) and subsequent amendments. The permanent deflection of the flat plates after the excess pressure has been released, shall not exceed the figures for vacuum test.

27.12 Pressure relief device test: The pressure relief device shall be subject to increasing fluid pressure. It shall operate before reaching the test pressure as specified in the above class. The operating pressure shall be recorded. The device shall seal-off after the excess pressure has been released.

27.13. **Short Circuit Test and Impulse Voltage Withstand Tests**: The purchaser intends to procure transformers designed and successfully tested for short circuit and impulse test. In case the transformers proposed for supply against the order are not exactly as per the tested design, the supplier shall be required to carry out the short circuit test and impulse voltage withstand test at their own cost in the presence of the representative of the purchaser.

27.13.1.The supply shall be accepted only after such test is done successfully, as it confirms on successful withstand of short circuit and healthiness of the active parts thereafter on un-tanking after a short circuit test.

27.13.2.Apart from dynamic ability test, the transformers shall also be required to withstand thermal ability test or thermal withstand ability will have to be established by way of calculations.

27.13.3. It may also be noted that the purchaser reserves the right to conduct short circuit test and impulse voltage withstand test in accordance with the IS, afresh on each ordered rating at purchaser cost, even if the transformers of the same rating and similar design are already tested. This test shall be carried out on a transformer to be selected by the purchaser either at the manufacturer's works when they are offered in a lot for supply or randomly from the supplies already made to purchaser's stores. The findings and conclusions of these tests shall be binding on the supplier.

28 ACCEPTANCE TESTS

28.1. **At least 10% transformers of the offered lot (minimum of one)** shall be subjected to the following routine/ acceptance test in presence of purchaser's representative at the place of manufacture before dispatch without any extra charges. The testing shall be carried out in accordance with IS:1180 (Part-1): 2014 and IS:2026.

28.2. Checking of weights, dimensions, fitting and accessories, tank sheet thickness, oil quality, material, finish and workmanship as per GTP and contract drawings on one transformer of each type in every inspection.

28.3. Physical verification of core coil assembly and measurement of flux density of one unit of each rating, in every inspection with reference to short circuit test report.

28.4. Temperature rise test on one unit of the total ordered quantity.

29 TESTS AT SITE

The purchaser will conduct the following test on receipt of transformers in their store. The utility shall arrange all equipment, tools & tackle and manpower for the testing. The bidder will depute his representative to witness the same. All such test shall be conducted by utility not later than 10 days from receipt of transformers.

i) Megger Test

ii) Ratio test

30 INSPECTION:

30.1. In respect of raw material such as core stampings, winding conductors, insulating paper and oil, supplier shall use materials manufactured/supplied by standard manufacturers and furnish the manufacturers' test certificate as well as the proof of purchase from these manufacturers (excise gate pass) for information of the purchaser. The bidder shall furnish following documents along with their offer in respect of the raw materials:

* Invoice of supplier.
* Mill's certificate.
* Packing list.
* Bill of landing.
* Bill of entry certificate by custom.

Please refer to "**Check-list for Inspection of Prime quality CRGO for Transformers"** attached at Annexure-VII. It is mandatory to follow the procedure given in this Annexure.

31 INSPECTION AND TESTING OF TRANSFORMER OIL:

31.1. To ascertain the quality of the transformer oil, the original manufacturer's tests report should be submitted at the time of inspection. Arrangements should also be made for testing of transformer oil as per IS: 335, after taking out the sample from the manufactured transformers and tested in the presence of purchaser's representative.

31.2. To ensure about the quality of transformers, the inspection shall be carried out by the purchaser's representative at following two stages:-

31.2.1. Anytime during receipt of raw material and manufacture/ assembly whenever the purchaser desires.

31.2.2. At finished stage i.e. transformers are fully assembled and are ready for dispatch.

31.3. The stage inspection shall be carried out in accordance with **Annexure-III.**

31.4. After the main raw-material i.e. core and coil material and tanks are arranged and transformers are taken for production on shop floor and a few assembly have been completed, the firm shall intimate the purchaser in this regard, so that an officer for carrying out such inspection could be deputed, as far as possible within seven days from the date of intimation. During the stage inspection a few assembled core shall be dismantled to ensure that the laminations used are of good quality. Further, as and when the transformers are ready for despatch, an offer intimating about the readiness of transformers, for final inspection for carrying out tests as per relevant IS shall be sent by the firm along with Routine Test Certificates. The inspection shall normally be arranged by the purchaser at the earliest after receipt of offer for pre-delivery inspection. The proforma for pre delivery inspection of Distribution transformers is placed at **Annexure - IV.**

31.5. In case of any defect/defective workmanship observed at any stage by the purchaser's Inspecting Officer, the same shall be pointed out to the firm in writing for taking remedial measures. Further processing should only be done after clearance from the Inspecting Officer/ purchaser.

31.6. All tests and inspection shall be carried out at the place of manufacture unless otherwise specifically agreed upon by the manufacturer and purchaser at the time of purchase. The manufacturer shall offer the Inspector representing the Purchaser all reasonable facilities, without charges, to satisfy him that the material is being supplied in accordance with this specification. This will include Stage Inspection during manufacturing stage as well as Active Part Inspection during Acceptance Tests.

31.7. The manufacturer shall provide all services to establish and maintain quality of workman ship in his works and that of his sub-contractors to ensure the mechanical / electrical performance of components, compliance with drawings, identification and acceptability of all materials, parts and equipment as per latest quality standards of ISO 9000.

31.8. Purchaser shall have every right to appoint a third party inspection to carry out the inspection process.

31.9. The purchaser has the right to have the test carried out at his own cost by an independent agency wherever there is a dispute regarding the quality supplied. Purchaser has right to test 1% of the supply selected either from the stores or field to check the quality of the product. In case of any deviation purchaser have every right to reject the entire lot or penalize the manufacturer, which may lead to blacklisting, among other things.

32. QUALITY ASSURANCE PLAN:

32.1 The bidder shall invariably furnish following information along with his bid, failing which his bid shall be liable for rejection. Information shall be separately given for individual type of equipment offered.

32.2 Statement giving list of important raw materials, names of sub-suppliers for the raw materials, list of standards according to which the raw materials are tested, list of tests normally carried out on raw materials in the presence of bidder's representative, copies of test certificates.

32.3 Information and copies of test certificates as above in respect of bought out accessories.

32.4 List of manufacturing facilities available.

32.5 Level of automation achieved and list of areas where manual processing exists.

32.6 List of areas in manufacturing process, where stage inspections are normally carried out for quality control and details of such tests and inspection.

32.7 List of testing equipment available with the bidder for final testing of equipment along with valid calibration reports. These shall be furnished with the bid. Manufacturer shall possess 0.1 accuracy class instruments for measurement of losses.

32.8 Quality Assurance Plan (QAP) withhold points for purchaser's inspection.

32.9 The successful bidder shall within 30 days of placement of order, submit following information to the purchaser :

32.9.1 List of raw materials as well as bought out accessories and the names of sub-suppliers selected from those furnished along with offer.

32.9.2 Type test certificates of the raw materials and bought out accessories.

32.9.3 The successful bidder shall submit the routine test certificates of bought out accessories and central excise passes for raw material at the time of routine testing.

32.9.4 ISI marking on the transformer is mandatory. As per Quality Control Order for Electrical Transformers- 2015, issued by Department of Heavy Industries, Government of India, the Standard / ISI marking on Distribution Transformers is mandatory and the product should be manufactured in compliance with IS 1180 Part-1: (2014).

33. DOCUMENTATION:

The bidder shall furnish along with the bid

33.1 The dimensional drawings of the items offered indicating all the fittings.

33.2 Dimensional tolerances.

33.3 Weight of individual components and total weight.

33.4 An outline drawing front (both primary and secondary sides) and end-elevation and plan of the tank and terminal gear, wherein the principal dimensions shall be given.

33.5 Typical general arrangement drawings of the windings with the details of the insulation at each point and core construction of transformer.

33.6 Typical general arrangement drawing showing both primary and secondary sides and end-elevation and plan of the transformer.

33.7 **Calculations for Flux Density, Over Fluxing, Short Circuit Thermal Ability, Heat Dissipation, Temperature Rise and Loss calculation of the offered transformer, along with the bid.**

34. PACKING AND FORWARDING:

34.1. The packing shall be done as per the manufacturer's standard practice. However, it should be ensured that the packing is such that, the material would not get damaged during transit by Rail / Road / Sea.

34.2. The marking on each package shall be as per the relevant IS.

35. GUARANTEE

35.1 The manufacturers of the transformer shall provide a guarantee of 60 months from the date of receipt of transformer at the stores of the Utility. In case the transformer fails within the guarantee period, the supplier will depute his representative within 15 days from date of intimation by utility for joint inspection. In case, the failure is due to the reasons attributed to supplier, the transformer will be replaced/repaired by the supplier within 2 months from date of joint inspection.

35.2 The outage period i.e. period from the date of failure till unit is repaired/ replaced shall not be counted for arriving at the guarantee period.

35.3 In the event of the supplier's inability to adhere to the aforesaid provisions, suitable penal action will be taken against the supplier which may inter alia include blacklisting of the firm for future business with the purchaser for a certain period.

36. SCHEDULES:

36.1 The bidder shall fill in the following schedules in Annexure VIII which will be part of the offer. If the schedule are not submitted duly filled in with the offer, the offer shall be liable for rejection.

Schedule- I A : Guaranteed Technical Particulars

Schedule- I B : Additional Details

CHIEF ENGINEER (SCM)

ANNEXURE - I

METHODOLOGY FOR COMPUTING TOTAL OWNING COST

TOC = IC + (A xWi) + (B xWc) ; Losses in KW		
Where,		
TOC	=	Total Owning Cost
IC = Initial cost including taxes of the transformer as quoted by the manufacturer		
A factor	=	Cost of no load losses in Rs/KW (A = 288239)
B factor	=	Cost of load losses in Rs/KW (B = 93678)
Wi	=	No load losses quoted by the manufacturer in KW
Wc	=	Load losses quoted by the manufacturer in KW

Note: No (+)ve tolerance shall be allowed at any point of time on the quoted losses after the award. In case, the losses during type testing, routine testing etc are found above the quoted losses, the award shall stand cancelled. In such a case, the CPG money shall also be forfeited.

ANNEXURE – II -Paint

Painting-Transformer Main tank, pipes, Conservator Tank, Radiator etc.

	Surface Preparation	Primer coat	Intermediate under coat	Finish coat	Total DFT	Colour shade
Main tank, pipes, conservator tank, etc. (External surfaces)	Blast cleaning Sa2½	Epoxy base Zinc primer 30-40 micron	Epoxy base Zinc primer 30-40 micron	Aliphatic Polyurethane (PU Paint) (min 50 micron	Min 110 micron	632 / 541 shade of IS:5
Main tank, pipes (above 80 NB), conservator tank, etc (Internal surfaces)	Blast cleaning Sa2½	Hot oil resistant, non-corrosive varnish or paint	--	--	Min 30 micron	Glossy white for paint
Radiator (External surfaces)	Chemical / blast cleaning (Sa2½)	Epoxy base zinc primer 30-40 micron	Epoxy base Zinc primer Min 30-40 micron	Aliphatic Polyurethane(PU Paint) (min)50 micron	Min 110 micron	632 / 541 shade of IS:5
Radiator and pipes up to 80 NB (Internal surfaces)	Chemical cleaning if required	Hot oil proof low viscosity varnish or hot oil resistant non corrosive paint	--	--	--	Glossy white for paint

ANNEXURE - III

PROFORMA FOR STAGE INSPECTION OF DISTRIBUTION TRANSFORMERS

(A) GENERAL INFORMATION:

1. Name of firm : M/s.
2. Order No. and Date :
3. Rating-wise quantity offered :
4. Details of offer
   a) Rating
   b) Quantity
   c) Serial Numbers
5. Details of last stage inspected lot:
   a) Total quantity inspected
   b) Serial Numbers
   c) Date of stage inspection
   d) Quantity offered for final inspection of
      (a) above with date

(B) Availability of material for offered quantity :

Details to be filled in

(C)Position of manufacturing stage of the offered quantity:

a) Complete tanked assembly
b) Core and coil assembly ready
c) Core assembled
d) Coils ready for assembly
   (i) HV Coils
   (ii) LV Coils

Note:

i. A quantity of less than 100 Nos. shall not be entertained for stage inspection. If the awarded quantity is less than 100 Nos., then whole lot shall be offered in single lot.
ii. The stage inspection shall be carried out in case :-
   (a) At least 25% quantity offered has been tanked and
   (b) Core coil assembly of further at least 30% of the quantity offered has been completed.
iii. Quantity offered for stage inspection should be offered for final Inspection within 15 days from the date of issuance of clearance for stage inspection, otherwise stage inspection already cleared shall be liable for cancellation.

Sl.No	Particulars	As offered	As observed	Deviation and Remarks
(D)	**Inspection of Core:** Core Material (1) Manufacturer's Characteristic Certificate in respect of grade of lamination used. (Please furnish test certificate)			
	(2) Remarks regarding Rusting and smoothness of core.			
	(3) Whether laminations used for top and bottom yoke are in one piece.			

	(II) Core Construction :												
	(1) No. of Steps												
	(2) Dimension of Steps												
	Step No.	1	2	3	4	5	6	7	8	9	10	11	12
	As offered:												
	W mm												
	T mm												
	As found:												
	W mm												
	T mm												

	(3) Core Dia (mm)			
	(4) Total cross Section area of core			
	(5) Effective cross Sectional area of core			
	(6) Clamping arrangement			
	(i) Channel Size			
	(ii) Bolt size and No.			
	(iii) Tie Rods size and No.			
	(iv) Painting			
	(a) Channels			
	(b) Tie Rods			
	(c) Bolts			
	(7) Whether top yoke is cut for LV connection.			
	(8)If yes, at 7 above, whether Reinforcement is done.			
	9) Size of Support Channels provided for Core base and bottom yoke (Single piece of channels are only acceptable) This will not be applicable for Amorphous core. For Amorphous core, core clamps with locking arrangement with tank base cover will be provided. This will not be applicable for Amorphous core. For Amorphous core, core clamps with locking arrangement with tank base cover will be provided			
	(10) Thickness of insulation provided between core base and support channel.			
	(11) core length (leg center to leg center)			
	(12) Window height			
	(13) Core height			

	(14) Core weight only (without channels etc.)			
(E)	INSPECTION OF WINDING			
	(I) Winding material			
	(1) Material used for			
	(a) HV winding			
	(b) LV winding			
	(2) Grade of material for			
	(a) HV winding			
	(b) LV winding			
	3)Test certificate of manufacturer (enclose copy) for winding material of:			
	(a) HV			
	(b) LV			
	CONSTRUCTIONAL DETAILS Size of Cross Sectional area of conductor for:			
	(a) HV winding			
	(b) LV winding			
	(2) Type of insulation for conductor of :			
	a) HV winding			
	(b) LV winding			
	(3) Diameter of wire used for delta formation (mm)			
	(4) Diameter of coils in:			
	a) LV winding			
	i) Internal dia (mm)			
	ii) Outer dia (mm)			
	b) HV winding			
	i) Internal dia (mm)			
	ii) Outer dia (mm)			
	(5) Current Density of winding material used for :			
	(a) HV			
	(b) LV			
	(6) Whether neutral formation on top.			
	(7) HV Coils/ Phase			
	a) Number			
	b) Turns / coil			
	c) Total turns			
	(8) LV Coils/ Phase			

	a) Number			
	b) Turns / coil			
	c) Total turns			
	(9) Method of HV Coil Joints			
	(10) Total weight of coils of			
	a) LV winding (kg)			
	b) HV winding (kg)			
(F)	INSULATION MATERIALS :			
	(I) MATERIAL :			
	1) Craft paper			
	a) Make			
	b) Thickness (mm)			
	c) Test Certificate of manufacturer (enclose copy).			
	2) Press Board			
	a) Make			
	b) Thickness (mm)			
	c) Test Certificate of manufacturer (enclose copy).			
	3) Material used for top and bottom yoke and insulation			
	(II) Type and thickness of material used: (mm)			
	a) Between core and LV			
	b) Spacers			
	c) Inter layer			
	d) Between HV and LV winding			
	e) Between phases			
	f) End insulation			
(G)	CLEARANCES : (mm)			
	(1) Related to core and windings			
	(2) LV to Core (Radial) Between HV and LV (Radial)			
	3) (i) Phase to phase between HV Conductor			
	(ii)Whether two Nos. Press Board each of minimum1 mm thick provided to cover the tie rods.			
	4) Thickness of locking spacers between LV coils (mm)			

	5) Axial wedges between HV and LV coils / phase (Nos.)			
	6) No. of radial spacers per phase between HV coils			
	7) Size of duct between LV and HV winding (mm)			
	(II) **Between core - coil assembly and tank : (mm)**			
	1) Between winding and body:			
	a) Tank lengthwise			
	b) Tank Breadth wise			
	2) Clearance between top cover and top yoke upto 100 kVA and between top cover and top most live part of tap changing switch for 200 kVA and above.			
(H)	**TANK :** (I) Constructional details : 1) Shape 2) Thickness of side wall (mm) 3) Thickness of top and bottom plate (mm) 4) Provision of slopping top cover towards HV bushing.			
	5) Tank internal dimensions (mm)			
	a) Length			
	b) Breadth			
	c) Height i) On LV side			
	(ii) On LV side			
	(II) **General details :**			
	1)Inside painted by varnish/ oil Corrosion resistant paint (please specify which type of coating done).			
	2. Gasket between top cover and tank (i) Material			
	ii) Thickness (mm)			
	(iii)Jointing over laps (mm)			
	3). Reinforcement of welded angle (specify size and No. of angle provided) on side walls of tank.			
	4. Provision for lifting lugs			
	a) Whether lugs of 8 mm thick MS Plate provided			
	b) Whether reinforced by welded plates edge wise below the lug upto re- enforcing angle of the tank done.			

	5.Pulling lug of MS plate			
	a) Nos. **b)** Thickness (mm) **c)** Whether provided on breadth side or length side			
	6) Provision of air release plug			
	7) Provision of galvanized GI Nuts Bolts with 1No.Plain and 1No.spring washer.			
	8) Deformation of length wise side wall of tank when subject to:			
	a) Vacuum of (-)0.7kg/sqcm for 30 minutes.			
	b) Pressure of 0.8 kg/sqcm for 30 minutes.			
(I)	**RADIATORS :**			
	1. Fin Radiators of 1.25 mm thick Sheet			
	a) Dimension of each fin (LxBxT)			
	b) Fins per radiator			
	c) Total No. of radiators			
	2. Verification of manufacturer's Test certificate regarding Heat dissipation (excluding Top and Bottom) in w/sq m			
	3. Verification of position of radiator with respect to bushing.			
(J)	**CONSERVATOR :**			
	1. Dimensions (L x D) (in mm)			
	2. Volume (m3)			
	3. Inside dia of Conservator tank pipe(mm)			
	4. Whether conservator outlet pipe is projected approx.20mm inside the conservator tank.			
	5.Whether arrangement made so that oil does not fall on the active parts.			
	6. Whether die cast metal oil level gauge indicator having three positions at (- 5°C, 30 °C and 98 °C) is provided.			
	7. Whether drain plug and filling hole with cover is provided.			
	8. Inner side of the conservator Tank painted with-			
(K)	**BREATHER :**			
	1. Whether Die cast Aluminium body breather for silica gel provided.			
	2. Make			
	3. Capacity			

	1. Material whether of Brass Rods/ Tinned Copper.			
	a) HV			
	b) LV			
	2. Size (dia in mm)			
	a) HV			
	b) LV			
	3. Method of Star connection formed on LV side of 6mm thick(Should use Al./Cu. Flat bolted/ brazed with crimped lugs on winding alternatively for 63 and100 kVA ratings brazing is done covered with tubular sleeve duly crimped). - Please state dimensions of Al/ Cu flat or tubular sleeve used. (mm)			
	4. Method of Connection of LV winding to LV Bushing (end of winding should be crimped with lugs (Al/Cu)and bolted with bushing stud).			
	5. Method of Connection of HV winding to HV bushing (Copper joint should be done by using silver brazing alloy and for Aluminium, brazing rod or with tubular connector crimped at three spots).			
	6. Whether SRB P tube/insulated paper used for formation of Delta on HV.			
	7. Whether Empire sleeves used on the portion of HV winding joining to HV bushing.			
	8. Whether neutral formation is covered with cotton tape			
	3. Whether arrangement for studs for fitting of HV Bushing are in diamond shape (so that Arcing Horns are placed vertically).			
	4. Position of mounting of LV bushings.			
	5. Bushing Clearance:(mm)			
	a) LV to Earth			
	b) HV to Earth			
	c) Between LV Bushings			
	d) Between HV Bushings			
(N)	**TANK BASE CHANNEL /**			
	ROLLERS :			
	1. Size of channel (mm)			
	2. Whether channels welded across the length of the tank			
	3. Size and type of roller (mm)			

(O)	**OIL :**			
	1. Name of supplier			
	2. Break down voltage of oil: (kV)			
	i) Filled in tanked transformer			
	ii) In storage tank (to be tested by Inspecting Officer).			
	3.Supplier’s test certificate (enclose copy)			
(P)	**ENGRAVING :**			
	1. Engraving / punching Sl. No. and name of firm on top channel / clamp or on separate plate which is firmly welded to the top channel/ clamp.			
	i) On bottom of clamping channel of core-coil assembly.			
	ii) Engraving of Sl. No. and name of firm on side wall and top cover of tank along with date of dispatch.			
(Q)	i) MS plate of size 125x125 mm welded on width side of stiffner			
	ii) Following details engraved (as per approved GTP):			
	(a) Serial Number			
	(b) Name of firm			
	(c) Order No. and Date			
	(d) Rating			
(R)	**NAME PLATE DETAILS :**			
	Whether Name Plate is as per approved drawing			
(S)	**Colour of Transformer**			
	1. Tank body colour shall be as per Annexure-Paint which is attached herewith			
	2. Conservator colour shall be as per Annexure-Paint which is attached herewith .			
(T)	**CHECKING OF TESTING FACILITIES:**			
	(Calibration certificate also to be checked for its validity)			
	TESTS :			
	1. No Load Current			
	2. No Load Loss			
	3.%Impedance			

	4. Load Losses			
	5. Insulation Resistance Test			
	6. Vector Group Test (phase relationship)			
	7. Ratio and Polarity test relationship			
	8. Transformer Oil Test (Break Down Voltage)			
	9.Magnetic Balance			
	10. Measurement of winding resistance (HV and LV both)			
	11. Induced over voltage withstand test (Double voltage and Double frequency)			
	12. Separate source power frequency With stand test at 28 kV for HV and 3 kV for LV (one minute).			
	13. Air pressure/ Oil leakage Test			
	14. Vacuum test			
	15. Unbalanced current test			
	16. Temperature rise (Heat Run) test.			
(U)	We have specifically checked the following and found the same as per G.T.P./deviations observed as mentioned against each:			
	i) Rustlessness of CRGO laminations used			
	ii) Core steps			
	iii) Core area			
	iv) Core weight			
	v) Winding cross sectional area			
	a) LV			
	b) HV			
	vi) Weight of windings			
	vii) Clearance between winding and wall of tank (mm)			
	a) Length-wise			
	b) Breadth-wise			
	viii) Clearance between top of yoke/ topmost live part of tap changer to tank cover.			
	ix) Details of Neutral formation			

	x) Connections to bushings:			
	a) LV			
	b) HV			
	xi) Slope of tank top			
	xii) Position of mounting of bushings			

ANNEXURE – IV

PROFORMA FOR THE PRE-DELIVERY INSPECTION OF DISTRIBUTION TRANSFORMERS

1.	Name of the firm		
2.	Details of offer made		
	(i) Order No. and Date		
	(ii) Rating		
	(iii) Quantity		
	(iv) Sl. No. of transformers		
3.	Date of stage inspection of the lot		
4.	Reference of stage inspection clearance		
5.	Quantity offered and inspected against the order prior to this lot		

(A) ACCEPTANCE TESTS TO BE CARRIED OUT

Sl. No.	PARICULARS	OBSERVATION
1	(a) Ratio Test	AB/an
		BC/bn
		CA/cn
	(b) Polarity test	
2	No load loss measurement	
		W1
		W2
		W3
	TOTAL	
	Multiplying Factor	
	CT	
	Watt meter	
	Total x MF	
	NET LOSS	
3	Load loss measurement	
		W1
		W2
		W3
	Total	
	Multiplying Factors:-	
	CT	
	Watt meter	
	PT	
	Total x MF	
	Loss at ambient temperature (watt)	
	Loss at 75°C (with calculation sheet) (watt)	
4	Winding Resistance	

	H.V.(In Ohms)		
	(a) At ambient temperature of -------0C	A-B	
		B-C	
		C-A	
	(b) Resistance at 75^0C	A-B	
		B-C	
		C-A	
	L.V.(In Ohm)		
	(a) At ambient temperature of -------0C	a-b	
		b-c	
		c-a	
	(b) Per Phase resistance at 75^0C	a-n	
		b-n	
		c-n	
5	Insulation Resistance (M ohm)	HV-LV	
		HV-E	
		LV-E	
6	Separate Source Voltage withstand test voltage:		
	HV	28 kV for 60 secs.	
	LV	3 kV for 60 secs.	
7	Induced over – voltage withstand test at double voltage and double frequency	100 Hz, 866 volts for 60 seconds.	
8	No load current at		
	90 % volts		
	110 % volts		
9	Unbalance current		
10	Vector group test	Diagram and readings be shown in separate sheets	
11	Percentage impedance at 75^0C (Please furnish calculation sheet)		
12	Transformer oil test (Break down voltage)		
13	Oil leakage test		
14	Heat run test	To be carried out Once against the order	
15	Bushing clearance (mm)	HV	LV
	(a)Phase to Phase		
	(b) Phase to Earth		
16	Comments on compliance by the firm on the modifications done as per stage inspection clearance letter issued		
17	Whether fittings of the order have been verified.		
18	Whether aluminium die cast silicate breather with tin container is fitted on the transformers offered.		
19	Whether engraving of Sl. No. and Name of firm on core clamping channel, side wall and top cover of tank has been verified.		
20	Whether MS Plate of size 125x 125 mm welded on with side of stiffener		
21	Whether engraving of name of firm, Sl. No. and Rating of transformer, Order no. and date and Date		

	of despatch on MS Plate.	
22	Copy of calibration certificates of metering equipments be enclosed.	

ANNEXURE - V

POINTS TO BE SEEN/DIMENSIONS TO BE NOTED AT THE TIME OF DISMANTLING OF TRANSFORMERS:

Sl. No.	PARICULARS	OBSERVATION
1	Details of the transformer dismantled to physical verification	
	(a) Rating (KVA)	
	(b) Sl.No.	
2	Whether GI Nut Bolts with one spring one plain washer provided for tightening the tank cover	
3	Details of gasket used between top cover and tank Material:	
	(i) Thickness (mm)	
	(ii) Type of joints	
4	Whether core is earthed properly with copper strip (one end should be tightened in between the core laminations and other end bolted on core camping channel)	
5	Connections from winding to bushings (describe the manner in which it has been done)	
	(a) HV	
	(b) LV	
	(c) Formation of Star connection on LV side	
6	Working wire dia and cross sectional area;	
	(a) HV	
(i)	Dia (mm)	
(ii)	Area (sq mm)	
	(b) LV	
(i)	L x W x Nos. of layer	
(ii)	Area (sq mm)	
7	Thickness of press board (s) provided between HV rod to cover the tie rods	
8	Whether painted with oil and corrosion resistant Paint/ varnish	
	(a) Inside of the tank	
	(b)Inside of the conservator tank	
	(c) Core clamping and core base channels	
	(d)Tie rods	
	(e)Core bolts	
9	Whether tie rods and core bolts insulated, if yes, material of insulation ,	
10	Whether flap on inner side of top cover provided to prevent direct falling of oil on core- coil assembly	
11	Method of joints	
	(a) Between HV Coils	
	(b) Between tap coils	
	(c) For tap changer	

12	Whether engraving of Sl. No. and name of firm done on bottom channel of core coil assembly.	
13	Diameter of copper wire, used for formation of delta (should not be less than 1.5 times the dia of conductor). (mm)	
14	Whether empire sleeves provided upto the end portion of HV winding joining to bushing	
15	HV Coils:	
	(a) Inner dia (mm)	
	(b) Outer dia (mm)	
16	LV Coils:	
	(a) Inner dia (mm)	
	(b) Outer dia (mm)	
17	Core dia	
18	Core height including base channel and insulation in between (mm)	
19	Leg Center of core	
20	Clearances between	
	(a)Core and LV (mm)	
	(b) HV and LV (mm))	
	(c)Phase to phase of HV Coils (mm)	
	(d)Core coil assembly and tank body (mm)	
	(i)Length- wise	
	(ii)Width- wise	
	(e) Top of yoke and top cover (mm)	
	(f)Top most live part of tap changer and top cover.	
21	Weight of core only (Kg)	
22	Weight of windings (Kg)	
	(a)LV	
	(b)HV	
23	Whether core lamination are in one piece, used for	
	(a)Bottom yoke	
	(b) Top yoke	
24	Specific remarks regarding smoothness and rusting of core used	
25	Volume of oil filled (to be done once against the order)	
	(a)In conservator tank	
	(b)In tank of the transformer	
26	Weight of transformer (inclusive of all fittings, accessories, oil etc. complete)	
27	Inner dimensions of the tank	
	(a) Length	
	(b) Width	
	(c) Height	
	(i) LV side	
	(ii) HV side	
28	Remark, if any:	

Note: Please ensure that complete details have been filled in the proforma and no column has been blank.

SIGNATURE OF FIRM'S REPRESENTATIVE
(With name and designation)

SINGATURE OF INSPECTIONG OFFICER
(With name and designation)

DATE OF INSPECTION:-

ANNEXURE - VI

SOURCE OF MATERIALS/PLACES OF MANUFACTURE, TESTING AND INSPECTION

Sl. No	Item	Source of Material	Place of Manufacture	Place of testing and inspection
1	Lamination			
2	Copper Conductor			
3	Insulated winding wires			
4	Oil			
5	Press boards			
6	Kraft paper			
7	MS Mates/Angles/Channel			
8	Gaskets			
9	Bushing HV/LV			
10	Paints			

ANNEXURE - VII

Check-list for Inspection of Prime quality CRGO for Transformers

During inspection of PRIME CRGO, the following points need to be checked by the Transformer manufacturer. Utility's inspector shall verify all these points during inspection:-

i) In case PRIME CRGO cutting is at works of Transformer Manufacturer:

Review of documents:

Purchase Order (unpriced) to PRIME CRGO supplier/Authorised Agency
Manufacturer's test certificate

Invoice of the Supplier

Packing List

Bill of Lading

Bill of Entry Certificate by Customs Dept.

Reconciliation Statement as per format below
Certificate of Origin
BIS Certification

Format for Reconciliation/Traceability records
Packing List No./date /Quantity of PRIME CRGO received
Name of Manufacturer
Manufacturer test certificate No./date

Serial No.	Details of package/job	Drawing Reference	Quantity Involved	Cumulative Quantity Consumed	Balance stock

1 Inspection of PRIME CRGO Coils:

PRIME CRGO-Manufacturer's Identification Slip on PRIME CRGO Coils

Visual Inspection of PRIME CRGO Coils offered as per packing list (for verification of coil details as per Test certificate & healthiness of packaging).

Unique numbering inside of each sample of PRIME CRGO coil and verification of records to be maintained in the register for consumption of CRGO coil.

ISI logo sticker on packed mother coil and ISI logo in Material TC.

2.2. During inspection of PRIME CRGO, surveillance testing of sample shall be carried out for Stacking Factor, Permeability, Specific watt loss at 1.5 Tesla and/or 1.7 Tesla depending on the grade of PRIME CRGO and aging test etc. applicable as per relevant IS/ IEC standard, Tech. Spec., MQP and Transformer manufacturer plant standard.

Inspection Clearance Report would be issued after this inspection

3. Inspection of PRIME CRGO laminations: Transformer manufacturer will maintain records for traceability of laminations to prime CRGO coils and burr/bow on laminations shall be measured. Utility can review these records on surveillance basis.

4. Inspection at the time of core building:

Visual Inspection of PRIME CRGO laminations. In case of suspected mix-up/ rusting/decoloration, samples may be taken for testing on surveillance basis for tests mentioned in A.2.2 above.

Above tests shall be witnessed by Utility. In case testing facilities are not available at Manufacturer's work, the sample(s) sealed by Utility to be sent to approved labs for testing.

Inspection Clearance Report would be issued after this inspection

1. In case PRIME CRGO cutting is at Sub-vendor of Transformer Manufacturer:

1. Review of documents:

    1. Purchase Order (unpriced) to PRIME CRGO supplier/ Authorised Agency
    2. Purchase Order (unpriced) to Core Cutter
    3. Manufacturer test certificate
    4. Invoice of the Supplier
    5. Packing List
    6. Bill of Lading
    7. Bill of Entry Certificate by Customs Dept.
    8. Reconciliation Statement as per format below
    9. Certificate of origin
    10. BIS Certification

Format for Traceability records as below:-

Packing List No./date /Quantity of PRIME CRGO received
Name of Manufacturer
Manufacturer test certificate No./date

Serial No.	Name of Customer	Details of package/job	Drawing Reference	Quantity Involved	Cumulative Quantity Consumed	Balance stock	Dispatch Details

.1 Inspection of PRIME CRGO Coils: PRIME CRGO-Manufacturer's Identification Slip on PRIME CRGO Coils

Visual Inspection of PRIME CRGO Coils offered as per packing list (for verification of coil details as per Test certificate & healthiness of packaging).

Unique numbering inside of each sample of PRIME CRGO coil and verification of records to be maintained in the register for consumption of CRGO coil.

ISI logo sticker on packed mother coil and ISI logo in Material TC.

2.2. During inspection of PRIME CRGO, surveillance testing of sample shall be carried out for Stacking Factor, Permeability, Specific watt loss at 1.5 Tesla and/or 1.7 Tesla, thickness depending on the grade of PRIME CRGO and aging test etc. applicable as per relevant IS/ IEC standard, Tech. Spec., MQP and Transformer manufacturer plant standard.

Inspection Clearance Report would be issued after this inspection

3 Inspection of PRIME CRGO laminations**:**

Transformer manufacturer representative will inspect laminations and issue their internal Inspection Clearance Report. Inspection will comprise of review of traceability to prime CRGO coils, visual Inspection of PRIME CRGO laminations and record of burr/bow. After

clearance given by transformer manufacturer, Utility will issue an Inspection Clearance Report after record review. If so desired by Utility, their representative may also join transformer manufacturer representative during this inspection.

Inspection Clearance Report would be issued after this inspection

a) Inspection at the time of core building:

Visual Inspection of PRIME CRGO laminations. In case of suspected mix-up/rusting/decoloration, samples may be taken for testing on surveillance basis for tests mentioned in B.2.2.

Inspection Clearance Report would be issued after this inspection

NOTE :-

a) Transformer Manufacturer to ensure that PRIME CRGO is procured from POWERGRID approved vendors and CRGO manufacturer should have valid BIS Certificate for respective offered Grade.

14.1 Transformer Manufacturer should also involve themselves for ensuring the quality of CRGO laminations at their Core Cutter's works. They should visit the works of their Core cutter and carry out necessary checks.

a) General

If a surveillance sample is drawn and sent to TPL (if testing facility not available with the manufacturer), the Transformer manufacturer can continue manufacturing at their own risk and cost pending TPL test report on PRIME CRGO sample drawn. Decision for acceptance of PRIME CRGO shall be based upon report of the sample drawn.

These checks shall be read in-conjunction with approved Quality Plan, specification as a whole and conditions of contract.

Sampling Plan (PRIME CRGO)

11 kV -1st transformer and subsequently at random 10% of Transformers (min. 1) offered for inspection.

DTs and other ratings -1st transformer and subsequently at random 2% of Transformers (min. 1) offered for inspection.

NOTE:- One sample for each lot of CRGO shall be drawn on surveillance basis.

CRGO has to be procured only from POWERGRID approved vendors. List of such vendors is available at the following website. Since the list is dynamic in nature, the site may be checked from time to time to see the list of approved vendors.

http://apps.powergridindia.com/ims/ComponentList/Power-former upto 4kV-CMList.pdf

CHIEF ENGINEER (SCM)

ANNEXURE VIII
SCHEDULE - I A
GUARANTEED AND OTHER PARTICULARS FOR DISTRIBUTION TRANSFORMERS

Sl. No.	Description	
1	Make	
2	Name of Manufacture	
3	Place of Manufacture	
4	Voltage Ratio	
5	Rating in KVA	
6	Core material used and Grade	
(a)	Flux density	

(b)	Over fluxing without saturation (curve to be furnished by the manufacturer in Support of his claim)	
7	Maximum temperature rise of	
(a)	Windings by resistance method	
(b)	Oil by thermometer	
8	Magnetizing (no-load) current at	
(a)	90% Voltage	
(b)	100% Voltage	
(c)	110 % Voltage	
9	Core loss in watts	
(a)	Normal Voltage	
(b)	Maximum Voltage	
10	Resistance of windings at 20 ° C (with 5% tolerance)	
(a)	HV Winding (ohms)	
(b)	LV Winding (ohms)	
11	Full load losses (watts) at 75 °C	
12	Total losses at 100% load at 75 °C	
13	Total losses at 50% load at 75°C	
14	Current density used for: (Ampere/ sq mm)	
(a)	HV Winding	
(b)	LV Winding	
15	Clearances (mm)	
(a)	Core and LV	
(b)	LV and HV	
(c)	HV Phase to phase	
(d)	End insulation clearance to earth	
(e)	Any point of winding to tank	
16	Efficiency at 75°C	
a)	Unity P.F and	
b)	0.8.P.F	
1)	125% load	
2)	100% load	
3)	75% load	
4)	50% load	
5)	25% load	
17	Regulation at:	
a)	Unity P.F.	
b)	0.8.P.F 75°C	

18	% Impedance at 75°C	
19	Flash Test:	
i)	HV 28 KV/50HZfor I minute	
ii)	LV 3 KV/ 50 Hz for 1minute	
20	Over potential Test (Double Voltage and Double Frequency for 1 minute)	
21	Impulse test	
22	Mass of : (Kg)	
a)	Core lamination (minimum)	
b)	Windings(minimum)	
c)	Tank and fittings	
d)	Oil	
e)	Oil quantity (minimum)(litre)	
f)	Total Weight	
23	Oil Data:	
1.	Quantity for first filling (Minimum)(litre)	
2.	Grade of oil used	
3.	Maker’s name	
4.	BDV at the time of filling (KV)	
24	Transformer:	
1.	Overall length x breadth x height (mm x mm x mm)	
2.	Tank length x breadth x height	
3.	Thickness of Plates	
a)	Side Plate (min)	
b)	Top & Bottom Plate (min)	
4.	Conservator Dimensions	
25	Radiation:	
1.	Heat dissipation by tank walls excluding top and bottom	
2.	Heat dissipation by cooling tube	
3.	Diameter and thickness of cooling tube	
4.	Whether calculation sheet for selecting cooling area to ensure that the transformer is capable of giving continuous rated output without exceeding temperature rise is enclosed.	
26	Inter layer Insulation provided in design for:	
1.	Top and bottom layer	
2.	In between all layer	
3.	Details of end Insulation	
4.	Whether wedges are provided at 50%tums of the HV coil	
27	Insulation materials provided	
a)	For Conductors	
	(1) HV	

	(2) LV	
b)	For Core	
28	Material and Size of the wire used	
1)	HV Dia (mm) (SWG)	
2)	LV	
a)	Strip size	
b)	No. of Conductors in parallel	
c)	Total area of cross section (sq.mm)	
29	Whether the name plate gives all particulars as required in Tender	
30	Particulars of bushings HV/LV	
1.	Maker's name	
2.	Type IS-3347/IS-3099/IS7421	
3.	Rating as per IS	
4.	Dry power frequency voltage withstand test	
5.	Wet power frequency voltage withstand test	

SCHEDULE - I B

ADDITIONAL DETAILS

Sl.No	**Description**		
1	Core Grade		
2	Core diameter	mm	
3	Gross core area	Sq cm	
4	Net core area	Sq cm	
5	Flux density	Tesla	
6	Mass of core	Kg	
7	Loss per kg of core at the specified flux density	watt	
8	Core window height	mm	
9	Center to center distance of the core	mm	
10	No .of LV Tums		
11	No. of HV tums		
12	Size of LV conductor bare/covered	mm	
13	Size of HV Conductor bar/covered	mm	
14	No .of parallels		
15	Current density of LV winding	A/sq mm.	
16	Current density of HV winding	A/sq mm.	

17	Wt. of the LV winding for Transformer	Kg	
18	Wt. of the HV winding for Transformer	Kg	
19	No. of LV Coils/Phase		
20	No. of HV coils /Phase		
21	Height of LV Windings	mm	
23	Height of HV winding	mm	
24	ID/OD of HV winding	mm	
25	ID/OD of LV winding	mm	
26	Size of the duct in LV winding	mm	
27	Size of the duct in HV winding	mm	
18	Size of the duct between HV and LV	mm	
29	HV winding to LV winding clearance	mm	
30	HV winding to tank clearance	mm	
31	Calculated impedance	%	
32	HV to earth creepage distance	mm	
33	LV to earth creepage distance	mm	

ANNEXURE - IX
PRICE VARIATION CLAUSE FOR ALUMINIUM WOUND DISTRIBUTION TRANSFORMERS

The price quoted/ confirmed is based on the input cost of raw materials/ components and labour cost as on the date of quotation and the same is deemed to be related to prices of raw materials and all India average consumer price index number for industrial workers as specified in the price variation clause given below. In case of any variation in these prices and index numbers, the price payable shall be subject to adjustment up or down in accordance with the following formula.

$$P = \frac{P_0}{100}\left\{10 + 19\frac{AL}{AL_0} + 30\frac{ES}{ES_0} + 13\frac{IS}{IS_o} + 4\frac{IM}{IM_o} + 11\frac{TO}{TO_0} + 13\frac{W}{W_0}\right\}$$

Wherein

P	=	Price payable as adjusted in accordance with the above formula
P_o	=	Price quoted/confirmed
AL_o	=	Price of LME CSP Average of Aluminium (refer notes) This price is as applicable on the 1st working day of the month one month prior to the date of tendering
ES_0	=	Price of CRGO Electrical Steel Lamination (refer notes) This price is as applicable on the 1st working day of the month one month prior to the date of tendering
IS_0	=	Price of HR coil of 3.15mm thickness (refer notes) This price is as applicable for the month, one month prior to the date of tendering
IM_0	=	Price of Insulating Materials (refer notes) This price is as applicable on the 1st working day of the month, one month prior to the date of tendering
TO_0	=	Price of Transformer Oil (refer notes) This price is as applicable on the 1st working day of the month, one month prior to the date of tendering
W_0	=	All India average consumer price index number for industrial workers, as published by the Labour Bureau, Ministry of Labour, Government of India (Base 2001=100). This index number is as applicable on the 1st working day of the month, three months prior to the date of tendering

For example if date of tendering (PQ Bid opening date) falls in December 2015, applicable prices of Aluminium (AL_o) ,Transformer Oil (TO_o), CRGO Steel Sheets (ES_o) and insulating material (IM_o) should be as on 1st November 2015 and All India average consumer price index number (W_0) should be for the month of September 2015.

The above prices and indices are as published by IEEMA vide circular reference number IEEMA (PVC)/DIST_PWR_TRF/__/__ one month prior to the date of tendering (PQ Bid opening date).

AL	=	Price of LME CSP Average of Aluminium (refer notes) This price is as applicable on the 1st working day of the month **one** month prior to the date of delivery.
ES	=	Price of CRGO Electrical Steel Lamination (refer notes) This price is as applicable on the 1st working day of the month one month prior to the date of delivery.

IS	=	Price of HR coil of 3.15mm thickness (refer notes) This price is as applicable for the month, one month prior to the date of delivery.
IM	=	Price of Insulating Materials (refer notes) This price is as applicable on the 1st working day of the month, one month prior to the date of delivery.
TO	=	Price of Transformer Oil (refer notes) This price is as applicable on the 1st working day of the month **one** month prior to the date of delivery.
W	=	All India average consumer price index number for industrial workers, as published by the Labour Bureau, Ministry of Labour, Government of India (Base 2001=100). This index is as applicable on the 1st working day of the month **three** months prior to the date of delivery.

For example, if date of delivery in terms of clause given below falls in December 2015 , applicable prices of Aluminium (AL) , Transformer Oil (TO), CRGO Steel sheets (ES), HR Coil (IS) and insulating materials (IM) should be as on 1st November 2015 and All India average consumer price index number (W) should be for the month of September 2015.

The above prices and indices are as published by IEEMA vide circular reference number IEEMA(PVC)/DIST_PWR_TRF/_/_ one month prior to date of delivery.

The date of delivery is the date on which the transformer is notified as being ready for inspection/ despatch (in the absence of such notification, the date of manufacturer's despatch note is to be considered as the date of delivery) or the contracted delivery date (including any agreed extension thereto) whichever is earlier.

Notes:-

a) All prices of raw materials are exclusive of modvatable excise / CV duty amount and exclusive of any other central, State or local taxes, octroi etc. transformers manufacturers import some raw materials. The landed cost of these imported raw materials includes applicable customs duty but exclusive of modvatable CVD.

b) Most of the prices are as on first working day of the month.

c) Date of Tendering is the due date of tender submission.

d) The details of prices are as under.

1. The price of Aluminium in Rs.MT is the average ex-works price of EC Grade Aluminium rods quoted by the primary producers conforming to specifications IS:5484 OR

Price of LME average Cash Seller Settlement price of primary Aluminium in US$ per MT as published by London Metal Bulletin (LME) including premium for Aluminium ingot in US$ per MT is converted in Indian Rs. / MT using exchange rate and adding appropriate customs duty.

2. The price of CRGO Electrical Steel Sheets suitable for Transformers of rating up to 10 MVA and voltage upto 33 kV (BEE & Energy efficiency levels as per IS 1180 (Part -1):2014 in Rs./MT) is the average price as quoted by processing centers of overseas mills and lamination suppliers which is same as applicable for power transformers (of rating above 10 MVA or voltage above 33 kV)

3. Price of Steel is the average retail price of HR coil 3.15 mm thickness as published by Joint Plant Committee (JPC) in Rs. / MT as on first working day of the month.

4. The average price of insulating materials (in Rs./Kg) of pre-compressed press boards of size 3mm and 10mm thick, 3200mm x 4100mm C& F price in free currency per MT converted into Indian Rupees with applicable exchange rates prevailing as on

1st working day of the month, as quoted by primary suppliers. This price is the landed cost, inclusive of applicable customs duty only but exclusive of countervailing duty.

5. The price of Transformer Oil (in Rs./K.Ltr.) is the average price on ex-refinery basis as quoted by primary producers for supply in drums.

CHIEF ENGINEER (SCM)

11 KV RING MAIN UNITS AND ACCESSORIES

11 KV RMU (RING MAIN UNITS)

1. **Scope**: - Design, engineering, manufacture, assembly, stage testing, inspection and testing before supply and delivery at site, storing, erection, installation, testing, commissioning and handing over of **SCADA** compatible, motorized, both side extensible/ outdoor type Ring Main Units (RMUs) with various combinations of SF6 insulated/arc quenching Load Break Switches and Vacuum Circuit breakers suitable for 11KV/433V Distribution Transformers as listed below with cable termination kits, terminal protectors, current transformers, protection relays, and with metering facility for breakers, complete with all materials and accessories, spares etc.. (except plinth, excavation, earthing)

   i. 11kV Ring Main units with load break switches and 1 No. circuit breaker. – 13 Nos

2. **Standards :**

   The equipment shall conform in all respects with the requirements of the latest editions of the IEC standards stated below except where specified otherwise.

Indian Standard	Title	International and Internationally recognized Standard
IS 13118 :1991	High Voltage Alternating Current Circuit Breaker	IEC 60056, 62271-100
IS 9920:1981, 1982	High Voltage Switches	IEC 60265, BS 5463

IS 2099	Dimensions of Indoor and Outdoor post insulators with voltages > 1000 volts	IEC 60273
IS 9921	Alternative current disconnectors and earthing switches	IEC 60129, 62271-102
IS 12729: 1988	General requirements for switchgear and control gear for voltages exceeding 1000V.	IEC 60298
IS 13947 Part-1	Degrees of protection provided by enclosures for low voltage switchgear and control gear.	IEC 60529
IS 2705 :1992	Current Transformers	IEC-60185, 60044-1
IS: 3156	Voltage Transformers	IEC 60044-2
IS: 3231	Electric Relays for power system	IEC 60255
IS:1248	Meters and Instruments	
IS:14697-1999	Specification for AC static transformer operated watt hour and VAR hour meters class 0.2 S & 0.5 S.	IEC-62053-22-2003 IEC-62052-11-2003
Equivalent IS	Monitoring and Control	IEC 60801
Equivalent IS	Common clauses for High Voltage switchgear and control gear standards	IEC 60694, 62271-1
IS-3427	AC metal-enclosed switchgear and controlgear for rated voltage above 1 kV and up to and including 52 kV	IEC 62271-200
	Control switches (low-voltage switching devices for control and auxiliary circuits, including contactor relays)	IEC 60337
	Classification of degree of protection provided by enclosures	IEC 60529
	Metallic coatings – protection of iron and steel against corrosion – metal spraying of Zinc and Aluminum	ISO 2063
	Specification and acceptance of new sulphur hexafluoride, Filling of SF6 Gas in RMU	IEC 60376

General Technical Requirements :

General requirements of RMUs shall be as follows.

Rated voltage	kV	12
Rated short-duration power-frequency withstand voltage		28 kV RMS - 1 min
Rated lightning impulse withstand voltage	kV	75
Rated frequency	Hz	50

Rated normal current			
for ring-main feeders		A	630
for busbar		A	630
for circuit-breaker feeders		A	630
Rated short-time withstand current			20kA, 3 sec
Rated peak withstand current		kA	50
Rated short-circuit making current			
for ring-main feeders		kA	50
for circuit-breaker feeders		kA	50
Degree of protection			
for gas-filled switchgear vessel			IP65
for switchgear enclosure			IP54
for low-voltage compartment			IP54
Internal Arc test			20kA, 1 sec

ELECTRICAL DATA

For On-load Switch Disconnector (C-Module)

Rated Current	A	630
Breaking capacities		
Active load	A	630
Closed loop	A	630
Off load transformer	A	40
Off load cable charging	A	68
Earth fault	A	200
Earth fault cable charging	A	115
Short circuit breaking current	kA	20
Making capacity	kA	50

Vacuum circuit-breaker

Switching capacity according to IEC 62271-100

Rated voltage	kV	12
Rated normal current of feeders	A	630

Rated short-time withstand current		20kA, 3 s
Rated peak withstand current	kA	50
Rated short-circuit breaking current	kA	20
Rated short-circuit making current	kA	50
Number of mechanical operating cycles for disconnector		1000
Number of mechanical operating cycles for earthing switch		1000
Number of mechanical operating cycles for circuit-breaker		10 000
Rated operating sequence		O - 0.3 s - CO - 3 min - CO
Number of short-circuit breaking operations	n	25

Switching capacity for make-proof earthing switch according to IEC 62271-102

Rated short-circuit making current : 50kA

Number of operating cycles, mechanical

:1000 Number of short-circuit making

operations : 5

4. Design :

1. General

The offered switchgear must have the following features:

- Suitable for outdoor installation
- Compact construction
- High staff safety and sure control
- Maximum reliability
- Maintenance free
- Possibility of Various cable connections
- SCADA compatible and motorized
- Both sided extensible

1. The Ring Main Unit shall be designed to operate at the rated voltage of 12KV. It shall consists of 630A SF6 Insulated Load Break Switch and 630A Vacuum Circuit Breaker, earthing switches for each Load Break Switch and Circuit Breaker, for earthing each of the devices, and potential transformer for each set of RMU. The circuit breaker

panel shall preferably be in the middle.

2. The RMU shall be **both side extensible/non extensible** i.e., additional load break switch / circuit breaker panel may be added to either side as requested in the tender.
3. RMUs shall originally be designed, engineered and manufactured as a fully integrated outdoor module, which would meet the relevant standards for outdoor application.
4. The RMU shall be outdoor, metal-enclosed, single bus-bar type and shall meet the criteria for compact, metal-enclosed switchgear, in accordance with IEC 60298.
5. Degree of protection of the panels shall be class IP-54 for outdoor application. All access to the switching mechanism shall be protected against dust and moisture and the degree of protection shall be class IP-65.
6. The RMUs shall be complete, as per site requirement, with earthing switches, load break Switches, busbars, Circuit breakers, all enclosed in a Stainless steel tank and CT, PT protection equipments, shall enclosed in a CRCA panel housing with 2mm thickness.
7. Insulation medium shall be SF6 and fault interruption medium shall be vacuum.
8. The active parts of the switchgear shall be maintenance-free.
9. Each RMU shall be identified by an appropriately sized label, which clearly indicates the functional units and their electrical characteristics.
10. The switchgear and RMUs shall be designed so that the position of the different devices is visible to the operator on the front of the switchboard and operations are visible as well.
11. Temperature independent gas pressure gauge marked with **green** (safe) and **red** (not safe) zones shall be provided. The safe operating zone shall correspond to a temperature range of –10º C to +55º C. The unit shall continue to work safely even if the gas pressure inside the tank goes down to the atmospheric pressure. Refilling / re-pressurizing inlet valve, if provided, shall be easily accessible for field refilling.
12. In accordance with the standards in effect, the RMUs shall be designed so as to prevent access to all live parts during operation.
13. All the statutory clearances between phase to phase and phase to earth are to be maintained. Considering the space constraints in the city, the maximum width of the panels shall be 750 mm for breaker panel and 500 mm for load break switch panel. The maximum depth of the panels shall be 800 mm and suitable for 600 mm wide cable trench. The total height shall not exceed 2000mm.
14. Suitable fool proof interlocks shall be provided to prevent its inadvertent or accidental

closing when the circuit is live and the concerned Load Break Switch / Circuit Breaker is in the closed position.

15. The operating mechanisms shall be lockable at each position with padlocks having 6 mm shackle diameter and 25 mm clearance.
16. The operating handle shall have anti-reflex action for load break switches and shall be stored in a proper place at the front or side of the unit. Operating handle inserts shall have marking as appropriate to avoid inserting the wrong end during switching operations. It is preferred to have one common handle for all switches. The switching movements shall be performed independently of the operating speeds. The maximum physical effort required for operating any mechanism shall not exceed 250 Newton. The maximum height of RMU shall not exceed 2 m.
17. All parts of equal size and shape shall be inter-changeable.
18. All bolted electrical joints shall be secured by fasteners of corrosion-proof materials, preferably brass.
19. A cable test rod has to be provided which can be fixed on the terminations to facilitate testing. Termination boots/ Protectors should have a proper opening to facilitate the same. The opening should be covered by means of removable protection cap. Boots used in terminations must have this facility.
20. The roof of RMUs should be made slanting so as to avoid collection of water, dirt etc and consequent rusting.
21. The maximum temperature in any part of the equipment at specified rating shall not exceed the permissible limits as stipulated in the relevant standards.
22. The equipment shall be capable of withstanding the dynamic and thermal stresses of listed short circuit current without any damage or deterioration.
23. The safety clearances of all live parts of the equipment shall be as per relevant standards.
24. Counters for recording number of operations of load break switch / circuit breaker shall be provided.
25. Voltage indication shall be provided for all cable ends.
26. ON / OFF / TRIP indications shall be externally visible

2. Service conditions:

The RMU shall be compact, modular in construction and suitable for outdoor applications without any further covers or enclosures. The RMU shall be tested for weather proofing tests as per IS and IEC. The switchgear chamber shall be protected against

adverse environmental and climatic conditions like flooding, high humidity, high temperature etc. by providing IP67 degree of protection in accordance with recommendation of IEC 60529.

3. Outdoor characteristics:

The equipment will be installed outdoor in a hot, humid and tropical atmosphere. All equipment, accessories and wiring shall have tropical protection, involving special treatment of metal and insulation against fungus, insects and corrosion.

The RMU enclosure must be metallic and tropicalised. The metal part shall be made of high tensile steel of thickness not less than 2mm and shall have an IP54 degree of protection, grid/short blasted thermally sprayed with Zinc alloy, phosphate and subsequently painted with polyurethane powder coated paint, the overall paint layer thickness shall be not less than 150 microns. The equipment should also be designed to prevent ingress of vermin, accidental contact with live parts and to minimize the ingress of dust and dirt. The use of materials, which may be liable to attack by termites and other insects, should be avoided. Relevant IE Rules/ CEA Regulations for clearance shall be applicable. The enclosure shall have IP 54 degrees of protection and type tested for weather proof at EREDA/CPRI. Manufacturer shall provide test report to prove salt spray withstand for at least 350 hours on material components used to build the switchgear.

Removable lifting lugs are to be fitted on the top of each panel. Bolts and nuts used shall conform to ISO Standards (metric) and shall be rust protected. Nuts and bolts for pressure parts shall be best quality steel.

CONSTRUCTION :

The equipment shall consist of stationary type, self supporting sheet steel cubicle. The Cubicle shall have a front access door with a non-removable back cover. Cubicle shall have structural frame work enclosed on all sides and top by sheet steel of minimum thickness 2 mm. Fire retardant non- hygroscopic anti tracking insulating sheet barrier & cover shall be provided for circuit breaker assembly. Supporting insulator, if required, shall be of adequate strength made of resin cast component. The Vacuum Circuit Breaker assembly shall be suitably isolated from the operator by use of additional thick metal sheet protective cover in front of VCB truck.

The Load Break Switch, Circuit Breaker, Bus Bar, Instrument Transformer shall be installed in separate compartments within the cubicle. The compartments shall be so constructed that failure of one device of equipment does not affect the device of other compartment.

Meters, Lamps, Switches shall be flush mounting type and shall be installed in easy accessible position within the appropriate chamber on the front of the cubicle. All fixing bolts, screws etc. appearing on the panel shall be so arranged as to present a neat appearance. Door hinges shall be concealed type.

5. Mounting :

The equipment shall be mounted on base channels with anchor bolt holes for installation in a concrete plinth. The RMU shall be suitable for mounting on a trench. The RMU shall be complete with all necessary supporting frame works, Nuts and bolts etc. for securing the same to the plinth.

6. Extensiblity

The whole switchgear (RMU) should be suitable for extension on both the sides, with separate bushings for left and right extensibility, located on both the sides on the upper part of the tank.

Extensible bus-bar bushings on the roof or rear or bottom are not acceptable as they increase the dimensions of the switchgear during extension.

The exetensible Busbars should be plug-in/push on type to facilitate easy and fast connection and installation.

Bolted type extensible busbars are not acceptable, except for the existing RMU add on modules.

Switchgear installation, extension or panel replacement shall be possible without gas work.

They should be designed in such a way that after connection the Busbars are not visible / exposed to the atmosphere.

The gap between the RMU on connection should be minimum, preferably 10mm.

Addition of Interconnecting busbars should not exceed the dimension of the complete switchgear.

7. Stainless Steel metallic Tank :

The switchgear and busbar shall be contained in a stainless steel enclosure as per IS, filled with SF6 gas, so as to protect against adverse environmental and climatic conditions. The enclosure should meet the "sealed pressure system" criterion in accordance with the IEC 60298 standard (i.e. a system for which no handling of gas is required throughout the 30 years of service life), so that refilling is not required. In addition, manufacturer shall confirm that maximum leakage rate is lower than 0.1 % per year. Temperature compensated SF6 gas pressure indication system shall be provided in RMUs

for giving early warning of pressure loss. All live parts except for the cable connection shall be insulated with SF6 enclosure. The tank shall be made of stainless steel material conforming to IP 67 degree of protection and the thickness shall be not be less than 2mm and also shall withstand the pressure test as per standards.

8. Dielectric medium:

SF6 gas is the preferred dielectric medium for MV RMUs. SF6 gas used for the filling of the RMU shall be in accordance with IEC 60376. It is preferable to have an absorption material in the tank to absorb the moisture from the SF6 gas and to regenerate the SF6 gas following arc interruption.

9. Load Break Switches :

The Load Break Switches shall be maintenance-free, with breaking in low pressure SF6 gas. Ring switches shall be full load break and fault-making type. Ring switches shall be designed for interrupting full rated current, small inductive or capacitive currents involved in disconnecting of unloaded transformers, cables or overhead lines. It shall be suitable for full fault-making current, simultaneously for 3 poles, by a common shaft.

Ring switch shall consist of a moving contact assembly with three positions; 'ON'/ closed, 'OFF' /open-disconnected, and 'Earth' and will be constructed in such a way that natural interlocking prevents unauthorized operations. Two independent manual operating mechanisms for ring and earth switches are also acceptable. The design shall prevent simultaneous closing of the main switch contacts and the earth switch contacts. The earth switch contacts shall be designed to close into a fault and shall have the same short circuit capacity as the main contacts. The switches shall be fully mounted and inspected in the factory.

LBS shall be operated by 24V DC operated motor (possible to operate manualy, without removal of motor). The switches shall be of the "increased operating frequency" in accordance with IEC 60265-1. The switch and earthing switch operating mechanism shall have a mechanical endurance of at least 1000 operations.

The switching operation shall be manual by means of an operating handle and independent fast acting operating mechanism. Closing and opening speeds of the switch shall be independent of the speed with which the operating handle is moved.

Ring switch operating mechanism shall have provision for geared motor mechanism and associated closing and opening coils with necessary contactors for remote and future tele-control operations in the distribution network.

The position of the power contacts and earthing contacts shall be clearly visible on

the front of the switchboard with the help of mechanical indicator. The position indicator shall provide positive contact indication in accordance with IEC 60265-1 standard. In addition, manufacturer shall prove reliability of indication in accordance with IEC 60129.

10. Circuit Breakers :

Circuit breaker shall be of fixed type. It shall have SF6 gas as insulation medium and vacuum as interruption medium. The circuit breaker shall be maintenance-free. The duty of the circuit breaker shall involve satisfactory interruption of short circuit currents as listed in the specification. The breaker shall be capable of interruption of low reactive current (lagging/leading) without undue over voltage.

The circuit breaker shall withstand system voltage at atmospheric gas pressure. The circuit breaker can be operated safely (load make/break) at atmospheric gas pressure.

The circuit breakers shall have at least 2 positions: open-disconnected and closed and shall be constructed in such a way that interlocking system prevents all undesired operations. The earth switch shall be mechanically interlocked with the isolators/ breakers to prevent any unauthorized operation. They shall be fully mounted and factory inspected.

Circuit breaker shall be designed to open, close and trip by local push buttons, remote signals and tripping through protective relay circuit. Local and remote operation selection shall be by a selector switch on the front panel.

Circuit breaker shall be provided with manual and electrical switching operation.

An operating mechanism can be used to manually close the circuit breaker and charge the mechanism. It shall be fitted with a local system for manual tripping by an integrated push button. There will be no automatic re-closing.

Geared motor mechanism for spring charging and associated closing and opening coils with necessary contactors for remote and tele-control operations shall be included.

Earthing of circuit breaker shall be by means of a switch with same fault level capacity of the breaker.

Operating mechanism shall be fast acting and independent of the operator action when operating manually and shall indicate the following positions:

- Circuit breaker ON and OFF
- Off-Load Isolator ON and OFF
- Earthing ON and OFF

The circuit breaker panel shall be equipped with an off-load isolator switch, and it shall be fully interlocked with the circuit breaker.

The position of the power and earthing contacts shall be clearly visible on the front

of the switchboard. The position indicator shall provide positive contact indication in accordance with IEC 60265-1 standard. In addition, manufacturer shall prove reliability of indication in accordance with IEC 60129.

The circuit breaker shall be associated with an integrated protection unit that will operate without any auxiliary power supply for Over Current, Short Circuit and Earth Fault protection using Class 5P10, epoxy cast resin type CTs, setting range of 5A to 80A.

11. Main Contacts

The main contacts shall have adequate area and contact pressure for carrying rated continuous and short time current without excessive heating liable to cause pitting and welding.

The breakers may be provided with silver plated contacts, if necessary, to meet the requirement of IS:13118/IEC56 where higher temperature rise is permitted with silver plated contacts. The quantity of silver facing shall be such that after carrying out one tenth of total number of operations specified for mechanical endurance tests, there is still continuous layer of silver on contacts.

12. Bus Bar

Switchgear (Load Break Switch, Vacuum Circuit breakers etc.) and control gear (CTs, PTs, relays etc.) shall be mounted on the same Kiosk. Bus bars shall be air insulated with PVC insulation/sleeves on electrostatic powder coating. The bus bars should be of electrolytic high grade copper with permissible limits of current density. Size of the bus bars and current density should be specified in the offer. The bus bars conductor shall conform to IS 8084 and 3427 and shall be rated for 630 A. It shall withstand the mechanical stresses of the rated short circuit current.

13. Earthing :

The cables shall be earthed by an earthing switch with short-circuit making capacity, in compliance with IEC 60129 standard. The earthing switch can only be operated when the main Load Break Switch/ Circuit Breaker is open. The earthing switch shall be fitted with its own / common operating mechanism and manual closing shall be driven by a fast-acting mechanism, independent of operator action. Mechanical interlocking systems shall prevent access to the operating shaft to avoid all operator errors such as closing the earthing switch when the load switches are closed.

All ring main units (RMUs) shall have a special earth bar with a sectional area of not less than 120sq.mm. Copper run along the whole of metal enclosed switch structure, each end being connected to the main earthing system where metal cases are used on

instruments these shall be connected to this bar by conductors of not less than 16 sq.mm section. There shall be continuity between the metallic parts of the switchboard and armour of cables so that there is no electric field pattern in the surrounding air, thereby ensuring the safety of people. That is, all the power cables shall be suitably glanded to the equipment while termination.

In addition, a terminal having M12 stud and nut shall be provided in the back of the panel with clear grounding mark.

14. HV Bushings :

The bushing should be conveniently located for working with cables specified, and allow for the termination of these cables in accordance with the instructions of Manufacturers. The profiles of the cable connection bushing shall be in compliance with EN-50181/DIN-47636 standards.

15. Cable termination in RMUs :

Cable termination for Load Break Switches and Circuit Breakers shall be Heat Shrinkable/ Push On type suitable for 3Core x 300sq.mm XLPE cable. A cable test rod has to be provided which can be fixed on the terminations to facilitate testing. Termination boots/Protectors should have a proper opening to facilitate the same. The opening should be covered by means of removable protection cap.

Type of cable box	:	Air insulated
Phase to phase clearance	mm	147
Phase to earth clearance	mm	110
Phase to earth over insulator surface (creepage distance)	mm	120
Type of cable termination suited	:	Heat shrink / Push on (Raychem or equivalent)

16. 66 Nos of 3C x 300 Sqmm XLPE, Heat Shrinkable Cable end kits for RMU's shall be supplied along with RMU, without additional cost.

1. Cable compartments

a) Termination in the ring switches and circuit breaker units shall be dry-type inside cable compartment suitable for accepting three core Aluminum XLPE insulated cables of outside diameter of 70-100 mm. Each cable box shall have a bottom plate and cable clamp. Bottom plate shall be in two halves with cable entry hole of 110 mm diameter

equipped with rubber bushing. Cable clamp shall be detachable semi-circular halves suitable to hold the cable inside the cable box without cable glands.

b) Cable shall be terminated using single hole cable lugs suitable for bolt size of M16. Cable termination shall be by means of bolted connection on cable bushing with heat/cold shrinkable or screened pre-moulded termination with right angle/straight boots. Plug-in type termination shall not be used.

c) Cable bushing shall be complete with brass fasteners (nuts, bolts and washers).

d) Vertical distance from the top of cable clamp to the centerline of cable bushings shall be suitable for all type of terminations. The clearances in the ring and Tee-Off cable compartment shall be sufficient for cable handling for termination applications.

e) The cable connection compartments must be fitted with front covers to the front. The front covers must be integrated in the comprehensive interrogator interlocking system.

f) The cable doors should be removable/detachable type so as to facilitate easy connection of cables and not to allow any hindrance to the maintenance staff while doing maintenance. The design of the cable compartments shall be such that their covers with sidewalls shall be removed to have full access during cable termination. Removal and installation of cable compartment covers shall be with minimum number of bolts.

g) The cable connection compartment shall be arc resistant as per IEC 62271-200 amended up-to-date. The internal arc fault test on cable box shall be carried out for 11 kV system for 20 kA for 1 second. The clearance between phase to phase and phase to earth shall be as per IEC 61243 – 5 amended up-to- date.

No insulating material on metal surface of the cable box is allowed to ensure arc proof resistance in the cable connection compartment

2. Cable Entry :

The cable termination access for the Load break Switch or Vacuum circuit breaker should be from the front/side. Termination access from the rear is not acceptable.
Necessary Right angle Boot should be supplied to the cable terminations. Compound filled cable boxes are not acceptable. The cable termination and gland arrangements shall be appropriate for the type and style of cables used at the time.

3. Cable clamps :

A non Ferro-magnetic cable clamp arrangement for 3 core XLPE cables must be provided for all cables terminated on the RMU. Cable shall be terminated by properly glanding in the base plate of the RMU.

The ring main units must be equipped with outer cone connection bushings with

M16 – inside thread.

The connecting points of each outgoing feeder must be horizontally situated in one level at a suitable height from the bottom line of the unit, for easy connection.

The cable brackets inside the cable connecting compartments must be vertically and horizontally adjustable.

5. General stipulations regarding the design and development of switchgear

5.1.1 Safety of people:

Manufacturer shall provide type test report to prove compliance with IEC 60298. The degree of safety of persons against hazardous approach to live parts and moving parts shall be provided strictly as per latest safety standards.

Proper sealing for the safety against entrance of small animals/ insects/ rodents into the compartment shall be provided.

5.1.2 Over-pressure Release

In order to ensure maximum personal safety, Ring Main Unit shall be designed to withstand any overpressure due to an internal fault by rupture of a gas escape membrane located at the rear or bottom of the enclosure. The gas shall be led out through a flap in the rear panel to the bottom of the enclosure.

Any accidental overpressure inside the sealed chamber will be limited by the opening of a pressure-release device in such a way that the released gas shall not affect the operator. Partition plate shall be provided between cable compartment and pressure relief compartment.

5.1.3 Operations

All operating positions shall be on the front of the unit and position of each of the switches shall be displayed on a mimic diagram. Clear indicators showing 'ON', OFF' and 'Earth' shall be provided on polycarbonate or metal painted labels not less than 15 mm in height and 1.5 mm thick (sticker type labels are not acceptable).

Indicator windows shall not be less than 15 mm in diameter and shall be covered with transparent UV resistant material with adequate mechanical strength.

Indicator	Letters	Background
ON	White	Red
OFF	White	Green

Earth	Black	Yellow

5.1.4 Cable Testing Facility

Ring switches shall have test bushings or test probe insertion facility for high voltage and current injection tests for the cables terminated on ring switches. Disconnection of cables for testing purposes is not acceptable. Where there is no provision for testing the cable without opening the door or cover, opening of door or cover should not be possible unless the Earthing switch is closed (as per IEC 298 Clause 5.102.4). However it must be possible to open the Earthing switch when the door is opened for cable testing. Internal faults in any compartment such as arcing to earth, unsuccessful breaking operation, shall not affect the operators standing in front of the switchgear assembly. All design arrangements to avoid such risks shall be taken.

5.1.5 Interlocking :

Every switching device must have its own drive. The plug-in holes or the holes for drive access must be included in the interrogator interlocking system of the switchgear. Mechanical type interlocks shall forbid access to the switchgear compartment if the following conditions are not fulfilled.

i) The switching device (load break switch / circuit breaker) is in the open position.

ii) The earthing switch is in the closed position.

iii) Any conducting parts, which extend outside the compartment, are earthed.

In addition to the interlocking provisions that prevent access into compartments, the following interlocking shall also be provided to make the following operations impossible:

a) Operation of load break/circuit breaker switch cannot be performed when the
   i. Cable compartment is open.
   ii Load breaks switch/circuit breaker is padlocked.
   iii Earthing switch is in the “closed” position.

b) Operation of the ring switch or circuit breaker directly from ‘ON’ to ‘Earth’ or from ‘Earth’ to ‘ON’.

The following additional requirements apply if the unit offered has two independent manual operating mechanisms for ring and earth switches:

- Operation of the ‘Earth ON / Earth OFF’ mechanism of earth switch unless the ‘ON/OFF’ mechanism of ring switch is in the ‘OFF’ position.
- Operation of the ‘ON/OFF’ mechanism of ring switch unless the ‘Earth ON

/ Earth OFF' mechanism of earth switch is in the 'Earth OFF' position.

c) Opening of the cable test cover without the associated ring switch being in the 'Earth' position.

d) Closing ring switch to 'ON' with the test plug inserted and /or the cover open.

e) Insertion or withdrawal of the test plugs with the switch in any position other than 'Earth' position.

f) Opening of cable boxes without the associated ring switch or breaker in the 'Earth' position.

g) Opening the off-load isolator switch unless the circuit breaker is in OFF position.

h) Closing the circuit breaker unless the off-load isolator switch is in ON position.

5.1.6 Padlocking facilities:

The load break switch, circuit breakers and earthing switches can be locked in the open or closed position by 1 to 3 padlocks 6 to 8mm in diameter.

5.1.7 Voltage indicator device and Phase comparators:

The live status of the cable terminated in the RMU shall be indicated by suitable voltage indicator device mounted on the front panel of the RMU to indicate whether or not there is voltage in the cables. In addition, voltage indicator shall be provided on the free connection side of the busbar for end panel.

Three inlets shall be provided to check the synchronization of phases. This device shall be in compliance with IEC 61958 standard. Verification of correct terminal-phase connections shall be possible by means of a phase comparison test unit.

Built-in push-button or continuous indication without push-button type neon voltage indicators shall be provided together with low voltage hot phasing facility on ring switches and circuit breaker panels. The lamps shall be powered by bushing type capacitive voltage dividers. Internal wiring in cable boxes shall be covered with heat resistant tape/tube, to protect it against flame temperature of gas torch during the cable termination.

5.1.8 Operating lever:

All manual operations will be carried out on the front of the switchboard. The operating handle shall have anti-reflex action for load break switches and shall be stored in a proper place at the front or side of the unit. Operating handle inserts shall have marking as appropriate to avoid inserting the wrong end during switching operations. It is preferred to have one common handle for all switches.

The switching movements shall be performed independently of the operating speeds. An anti-reflex mechanism on the operating lever shall prevent any attempts to

reopen immediately after closing of the switch or earthing switch. The maximum physical effort required for operating any mechanism shall not exceed 250Newton. The maximum height of the mechanism operating access shall not exceed 1.5 m.

5.1.9 Earth Fault & Short Circuit Indicator / Fault Passage Indicator (FPI)

All ring-main feeders shall be equipped with a 3-phase short-circuit and earth-fault indicator. Earth fault indicator, operated by core-balance type current transformer, shall be located near and outside cable box/termination with indicator visible from front and with automatic reset. They shall be provided with bright LED's / Flag Indicators, which shall be clearly visible all the time.

They shall have the following resetting facilities:

- Manual reset
- Resetting after a set time duration
- Remote reset

In case of a momentary fault in which the fault sensor picks up, but the breaker does not trip, then after 2 seconds the system shall automatically reset and shall revert to the monitoring mode. Subsequent to an actual fault, the system shall reset automatically as soon as the supply is re-established after isolating the faulty portion.

The fault sensing devices should function properly irrespective of the earth resistance of the location. FPI shall be installed on all the limbs.

It should be possible to test these indicators at site through "Test" push button. Three-pin plug for testing of FPI by primary current injection shall be provided in separate compartment with screwed cover, below the FPI housing. Fault current indication system shall have local and remote reset facility and compatible for SCADA applications through RTU. It shall be with two auxiliary contacts, one for light signal and the other for remote monitoring.

They should confirm to the following standards:

IEC 68-2-6, IEC 68-2-9 and IEC 529	:	Mechanical Test
IEC 950	:	Electrical security
IEC 1000-4 and IEC 1000-6	:	EMI/ RFI
IEC 1000-4-2	:	Air Discharges

5.1.10 Auxiliary supply

The RMU shall require an external auxiliary AC power supply of 230 V AC and capacity shall be adequate for spring charging motors, switching operations, status

indications, protective relays, necessary contactors for control and monitoring of ring switches and circuit breaker panels and rectifier for battery charger.

Enough space and provision should be provided in the cable compartment and cable terminations to accommodate ring type CT's

5.1.11 Current Transformers

Single Core, Double-ratio current transformers for protection according to IEC-60044-1 shall be fitted in the circuit breaker panel, The rating of secondary winding shall be 5 A. They shall be single phase, dry type, epoxy encapsulated rated as follows:

i)	Rated voltage	:	12 KV	
ii)	**Insulation level**	:		
a)	Impulse withstand voltage	:	75 KVP	
iii)	One minute power frequency withstand voltage on	:		
a)	Primary winding	:	35 KV rms	
b)	Secondary winding	:	3 KV rms	
iv)	Frequency	:	50 Hz.	
v)	Rated continuous thermal current	:	120% of rated primary current	
vi)	Short time thermal rating and its duration	:	16 KA for 3 sec.	
vii)	Transformation ratio of CTs	:	100-50/5-5A	
			Protection core	
a)	Class of accuracy	:	5 P	
b)	Accuracy limit factor.	:	10	

- VA burden should not be less than suitable for series tripping arrangement / metering provided
- C.T. shall be suitably supported to withstand stresses due to maximum short circuit current to absorb operational shock and also to take care any thermal expansion.
- C.T. shall be easily replaceable by removing cover of the equipment.
- Secondary Terminals of C.T. shall be easily accessible to facilitate easy replacement/ removal and testing of C.T. at site without dismantling.

- C.T. ratio change over link shall be provided on the Terminal Board at the front side of the terminal Point.
- One of the Secondary Terminal of each C.T. shall be shorted and earthed at terminal point.
- The core shall be of grade non ageing laminated silicon steel of low hysterisis loss and high permeability to ensure high accuracy at both normal and fault current. The magnetising curve of C.T. shall be furnished.
- C.T. shall be provided with terminal marking, wiring diagram and rating plate as per provision in I.S.

Required transformers ratio can be achieved in any manner, however, the current transformers will have to satisfy the requirement of rated VA burden, Class of accuracy, accuracy limit factor and short time thermal rating as have been specified above at all transformation ratios.

The rating of current transformers of all classes regarding ratio error, knee point voltage, resistance of secondary winding etc. shall have to be coordinated with the requirement of protective relays and protection scheme without any extra cost.

5.1.12 RELAYS :

The circuit breaker shall be fitted with AC Series tripping arrangement for operation on overload & earth fault by relays along with emergency shunt tripping from remote. The functions of relay are Protection, control, indicating, communications and measuring.

Specifications of Phase and Ground Over current Protective Relays with Low set (Time Delay) and High-set (Instantaneous) Elements (50/51,50N/51N)

1. General

1.1 The relay shall be microprocessor based numerical type.

1.2 All the components, hardware, input/output devices of the relay shall comply with relevant IEC or equivalent standards.

1.3 The relay shall use thoroughly tested software and hardware to IEC or equivalent standards. Relay should have acquired at least two (2) years of field experience in a major electric utility.

1.4 All the input/output units of the relay shall be capable of making/breaking currents (with any transients) and withstand voltages (normally intended/harmonic over voltages).

1.5 The relay shall be immune to all types of electrical and mechanical interference

in accordance with relevant IEC standard or equivalent.

1.6 It shall have communication interface for remote control functions.

1.7 It shall have Inrush current/harmonic restraint features.

1.8 The relay shall be self-powered from RMU CTs or provided with its own power supply. Relays requiring external power supply are not acceptable.

1.9 The degree of protection of the relay enclosure shall be of class IP 54 or better. Relay shall be suitable for outdoor installations in extreme heat and dusty conditions without affecting its normal performance.

2. Application

2.1 The relay shall consist of three (3) single-phase over current unit and one (1) ground fault unit and suitable for 5A or 1A CT secondary current.

2.2 Each phase and ground unit shall consist of Low-set (Time Delay) element and High-set (Instantaneous) element.

2.3 Low-set (Time Delay) element of both phase and ground fault units shall have:

2.3.1 Selectable inverse time characteristics according to IEC 255

2.3.2 Selectable pickup setting

2.3.3 Selectable time multiplier setting

2.4 High-set (Instantaneous) element of the phase and ground units shall have:

2.4.1 Separate target

2.4.2 Selectable setting

2.4.3 Provision to disable the element through front panel commands/settings or software.

2.5 The relay shall have:

2.5.1 Low-set Phase Over current Relay Pickup range: 30% to 240% of relay rated current in steps of 10%.

2.5.2 Low-set Ground Over current Relay Pickup range: 10% to 100% of relay rated current in steps of 10%.

2.5.3 Time multiplier range of 0.1 to 1.2s for the phase and ground over current in steps of 0.05.

2.5.4 High-set Phase over current relay pickup range: 100% to 3200% of relay rated current in steps of 50%

2.6 The relay shall be:

2.6.1 Suitable for operating on 50 Hz

2.6.2 Suitable for solidly / low resistance grounded system

2.6.3 Provide with high intensity LED target indicators for the low-set and high-

set elements

2.7 The relay AC circuits shall withstand continuous current of 3 x In (where In is the relay rated current), a current of 20 x In for 10 sec. and a current of 70 x In for 1 sec.

2.8 The relay shall have high dropout to pickup ratio and transient overreaching for instantaneous unit shall be less than 5%. The relay shall impose low burden on CTs.

2.9 The relay and CTs should be compatible with each other and supplied as one integrated package.

3. Testing

3.1 The relays shall be tested in accordance with the requirements of IS or equivalent IEC.

3.2 The relays shall be capable of being functionally tested completely, with adequate safety without the risk of spurious tripping, per standard test connections, using secondary injection test sets.

3.3 The relay shall have external testing facilities. The design of the test terminals/plugs shall be such that external test equipment can be connected at a conveniently located connector on the relay panel.

4. Instruction and Maintenance Manual

4.1 Original Manufacturer's Instruction Manuals and Documentation shall be provided.

4.2 The information in the manuals and documentation for the relay shall include but not limited to the following:

4.2.1 Specification and Characteristics and available functions

4.2.2 Relay limitations

4.2.3 External Connections

4.2.4 Any special device for testing/calibrating the relay shall be mentioned

4.2.5 Description, drawings of the construction and principals of operation.

4.2.6 All setting Calculation Procedures and Instructions

4.2.7 Installation Requirements and Instructions

4.2.8 Routine Maintenance Requirements and Instructions

4.2.9 Repair and re-calibration Instructions

4.2.10 Parts List

4.2.11 Certified Test Reports

The technical suitability of relays/schemes will also be examined by Protection Wing & acceptability will be judged appropriately.

5.1.16 Wiring :

The cables shall have the following characteristics:

a) All cables shall have stranded copper conductor.

b) Minimum core cross-section of 2.5 mm2 for PT cables, 4 mm2 for CT cables, and 2.5 mm2 for Control inputs and 1.5mm2 for Status outputs

c) Rated voltage Uo/U of 0.6/1.1KV

d) External sheathing of cable shall have oxygen index not less than 29 & temperature index not less than 250. Cable sheath shall meet fire resistance test as per IS 1554 Part- I and shall be finished with clear colour.

e) Dielectric withstand 2.5 kV at 50 Hz for 5 minutes

f) External marking with manufacture's name, type, core quantity, cross-section, and year of manufacture.

Armoured cables shall be used in the area where cable will pass through open area which may experience loading.

All wires that carry low-level signals shall be adequately protected and separated as far as possible from power wiring. Inter panel /inter-compartment wiring shall be routed through separate removable wiring duct properly fixed to the panel. Plastic or porcelain cleats of the limited compression type shall be used for holding wiring runs. All wires shall be suitable for bending to meet the terminal studs at right angles.

All wires should be properly ferruled and numbered as per international standards. Connections to the external circuits shall be brought out to suitably rated pressure type terminal blocks complete with cable identification and wire markers at all connection points.

Tenderers shall furnish the details of method being adopted by them for joint/ connections.

Metal cases of all apparatus mounted on kiosk shall be separately earthed by means of copper wire or strips. The colour schemes of the wiring shall be as per IS:375.

5.1.17 Terminal Blocks :

Terminal blocks shall be having provision for disconnection (isolation), with full-depth insulating barriers made from moulded self-extinguishing material. Terminal blocks shall be appropriately sized and rated for the electrical capacity of the circuit and wire used. No more than two wires shall be connected to any terminal. All terminal blocks shall be suitably arranged for easy identification of its usages such as CT circuits, status

outputs, control inputs, auxiliary power supply circuits, communication signals etc. TBs for CT circuits shall have feature for CT shorting (on CT side) & disconnection (from load side) to facilitate testing by current injection. Similarly, TBs for auxiliary supply shall be provided.

Spare terminals equal in number to 20% of active terminals shall be furnished. Terminal blocks shall be located to allow easy access. Wiring shall be so arranged that individual wires of an external cable can be connected to consecutive terminals.

5.1.18 Test Terminal Block :

One Set terminal block shall be provided one for testing of relays . They shall be of switch board type back connected for front of panel mounting. The test blocks shall provide complete isolation of meters, instruments etc. and the arrangement shall be such that testing power could be connected at the test block from any external source or may be taken from the instrument transformers. Provision shall be made for short circuiting current transformers. Suitable sealing arrangement shall be provided in test terminal blocks.

5.1.19 Ferrules :

Ferrules engraved/printed with the same numbers, of symbols as indicated in the connections and wiring diagram shall be provided on the terminal ends of all wires for identification of circuits for inspection and maintenance. Ferrules shall be of strong and flexible insulating material with glossy finish to prevent adhesion. They shall be engraved/ printed and clearly marked and shall not be effected by dampness. Ferrule numbering shall be in accordance with IS:375. The same ferrules number shall not be used on wires in different circuits on a panel.

6. SCADA Features : (RTU is not included in the scope of supply, even though provision for following shall be incorporated and wiring upto test terminal block / communication port for future installation of RTU).

6.1 Remote Monitoring and Control of RMUs :

The SCADA functions include

1. Remote control for Load Break Switches and Circuit Breakers
2. Position indicator for Load Break Switches, Circuit Breakers and Earthing Switches
3. Remote monitoring and Control of protection relays and fault indication system
4. Monitoring of local electrical operations of RMUs.
5. Monitoring of SF6 gas pressure
6. Remote monitoring of voltage and current (through Multi-Function Transducers to be supplied by TCED)

7. Remote monitoring of healthiness of battery and battery charger.

6.2 Status Monitoring Outputs :

Contact Multiplying Relays (CMRs) are required to multiply the contacts of breaker, isolators and protection relays etc. The contacts of these relays shall be used to provide status inputs to the RTUs. The relays shall be DC operated, self reset type. The rated voltage for relay operation shall be on 24V DC. The relay shall be able to operate for +/- 20% variation from nominal voltage. The relay shall have a minimum of two change over contacts, out of which one shall be used for SCADA purposes. The contacts shall be rated to carry minimum current capacity of 0.2A at 48VDC and shall provide arc suppression to permit interruptions of an inductive load.

The relays coils shall be shunted with diodes to suppress inductive transients associated with energizing and de-energizing of the relay coils. The relays shall conform to the IEC 255-1-00 and IEC 255-5 requirements. The relays must be protected against the effects of humidity, corrosion & provide with a dust tight cover. The connecting terminals shall be screw type & legibly marked. The relays may optionally have a visual operation indicator. The relays are to be mounted in RMU panel and therefore shall be equipped with suitable mounting arrangements.

6.3 Motor operation of Load Break Switches and Circuit Breakers:

Closing and Opening operation of Load Break Switch/ Circuit Breaker and shunt trip of the circuit breaker shall be done from remote.

Spring charging mechanism of the Breaker should be motorised for Local electrical charging. The motor drives have to be integrated into the recess of the drives.

The bidder shall specify characteristic of motor operation of Load break switch & circuit breaker. Reverse polarity protection shall be given for motors in RMUs. It should be possible to change the manual drives of the load break switches to motorized drives at site. Motor kit should easily be mounted in commissioned RMU at a later stage if required. All the mechanical interlocking must also work when the load break switches are operated by a motor drive. In case of power failure of the auxiliary voltage the manual operation of the switching devices must be possible by means of an operating handle.

Control Inputs

The control inputs from RTUs shall be used to control power system devices such as Circuit breakers, isolator, reset relay, disable/enable any other two-state devices. A set of control inputs shall be provided for each controllable device. The control input from the RTU shall be used for initiating heavy duty relays for trip/close of switching devices. The

power requirement of relays shall be maximum 0.2A at 24 Vdc.

The contractor shall provide heavy duty relays. The relays shall be DC operated, self reset type. The rated voltage for relay operation shall be on 24V DC. The relay shall be able to operate for +/-20% variation from nominal voltage. The relay shall have a minimum of two change over contacts, out of which one shall be used for telemetry purposes. The contacts shall be rated to carry minimum current capacity of 0.2A at 48VDC. The relays shall conform to the IEC 255-1-00 and IEC 255-5 requirements. These relay coils shall be shunted with diodes to suppress inductive transients associated with energizing and de-energizing of the relay coils & shall conform to the relevant IEC requirements. The relays must be protected against the effects of humidity, corrosion & provide with a dust tight cover. The connecting terminals shall be screw type & legibly marked. The relays may optionally have a visual operation indicator.

6.4 Battery:

The Battery should be of reputed make with superior dry fit technology, maintenance free suitable for Automation of RMU.

Following should be the features of the battery: -

a. 24V , 24AH type maintenance free batteries.
b. Exceptional energy storage capacity combined with long life.
c. Maintenance free (no topping up) during the whole service life.
d. Guaranteed service life for 5 years.
e. Very low gassing due to internal gas recombination.
f. Shelf life up to 2 years
g. Short recharging time.
h. Completely recyclable.
i. Should have capacity for 5 Switching operations and 48 hours of operation of RTU / Modem / Communication for SCADA in the event of supply failure.

6.5 Battery Charger : (24V 25AH)

24V on line Rectifier cum battery charger of sufficient capacity to drive motors and SCADA equipments with voltage regulation of +/-5% or less on full load. Battery charger, offered shall be suitable for Dry fit batteries with the following technical features

1. Industrial DIN RAIL mounted battery charger.
2. Input voltage 110 V AC +/ - 20%
3. Output voltage (as per requirement for the battery above).
4. Wide output adjustment range.

5. Series and parallel use should be possible.
6. The battery shall recharge to 80 % of its capacity in a maximum of 15 hours
7. Batteries shall be disconnected at the manufacturer's specified minimum voltage.
8. Battery Low' indication shall be available locally and remotely and shall include a battery test. The indication of "Battery Low" status shall allow for a further three RMU operations.
9. System Healthy and Power Fail indicators to be provided.
   Technical specifications are to be indicated by the bidder on the battery charger.

7. NAME, RATING, MARKING, PROPERTY PLATE, CIRCUIT LABEL, CONNECTION DIAGRAM AND OPERATION INSTRUCTION

1. The front plate shall have IP2X degree of protection. The front shall include a clear mimic diagram, which indicates the different functions. The position indicators shall give a true reflection of the position of the main contacts. They shall be clearly visible to the operator. The lever operating direction shall be clearly indicated in the mimic diagram.
2. The manufacturer's Name & Rating plate shall include the switchboard's main electrical characteristics and shall contain all information as per provision in the Standards. Each switchgear shall be provided with Aluminum /Stainless steel / Brass nameplate showing the following information indelibly marked in English:
   - Manufacturer’s Name
   - Country of Origin
   - Type/Model
   - Vendor’s Name
   - Reference of specification
   - Manufacturer’s Serial Number
   - KSEB Purchase Order Number
   - Year of Manufacture
   - Voltage Rating kV
   - Current Rating Amps
   - BIL kV
   - Short Circuit Rating / Duration kA / Sec
   - Rated Frequency Hz

- Rated Making Current kA
- Rated Breaking Current kA
- Gross Weight kg

3. Property Plate mentioning “TCED” shall be provided.
4. Circuit label incorporating identification of ring switches and tee switch unit, Ring Cables and outgoing Tee Cable shall be provided.
5. Ring switches and circuit breaker panels shall be provided with circuit number plates of dimension 150 x 50 mm without inscription. Plate shall be made of three layer traffolyte material (white/black/white) of 3 mm thickness.
6. Connection Diagram Plate shall be provided as per provision in the standards.
7. Danger plate shall be provided and installed at the front panel of the switchgear using M5 hot dipped galvanized / stainless steel / brass fasteners (oval head rounded neck bolts with nuts and external tooth lock washers) not removable / accessible from the front i.e. without opening the door / front cover. The danger Board plate as per relevant IS.
8. Operation Instruction mentioning sequential operation procedures shall have to be displayed.
9. All terminals including Earthing terminal shall be properly marked.
10. The name, rating, marking, property plate, circuit label, connection diagram and operation instruction shall be riveted / fixed using self threading screw.

8 Tests :

Routine tests shall be conducted on the Ring Main Units in accordance with the latest versions of IEC. Each completely wired Ring Main Unit shall be tested to ensure that all its protective, control and interlock systems are satisfactorily functioning in the manner as required. The bidder shall indicate tests recommended to be carried out at site during installation and commissioning to ensure satisfactorily performance of all the equipment supplied.

8.1 Type tests :

The Ring Main Units shall be fully type tested as per the relevant standards including the type tests mentioned below. The type tests must have been conducted on 11KV Ring Main Units of same type from recognized test laboratories not earlier than 5 years from the date of opening of bid. The bidder shall furnish two sets of type test reports as per relevant standards along with the bid. Bids without the following type test reports will be treated as non-responsive.

According to this specification and IEC recommendations, the following type test certificates shall be supplied:

- Impulse withstand test
- Temperature-rise test
- Short-time withstand current test
- Mechanical operation test
- Checking of partial discharge on complete unit
- Switch, circuit breaker, earthing switch-making capacity
- Switch, circuit breaker breaking capacity
- Internal arc withstand
- Checking of degree of protection
- Salt spray withstand test

In addition, for switches, test reports on rated breaking and making capacity shall be supplied. For earthing switches, test reports on making capacity, short-time withstand current and peak short-circuit current shall be supplied.

8.2 Routine Tests :

The switchgear offered shall meet the routine test requirements of the standards listed below:

8.2.1 Load break switches per IEC 60265

a) Power Frequency Voltage Tests
b) Voltage Tests on Auxiliary Circuits
c) Measurement of Resistance of Main Circuit
d) Operation Tests
e) Operation and Mechanical Endurance Tests

8.2.2 Circuit breaker per IEC 60056

a) Power Frequency Voltage Tests
b) Voltage Withstand Tests on Control and Auxiliary Circuits
c) Measurement of Resistance of Main Circuit
d) Mechanical Operating Tests

The routine tests carried out by the manufacturer shall be backed by test reports signed by the factory's quality control department. They shall include the following:

1. Conformity with drawings and diagrams
2. Measurement of closing and opening speeds
3. Measurement of operating torque

4. Checking of filling pressure
5. Checking of gas-tightness
6. Checking of partial discharges on individual components
7. Dielectric testing
8. Measurement of main circuit resistance
9. Measurement of the time travel characteristics of breakers
10. Measurement of Insulation Resistance

8.3 Tests during manufacture:

The Contractor shall furnish details of tests carried out during the process of manufacture and end inspection by the supplier to ensure the desired quality of the equipment to be supplied. Tests as per applicable standards should be carried out in respect of porcelain bushings, galvanization, relays and meters.

8.4 Make and type of bought out items :

The makes of all bought out items shall be acceptable if it is of "ISI Marked" or type tested for which tenderers shall furnish attested photostat copies of ISI Certificate/type test report not older than three years for the respective make offered along with tender.

Make / type of each relay, indicating instruments, integrating instruments, control switch for Circuit Breaker/Trip Transfer, selector switch for Voltmeter/Ammeter, Semaphore Indicator, indicating lamps, annunciator, Push Button, Link Type Test Terminal Block for testing of TVM, CFL Tube, 2/3 Pin Socket with Switch etc. shall be clearly and invariably indicated in the GTP (Guaranteed Technical Particulars), bill of material and unit price list. Only specific make accessories shall be indicated. The word "EQUIVALENT/REPUTED MAKE" will not be given for consideration.

8.5 Test on Bought Out Items :

The bidder must furnish type test reports as per relevant IS/ IEC along with bid to suit the environmental conditions of our State, in respect of the relay (of the type and design offered) which should have been type tested in NABL accredited test laboratory in respect of such tests for which the lab has been accredited / CPRI (for Indian make Relays) / Nationally accredited testing laboratory (for Foreign make Relays). These type test reports should not be older than three years from the date of opening of bid. Bids without Type Test reports will be treated as Non- Responsive.

The tenderer shall also furnish along with the tender, complete general arrangement, schematic and outline diagrams indicating the mounting arrangement and position of current transformers, potential transformer, terminal block etc.

Type of current transformers and employed shall also be clearly stated. The type test reports of Current Transformers, Relays, Meters etc. shall be complete in all respect as per relevant IEC/IS.

Tests are not required to be performed on bought out equipments/items like motor, meter, relay etc. at the works of RMU manufacturer. Furnishing Test Certificate of these items from the original equipment manufacturers shall be deemed to be satisfactory evidence. Inspection of the tests at Sub-contractors works will be arranged by the Contractor whenever required.

8.6 Additional Tests :

TCED reserves the right of having at contractors expenses any other tests of reasonable nature carried out at Manufacturer's premises, at site, or any in any other place in addition to the aforesaid type, acceptance and routine tests, to satisfy themselves that the material comply with the specifications.

In case of failure of any type test, the supplier is required to modify the design of the material and the material shall be type tested again for the modified design, without any extra cost to TCED. No delivery extension shall be given for this additional testing.

8.7 Test Reports :

Record of routine test reports shall be maintained by the Contractor at his works for periodic inspection at his works for periodic inspection by the TCED representative. A copy of the same shall be furnished along with each equipment.

8.8 Test facilities : Witnessing

The tests shall be carried out as per relevant standards and test certificates shall be furnished for approval. The bidder shall indicate the details of the equipment available with him for carrying out the various tests as per relevant standards. The bidder shall indicate the sources of all materials. He shall indicate the name of the Supplier and make of vacuum interrupters, relays, conductor, electrical steel laminations constructional steel etc.

Tests as per applicable standards should be carried out in respect of porcelain bushings, galvanization, relays and meters.

9. Information to be furnished along with the Bid :

The following information shall be furnished along with the bid:

1. Completely filled in Guaranteed Technical Particulars.
2. Catalogues describing the equipment duly indicating the model.
3. Literature describing the operational.

10. Mandatory Spares and Tools:

Comprehensive list of manufacturer's recommended spare parts shall be furnished along with the bid. The quantities offered should be adequate for the initial 5 years of operation. Firm price and delivery period shall be quoted for each item.

List of recommended special maintenance Tools and Tackles together with their individual prices shall be furnished along with the bid.

11. Pre despatch Delivery / Training

The Supplier shall install the RMUs at the locations specified by the TCED. The supplier shall provide training facilities before despatch at place of manufacture for atleast 2 engineers about the operation and maintenance. The training shall be for not less than 3 days with suppliers cost including Travelling, lodging, etc. Training for 4 engineers shall be given at site.

12. Deviations:

12.1. The tenderer shall furnish, if there are any deviations in the technical terms as per schedule. If no deviations are furnished it will be construed that the tenderer is accepting the technical specification. Similarly if any deviations are furnished in the specified form it will be construed that these are the only deviations and the tenderer is accepting all other terms of the technical specification and the offer will be taken for evaluation accordingly.

12.2 The offers of the tenders with deviations in commercial terms of the specification are liable for rejection.

12.3. No alternate offer will be accepted.

13. Guaranteed Technical Particulars:

Guaranteed Technical particulars shall be furnished by the Bidder, along with the bid.

14. Documentation:

All drawings shall conform to International Standards Organisation (ISO) 'A' series of drawings sheet / Indian Standard Specifications IS:656. All drawings shall be in ink and suitable for microfilming and a soft copy of the drawings. All dimensions and data shall be in S.I.Units.

15. List of Drawings and Documents:

The bidder shall furnish four sets of following drawings and documents along with his offer.

- Completely filled – in technical schedules
- Typical general arrangement drawings
- Type test certificates
- Quality Assurance Plan
- Experience List
- Foundation fixing drawings
- General outline drawings showing plan, elevation and end view dimensions assembly and constructional drawings of the equipment
- Name plate and schematic drawings
- Operation manuals, leafless literature

16.PACKING AND SHIPMENT

- The switchgear shall be delivered ready for installation.
- Units shall be supplied complete with all operation and installation accessories.
- Switchgear shall be individually packed in non-returnable cases.

17.GUARANTEE

The vendor shall guarantee the ring main unit against all defects arising out of faulty design or workmanship or defective material for a period of 60 months from the date of commissioning.

Warranty period for gas tightness shall conform to clause 5.15.3 of IEC 60694. For the maintenance-free version, the bidder / manufacturer shall assume full responsibility for no gas leakage during the service life. In case of gas leak during life service, all expenses for repairs and replacements shall be borne by bidder / manufacturer.

18.Recommender Spares :-

The tenderer shall furnish in this offer a test of recommended spares with unit rate for each set of equipment that may be necessary for satisfactory operation and maintenance of CB and isolators for a period 18 months. The purchaser reserve the right of selection of items and quantities of these spares to be provided the cost of such spares shall not be considered for tender evaluation.

20.Test Reports :-

Test reports from any NABL Lab shall be produced along with tender.

21.Operating Tools :-

Bidder shall supply appropriated tools along with the RMU.

22. Installation :-

Supplier's Engineers shall supervise the installation work including the cable termination, testing, fixing, all control wiring and commissioning.

SUPPLY CHAIN MANAGEMENT

THIRUVANANTHAPURAM

SPECIFICATION

11KV, 3X300MM^2 DRY CURED XLPE UG CABLE

APPLICABLE TO KSEBL	**Rev#0**	DOC. NO.: **SCM-SPEC/XH/11kV, 3x300mm^2 XLPE UG Cable**
		EFF. DATE: **14/12/2021**

Number of Pages: 25

Technical Specification and Evaluation Committee for Distribution Material

(i) Document Approval & Control Status

	Compiled by	Verified by	Approved by
Name	**Smt.Anu.V.R**	**Smt.Bindu.T.Wilson**	**Smt.Presannakumari.S**
Position	Assistant Engineer (Supply Chain Management)	Executive Engineer (Supply Chain Management)	Chief Engineer (Supply Chain Management)
Date	14/12/2021	14/12/2021	14/12/2021
Signature	**Sd/-**	**Sd/-**	**Sd/-**

(ii) Amendments and History

Sec. #	*Rev. #*	*Date*	*History of Change*

1. PURPOSE:

Purpose of this document is to document updates & history, upkeep and publish the specifications related to **11kV, 3x300mm^2 Dry Cured XLPE UG Cable** in a professional manner

2. SCOPE:

The Scope of this document is to inform and alert all relevant stakeholders including KSEBL. Public, KSERC etc regarding the current specifications and historical changes adopted in specifications of **11kV, 3x300mm^2 Dry Cured XLPE UG Cable** used in field by KSEB.

3. RESPONSIBILITY:

The Executive Engineer (H), Office of Chief Engineer, Supply Chain Management shall compile and take necessary steps to publish the specification in KSEBL website and shall inform relevant stakeholders regarding updates and revisions

4. PROCEDURE FOR REVISION:

Modifications if any, in the technical specification will be incorporated as **Revisions.** Any changes in values, minor corrections in pages, incorporation of small details etc. will be considered as Minor Modification. **The Revisions due to minor modifications will be assigned as Rev. No.0.1, 0.2 etc.**

A complete updation of the technical specification will be considered as Major modification. **The Revisions due to major modifications will be assigned as Rev. No.1.0, 2.0 etc.**

All the details of regarding the revisions (both minor and major) will be incorporated in **"(ii)-Amendments and history"** above.

The concerned officers, in consultation with the Technical Committee will review and suggest changes required and the revision suggestion will be approved by **Chief Engineer (SCM).** Those who notice any discrepancy or have any suggestion regarding revision, may bring the matter to the attention of Chief Engineer (SCM) in writing or through e-mail id:**cescm@kseb.in**

CONTENTS

TECHNICAL SPECIFICATIONS FOR 11 kV XLPE UG CABLE

Specification for 3 Core 300 mm^2 Dry cure type 11 kV UG XLPE Cable:-

The specification covers design, manufacture, factory testing, packing and delivery of 11kV grade cross-linked polyethylene insulated dry cured UG Cable with stranded aluminium conductor. The conductor screening shall consist of an extruded layer of semi conducting XLPE compound. The insulation screening shall consist of a non-metallic part shall be directly over the insulation of each core and shall consist of a layer of extruded semi conducting XLPE compound. The metallic part shall be a layer of copper tape over the individual core and the cores should be laid up, with fillers in the interstices. The cable should have inner sheath of extruded PVC(type ST2), Single layer galvanized flat steel strip armour and overall extruded PVC(type ST2) outer sheath covering conforming to IS:7098 Part II/1985, with amendment and REC Specifications suitable for 11 kV solidly earthed neutral system and manufactured through dry cure technology. (Nitrogen gas ie, with inert gas curing using CCV system only)

Cable manufacture should be in accordance with the above specification and also should be according to REC specification & IEC 502.

REC Guidelines for Manufacture of 11kV 3X300 mm^2 XLPE UG Cable:-

1) **Scope:-** This specification covers requirement of 11 kV cross-linked polyethylene (XLPE) insulated and PVC sheathed aluminum cable.

2) **System Details:-**

Nominal system voltage (rms) V - 11 KV

Highest system voltage (rms) Vm - 12 KV

Number of phases – 3

Frequency – 50 Hz.

Variation in frequency - $\pm$ 3%

Type of earthing – Solidly earthed.

3) **Applicable Standards:-** Except when it conflicts with specific requirements of this specification the cable shall comply with the latest version of IS (7098) (Part II) 1985 and its amendments.

Unless otherwise specified, the latest version of the following standards shall be applicable.

a) IS 7098 (Part 2) – Cross linked polyethylene insulation for cables.

b) IS 8130 - Conductor for insulated electrical cables and flexible cords.

c) IS 10810 (Series) – Methods of tests for cables.

d) IS 10418 – Drums for electric cables.

e) IS 3979 – Specification for mild steel wires, stripes and tapes for armouring of cables.

f) IS 5831 – Specification for PVC insulation sheath for electric cables.

g) IS 10462 – Fictitious calculation method for determining of dimensions of Protective coverings of cables Part I elastomatic and hermoplastic insulate cables.

h) IEC.502- Cross Linked Polyethylene Insulation for Cables.

4) **Specification for Cross Linked Polyethylene Insulated PVC Sheathed Cables:**

1) **Rated Voltage and Temperature:-** The rated voltage of the cables shall be 11kV and the maximum voltage shall be 12 kV. Maximum continuous operating temperature (combination of ambient temperature and temperature rise due to load) shall be 90°C under normal operation and 250°C under short circuit conditions.

2) **Type of Cables:-** The type of cables covered in this specification shall be three cored armoured screened.

3) **Continuous Current and Short Circuit Rating:-** The indicative values of the continuous current carrying capacities (for design purposes by field engineers) of the required sizes are given below.

4) Three Core Cables:-

Sl. No.	Size of Cable Sq.mm	Indicative value of continuous current carrying capacity in amps at Maximum conductor temperature of 90 degree	
		(In Ground)	(In Air)
1	300	Greater than 340	398

The short circuit rating for the various sizes of the cable (single core and three core) calculated for duration of 1 second at maximum temperature of 250 degrees is given below.

Sl. No.	Size Sq.mm (Three phase/ Single Phase	Short circuit rating kA (RMS Value)	
1	300	28.2	28.2

Minimum Technical Requirement

Details	**Earthed**	**Variation**
	Approx. weight in Kilograms	
Aluminium	2352	+/- 1 %
Copper tape (45 micron)	122	+/- 1 %
No. of Armouring Strips	44 nos.	+/- 1 No.

Note:- 1. The weight of Aluminium given above is after compacting.

2. Sqmm size of the conductor may reduce by about 2.5 to 3 % after compacting.
3. Aluminium used for the conductor should be sourced only from established sources in India. In case , it is imported, specifications of the same should meetas given in IS 8130/ equivalent.

5) Details of Cable:-

a) **Conductor:-** The cable conductors shall be of round, stranded and compact aluminum of nominal size as stipulated in Table under clause, standard size of cables, corresponding wire diameter and number of wires in the conductor as given in IS.8130.

b) **Conductor Screen:**- Conductor screening shall be provided over the conductor by applying non-meseif attested

c) tallic semi-conducting tape or by extrusion of semi conducting compound or a combination of the two.

d) **Insulation:-** The insulation shall be of extruded cross-linked polyethylene (XLPE) of nominal insulation thickness, 3.6mm and its properties shall conform to IS:7098 (Part II).

e) **Insulation Screen:-** The insulation screen shall consist of two parts, namely metallic and non-metallic. Non-metallic part shall be applied directly over the insulation of each core and shall consist of either a semi-conducting tape or extruded semi conducting compound or a combination of each core and shall consist of either a semi-conducting tape or extruded semi conducting compound or a combination of the two or either material with semi conducting coating.

The metallic part shall consist of either tape, or brand or concentric serving of wires or a sheath; shall be non-magnetic and shall be applied over the non-metallic part.

f) **Core-identification & Laying up of Cores:- The core identification and laying up of cores shall be as per IS.7098 (Part II). For identification of different cores in three-core cable, use of coloured strips, red, yellow and blue or use of numbered strips shall be employed.**

6) Inner Sheath:-The laid up cores shall be covered with inner sheath made of thermoplastic material applied either by extrusion or wrapping. It shall be ensured that the shape is as circular as possible. Thickness of inner sheath shall confirm to IS:7098

(Part II) at par with Table.5 clause16.3. Single core cables shall have no inner sheath, but in case of cables having both metallic part of screen and armour, there shall be an extruded inner sheath between them.

7) **Armouring:-** Armouring shall be applied over the insulation or protective barrier or non-metallic part of insulation screening over the inner sheath. The method, type, dimensions, joints, conductance etc. of armour shall conform to IS 7098 (Part II).

8) **Outer Sheath:-** The outer sheath shall be applied over the armouring by extrusion. The minimum thickness and properties of outer sheath shall conform to the requirements of IS:7098 (Part II).

The following tests shall be carried out on the cables as per IS:7098 (Part II).

5) **I)** **<u>Type Tests:</u>-** Type test shall be Obtained from CPRI/ERDA/Govt. Approved NABL Lab i.e., independent Lab.

1) Test on conductors:

Resistance test

2) Test for armouring wires / strips

3) Tests for thickness of insulation and sheath (eccentricity)

4) Physical test for insulation:

a) Tensile strength and elongation at break

b) Ageing in air oven

c) Hot Set test

d) Shrinkage test

e) Water absorption(gravimetric)

5) Physical Test for Outer Sheath:

a) Tensile strength and elongation at break

b) Ageing in air oven

c) Shrinking test

d) Hot deformation

e) Thermal Stability

f) Loss mass in air oven

g) Heat Shock

6) Partial discharge test

7) Thermal ageing Test for complete cable

8) Bending test

9) Dielectric power factor test

a) As a function of voltage

b) As a function of Temperature

10) Insulation resistance test (Volume Resistivity)

11) Heating cycle test

12) Impulse withstand test

13) High voltage test

14) Flammability test for PVC Sheathed Cable

II) **<u>Short Circuit Test</u>:- The short circuit test for 28.2KA for 1 sec shall be treated as one of the special test and is mandatory.** This test is to be carried out at a recognized test centre such as **CPRI / ERDA/ NABL Accredited Lab.**

The short circuit test shall be preceded and followed by the following tests so as to ensure that the characteristics of the cable remain within the permissible limits even after it is subjected to the required short circuit rating.

a) Partial Discharge test

b) Conductor Resistance

c) High voltage test

The above tests shall be carried out on a sample length of the cable of the approved size.

In case the bidder has not furnished the special test report at the time of bid submission the manufactured cable will be acceptable only after such a sample test is successfully carried out at CPRI /ERDA/Govt. Owned NABL Lab and approved by the purchaser. Also buyers reserve the right to draw samples at random from its stores/ site out of the cables supplied and send the same for testing to any NABL approved laboratory of their choice for 3rd party testing at the cost of the supplier.

If the samples fails in this test, the buyer reserve the right to reject the entire ordered quantity / consignment from which the sample was drawn.

III) Additional Tests:- Mandatory

The following shall constitute additional type test for the cables with improved fire performance as per the Category C2

a) Oxygen index
b) Flame retardance test on bunched cables
c) Smoke density test (on sheathing material)
d) Test for halogen acid gas evolution
e) Temperature index

IV) <u>Routine Acceptance test</u>:-

a) Tensile test
b) Wrapping test
c) Conductor resistance test
d) Test for thickness of insulation and sheath
e) Hot set test for insulation
f) Tensile strength and elongation at break test for insulation and sheath
g) Partial discharge test
h) High voltage test

i) Insulation resistance (volume resistively test)

j) Measurement of Capacitance

V) Routine Tests:-

a) Conductor resistance test

b) Partial discharge test

c) High voltage test

6) Packing & Marking:-

a) **Packing:-** The cables shall be supplied in well seasoned sturdy wooden drums (conforming to the latest edition of IS 10418) suitable for vertical / horizontal transport, as the case may be and shall be suitable to withstand rough handling during transport and outer storage. Similarly, the inside surface of drum shall have the protective layer of varnish / paint to protect it from white ants. There shall be no gaps in the wooden lagging around the drum. The wooden drums shall be reinforced with steel bends and strips for better protection reinforcements so as to withstand rough handling during transport by Rail, Road etc. The firm shall be responsible for any damage to the cables during transit due to improper and inadequate packing. Wherever necessary, proper arrangement for lifting, such as lifting hooks, shall be provided. The packing should withstand extended storage conditions in open yards. The standard length of the cable in each drum shall be 250 metre ± 2.5%. Any cable found short inside the packing cases will be rejected.

b) Marking:- Cable drum shall carry all the information as per IS:7098 (Part-II) stenciled clearly in the drum. In addition to the standard information as above, the drum should also carry the following information clearly stencilled in it:

(i) The letters "KSEBL"
(ii) Purchase Order No. and Date
(iii) Address of consignee.

c) Manufacturer's Identification in the Cable

The manufacturers name, trade mark, voltage grade, year of manufacture etc. shall be embossed on the cable as stipulated in IS 7098 (Part II). The embossing shall be done only on the outer sheath. Further, improved fire performance for Category C2 shall be identified by indenting, embossing the appropriate legend on the outer sheath throughout the cable length in addition to the existing marking requirements.

Bidder shall submit attested photo copy of valid ISI Licenses with technical bid.

6) **Inspection and despatch:-** All the test and inspection shall be made at the place of manufacture unless otherwise specifically agreed upon by the manufacturer and purchaser at the time of purchase. All Tests shall be performed in presence of Purchaser's representative if so desired by the Purchaser. The manufacturer shall give at least Twenty (20) days advance notice for witnessing such tests.

The manufacturer shall afford the inspector representing the purchaser all reasonable facilities without charge, to satisfy him that materials is being furnished in accordance with the inspection.

Certified copies of all routine tests carried out at works for each batch shall be furnished in two (2) copies along with the inspection call (pre-factory report) for approval of the purchaser. The acceptance test report signed by the manufacturer and inspector shall be furnished for obtained MDCC. The cables shall be despatched from Works only after receipt of Purchaser's written approval of the test reports and MDCC.

Upon delivery of the cable KSEBL will inspect them and / or may perform relevant tests in order to verify compliance with this specification. The Manufacturer / Supplier shall replace/rectify without any extra or additional charge to KSEBL, cables which upon examination, test or use, fail to meet any of the requirements in the specification.

7) **Sealing of Cable Ends on Drums:-** The Cable ends shall be sealed properly so that ingress of moisture is completely prevented. The individual core endings shall be sealed effectively with water resistant compound applied over the core and provided with a heat shrinkable or push-on or Tapex or cold shrinkable type cap of sufficient length, with adequate cushion space so that the conductor does not puncture the cap in case of movement of the core during unwinding or laying.

The three crore should have all over all heat shrinkable or push-on or Tapex or cold shrinkable type cap with adequate end clearance and sufficient cushioning to prevent puncturing of the overall sealing cap due to stretching of cores. The sealing cap shall have sufficient mechanical strength and shall prevent ingress of moisture into the cable.

8) **Documents/Drawings:-** The following shall be submitted by the Bidder along with the tender for tender evaluation. All the required details in complete form shall be submitted through relevant, legible documents in English to avoid delay due to back reference. **Partial submission shall not be restored to by the bidder.**

a) Guaranteed Technical Particulars completely filled and signed by the bidder.

b) Copies of certificates of type tests required as per IS: 7098 (Part-II) carried out in **NABL accredited lab/Approved Lab of Government of India/CPRI**. The tests shall be carried out in accordance with appropriate part of IS: 10810. The Type Test Certificates for a cable of the same type and design of the Cable offered and carried out within 10 years before the date of opening of the Tender shall be furnished.

c) Manufacturer's Catalogue giving cable construction details, characteristics and Cross sectional drawings of the cable showing detail dimensions.

d) List of Customers to whom the Cable of similar rating have been supplied.

e) Quality Assurance Plan / Procedure adopted by the manufacturer for ensuring the quality of the manufacturing process from raw material procurement to supply.

f) Detailed test program to be followed during factory testing.

g) Bidder shall submit attested photocopy of valid ISI Licenses with technical bid.

An illustrated literature on the cable, giving full technical information on current ratings, cable constants, short circuit ratings, derating factors for different types of installations, packing details, weights and other relevant information.

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SECTION II

SPECIFIC TECHNICAL REQUIREMENTS

1.0. SCOPE:- This section of the specification covers Service Conditions, System Particulars desired technical parameters

2.0. SERVICE CONDITIONS:- Equipment to be supplied against this specification shall be suitable for satisfactory continuous operation under the following tropical conditions.

a) Maximum ambient temperature (deg C) : 50

b) Maximum temperature in shade (deg C) : 40

c) Minimum temperature in air (deg C) in shade: 17

d) Relative Humidity (%) : 10 to 100

e) Maximum annual Rainfall (mm) : As per published Meteorological/ Climatological data

f) Maximum Wind Velocity (m/s) : 39

g) Maximum altitude above mean sea level (Meters) : 1000

h) Isoceraunic level (days/year) : 60

i) Maximum soil temperature at cable depth 0C : 30

j) Maximum soil thermal resistively 0C cm/watt : 150

k) Moderately hot and humid tropical climate, conducive to rust and fungus growth. Areas having seasonal climate of cold (snowfall prone) are also there.

The cables in service will be subject to daily load cycles, of morning peak, day peak and evening peak with reduced loading during night off-peak hours.

3.0. SYSTEM PARTICULARS

a.	Line Voltage (kV)	11
	HighestSystem Voltage (kV)	12
	Number of phase	3
	Frequency	50Hz
	Neutral	effectively earthed
	Short circuit level (KA)	22.77 kA, 31.8kA

4.0 SPECIFIC TECHNICAL REQUIREMNTS

Technical Parameters of the cable shall be as follows:

.	PARTICULAR	Unit	DATA
	Rated Voltage	kV	6.35/11
b.	Type of Insulation	-	XLPE
c.	Multi core	-	Three core
d.	Armoured/ Unarmoured	-	Armoured
e.	Material of Conductor	-	Aluminium
f.	System	-	11 kV Earthed
g.	Highest System Voltage	kV	12
h.	Conductor size	sq. mm	300
i.	Material		Stranded Aluminium
j.	Shape of Conductor		Circular
k.	Short Circuit Current	kA	28.2 for 1 Sec.
l.	Power Frequency Withstand Voltage	KV rms	28
m.	Lightning Impulse Withstand Voltage	kVp	75
n.	Continuous Withstand Temperature	Deg C	90
o.	Short Circuit withstand Temperature	Deg C	250
p.	Oxygen Index		Min 29 (as per ASTMD 2863)
q.	Acid Gas Generation		Max 20% (as per IEC 754-1)
r.	Smoke Density Generation		60% (As per ASTMD 2843)
s.	Flammability Test		As per Swedish Chimney test

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GUARANTEED TECHNICAL PARTICULARS

Sl. No	Particulars	KSEBL's Requirement
1	Manufacturers Name & Address	
2	Country of manufacturer	INDIA
3	Type of cable	A2XFY
4	Applicable standards for manufacturing	IS:7098(P-2)with latest amendment
5	Applicable standards for testing	IS:7098(P-2) & IS10810 with latest amendments
6	Rated voltage (kV)	6.35/11 (E)
7	Maximum service voltage (kV)	12
8	Continuous current carrying capacity in ground (Amp)	354
9	Continuous current carrying capacity in air (Amp)	441
10	Short circuit withstand capacities for 1 second of (With a conductor temperature of 90^{o}C at the commencement	
i)	Conductor (KA) for 1sec	28.20
ii)	Screen (KA)	
iii)	Armour (KA)	
iv)	Combined value for Screen &	7

	Armour	
11	**Conductor**	
i)	Material & Grade	Aluminium of H2/H4 grade as per class-2 of IS:8130
ii)	Nominal cross – sectional area (mm^2)	300
iii)	No. of strands (Min)	36 approx. (Before Stranding) complying 30 (minimum) as per IS:8130
iv)	Diameter of each strand (Nominal) (mm)	3.25 approx. (Before Stranding)
v)	Max. DC resistance of conductor at 20 Deg. C (ohm/kM)	0.100
vi)	Max. AC resistance of conductor at 90 Deg. C (ohm/kM)	0.128
vii)	Tensile strength of Aluminium (N/mm^2)	100-150 - H2 Above 150 - H4
12	Reactance of cable at normal frequency (Approx) (ohm/kM)	<0.085
13	Electrostatic capacitance at normal frequency (µF/kM)	<0.48
14	Charging current (A/kM)	1
15	Loss tangent at normal frequency at Uo	<0.004 /km
16	**Conductor screen**	
i)	Material	Extruded Semi Conducting Compound

ii)	Nominal thickness (mm)	0.3
17	**XLPE Insulation**	
i)	Composition	Extruded XLPE as per IS:7098(P-2)
ii)	Type of curing	Dry curing
iii)	Thickness of insulation (nominal) mm	3.6
iv)	Tolerance on thickness (mm)	0.1+0.1*t (Where t = nominal thickness of insulation)
v)	Dielectric constant at normal frequency	2.3
vi)	Specific insulation resistance at 20 deg. C	As per IS7098 P-2 2011
vii)	Min. Volume resistivity at 20 deg. C (Ohm-cm)	$1x10^{14}$ (Min.)
viii)	Min. volume resistivity at 90 deg.C (Ohm-cm)	$1x10^{12}$ (Min.)
ix)	Min. Tensile strength (N/mm^2)	12.5
x)	Min. Elongation % at rapture	200
xi)	Identification of cores	Colored strips of Red, Yellow & Blue
18	1.2/50 microsecond impulse wave withstand voltage (kVp)	75
19	power frequency withstand voltage (kV) (rms) 5 min.	28 – 1minute

		21 – 5 minute
20	Max. Dielectric stress at the at insulation screen	2 kV/mm (Approx.)
21	Max. Dielectric stress at the conductor screen (kV/cm)	1.5 kV/mm (Approx.)
22	**Insulation screen**	
i)	Material	Extruded non metalic semi conducting compound (Strippable)
ii)	Extruded/ wrapped	Extruded
iii)	Nominal thickness (mm)	0.3 mm
iv)	Colour	Black
23	**Metallic screen**	
i)	Material / composition	Copper tape
ii)	Nominal radial thickness / dia (mm)	0.04
24	Nominal diameter over metallic screen	29.5 mm approx.
25	Nominal radial clearance allowed under metal sheath	as per IS: 7098 (P-2)
26	Type and material of filler	Non-Hygroscopic PVC Fillers
27	**Armour**	
i)	Material and type	Galvanized Steel flat Strip as per IS:3975
ii)	Size of Armour (mm) (Min)	4.0x0.8

28	**Inner Sheath**	
i)	Material	Extruded PVC ST-2
ii)	Thickness (Min)	0.7mm
	Colour of sheath	Black
29	**Outer Sheath**	
a	Material	FRLSH PVC ST-2
b	Thickness (Min)	2.68mm
c	Colour of sheath	Black
30	**Approx overall diameter (mm)**	73 Approx.
31	Minimum bending radius	15*OD
32	Net weight of cable	
33	Approx Conductor weight - Kg/Km	
34	Embossing	
35	Standard drum length(m)	250+/-2.5%
36	Overall quantity tolerance	**+/-1%**
37	Sequential Length Marking	
38	Packing material	Non-returnable Wooden drum
39	**FR-LSH TEST**	
i)	Oxygen Index at room temp. as per ASTM D - 2863	29% (Min.)
ii)	Temp. Index at 21% oxygen Index as	250^{o}C (Min.)

	per ASTM D - 2863	
iii)	Smoke density rating (Average light absorption) as per ASTM D - 2843	60.00%
iv)	Acid gas degeneration	20%
v)	Flammability test	

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ANNEXURE - IV

PROPERTIES OF XLPE INSULATION

Sl. No.	**Property**	**Requirement**
I.	Tensile Strength	12.5 N/mm^2 (Min.)
II.	Elongation at break	200 percent (Min.)
III.	Ageing in air oven	
	(a) Treatment	
	Temperature	135 ± 3 ^{o}C
	Duration	7 days
	(b) Tensile Strength variation	± 25% Max.
	(c) Elongation variation	± 25% Max.
IV.	Hot set	
	(a) Treatment	
	Temperature	200 ± 3 ^{o}C
	Time under load	15 Minutes
	Mechanical Stress	20 N/cm^2
	(b) Elongation under load	175 percent, Max.

	(c) Permanent elongation (set) after cooling	15 percent, Max.
V.	Shrinkage	
	(a) Treatment	
	Temperature	135 ± 3 ^{o}C
	Duration	1 hour
	(b) Shrinkage	4% Max.
VI.	Water absorption (Gravimetric)	
	(a) Treatment	
	Temperature	85 ± 2 ^{o}C
	Duration	14 days
	(b) Water absorbed	1Mg/Sq. cm, Max.
VII.	Volume resistivity	
	(a) at 27 ^{o}C	1x10^{14} ohm-cm, Min.
	(b) at 90 ^{o}C	1x10^{12} ohm-cm, Min.

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