PROJECT	**OPTCL NEW DUBURI, ODISHA (400 kV AIS-EXT)**
ITEM	**400/132kV ISOLATOR**
SUBJECT	**BID SPECIFIC ATC**

1. **BHEL Contact (Technical):**
   For any **technical clarification**, please contact Mr. Baidyanath Yadav, Sr. Engineer (TBEM). Contact No. 0120 0674 8510; e-mail: byadav@bhel.in

2. **BHEL Contact (Commercial):**
   For any **commercial clarification**, please contact Mr. Sandeep, Dy. Manager (TBMM). Contact No. 0120-6748540; e-mail: kumar.sandeep@bhel.in

3. **Terms of Payment:**
   [A] Payment for Main Supply –Isolator

   i) 95% of payment along with 100% GST & F&I shall be made within 45 days for MSE (Micro & Small Enterprises) / within 60 days for Medium Enterprises / within 90 days for non MSME suppliers from the date of receipt of complete invoice along with documents in 3 sets (original + 2 copies) as follows:
   - LR / GR duly endorsed by BHEL Site Official.
   - CRAC (consignee receipt-cum-acceptance certificate) / MRC
   - GST Compliant Tax Invoice
   - Packing List (Case-wise)
   - Copy of Transit Insurance Certificate from underwriters.
   - Material Inspection Clearance Certificate (MICC) issued by BHEL Quality Management
   - Guarantee Certificate
   - Performance Bank Guarantee (PBG)
   -

   ii) Balance 05% of payment shall be made within 45 days for MSE (Micro & Small Enterprises) / within 60 days for Medium Enterprises / within 90 days for non MSME suppliers from the date of receipt of complete invoice along with documents in 3 sets (original + 2 copies) as follows:
   - Claim Invoice
   - Certificate of successful completion of Erection, Testing & Commissioning at Site issued by BHEL Site Official / Construction Management
   - Certificate of completion of final documentation as per Purchase Order / Technical Specification issued by BHEL Engineering Management

   [B] Payment for Supervision of Erection, Testing & Commissioning (ETC) of isolator at Site
   100% of payment shall be made within 45 days for MSE (Micro & Small Enterprises) / within 60 days for Medium Enterprises / within 90 days for non MSME suppliers against certificate of successful completion of Erection, Testing & Commissioning at Site issued by BHEL Site Official / Construction Management from the date of receipt of GST Compliant Tax invoice in 3 sets (original + 2 copies).

   Note 01: In-case commissioning is delayed beyond reason not attributable to supplier. Supplier may claim the balance 05% of supply portion after 12 months from the date of last delivery or 12 months from the date of 02.12.2024, whichever is later, upon submission of BG with equivalent amount and the certificate endorsed by BHEL Site In-Charge citing the details that the "delay in commissioning is not attributable to supplier". Further, Vendor has to depute their representative at site for supervision of ETC within 15 days after site readiness.
   Note 02:
   - Bills shall be submitted to BHEL TBG Noida office for processing along with billing checklist.
   - It should be ensured that Tax Invoice complies with statutory requirements under GST law to enable BHEL to avail Input Tax Credit.
   - Payment of GST component shall be made only if vendor has deposited the Tax and credit for the same is reflected in GSTN (GST Network).
   - Copy of GST Registration Certificate(s) shall be also be attached with Tax Invoice.

PROJECT	**OPTCL NEW DUBURI, ODISHA (400 kV AIS-EXT)**
ITEM	**400/132kV ISOLATOR**
SUBJECT	**BID SPECIFIC ATC**

4. Terms of Delivery:

Ex-Works basis including P&F (Packing & Forwarding). F&I (Freight & Insurance) up to site is in the scope of bidder. LR / GR date or invoice date (whichever is later) shall be considered as delivery date.

5. Delivery Requirement:

(a) Supply (Main Supply- ISOLATOR): Within 25 Weeks (175 days) from the date of PO/input by BHEL as per Activity schedule (Annexure-II).

Note: Purchase Order shall be valid for 02 years from the date of placement of purchase order.

Note: In case, BHEL's delivery requirement is not met by vendor(s), then a chance may be given to all such vendors to review their quoted delivery schedule in line with BHEL's delivery requirement. However, if vendor fails to meet the requisite delivery plan, then BHEL reserves the right not to consider the offer of such vendor(s).

6. Prices:

The quoted prices shall be on **Firm basis**. Price to be quoted as inclusive of GST, i.e., Ex-works including Packing & Forwarding Charges + F&I + GST.

Note: Unloading & safe storage at site and transfer of material from storage to erection site shall be under BHEL scope. Bidder to quote prices accordingly.

7. Reverse Auction:

Bid to RA is applicable.

8. Liquidated Damage for delayed Delivery:

If the Seller/Service Provider fails to deliver any or all of the Goods/Services within the original/re-fixed delivery period(s) specified in the contract, the Buyer will be entitled to deduct/recover the Liquidated Damages for the delay, unless covered under Force Majeure conditions aforesaid, @ 0.5% of the contract value of delayed quantity per week or part of the week of delayed period as pre-estimated damages not exceeding 10% of the contract value of delayed quantity without any controversy/dispute of any sort whatsoever.

9. Technical Specification:

Technical Specification Nos. TB-420B-316-005-Rev00 is applicable. No permissible Technical Deviation has been envisaged. Bidders to quote as per Technical Specifications.

10 Technical Pre-Qualification Requirement:

Technical pre-qualifying requirement shall be as per **Annexure-I.**

11 Manufacturing Quality Plan (MQP):

Inspection shall be carried out as per Customer's approved Quality Plan. For the same, Supplier to submit Quality Plan to BHEL for Customer approval.

12 Inspection & Inspection Charges:

To be inspected by Customer/ BHEL/ TPIA. Complete inspection cost to be borne by the bidder. For further details, please refer Annexure-X.

13 Destination/ Delivery Location:

FOR OPTCL DUBURI - 400kV AIS Substation at New Duburi, Odisha

PROJECT	**OPTCL NEW DUBURI, ODISHA (400 kV AIS-EXT)**
ITEM	**400/132kV ISOLATOR**
SUBJECT	**BID SPECIFIC ATC**

14 Guarantee Clause:

The equipment/ material supplied and services rendered (if applicable) shall be guaranteed to be free from all defects and faults in design & engineering, material, workmanship & manufacture and in full conformity with the Purchase Order/ Contract, Technical Specifications & approved drawings/ data sheets, if any, **for 18 months from the date of last delivery or up to 03.12.2025 whichever is later.**

The defective equipment/ material/ component shall be replaced free of cost at site. Freight & Insurance during transit shall also be in the scope of the supplier/ contractor. Any expenditure for dismantling and re-erection of the replaced equipment/ material/ component shall be to supplier's/ contractor's account. All replacements during the guarantee period shall be delivered at site promptly and satisfactorily within a period not more than 45 days from the date of reporting the defect/ rejection, etc.

In the event of the supplier/ contractor failing to replace the defective equipment/ material/ component within the time period mentioned above, BHEL may proceed to undertake the replacement of such defective equipment/ material/ component at the risk and cost of the supplier/ contractor without prejudice to any other rights under the contract and recover the same from PBG/ other dues of this Purchase Order/ Contract or any other Purchase Order/ Contract executed by the supplier/ contractor.

15 Performance Bank Guarantee (PBG):

As per GeM terms and conditions. Performance BG of **05% of GeM contract value** shall submitted be as per BHEL format valid till Guarantee period with claim period of 3 months extra over and above.

Note: Value of the Bank Guarantee (at the time of submission) shall remain unchanged for any subsequent variations in Purchase Order value up to ± 20%. Beyond this variation of ± 20%, the Supplier shall arrange to enhance or may reduce the value of the Bank Guarantee accordingly for the total variation promptly.

16 Acceptance of Offer:

Bidder's offer will be considered for evaluation based on PQR, Technical and other commercial documents submitted along with bid.

Bidder's offer will be acceptable subject to final acceptance of vendor by ultimate customer (OPTCL) as approved supplier. Bidder is required to submit the following documents for vendor approval along with Bid. Failing to submit below documents bidder is liable for rejection:

(a) Company Profile
(b) Performance Certificate
(c) Supply Experience
(d) ISO Certificate
(e) Audited Balance Sheets (latest 3 Years)
(f) Any other document if required

Please note that this is not exhaustive list of documents. Additional documents apart from above can be demanded for arranging customer approval.

17 Make in India:

For this procurement, the local content to categorize a supplier as Class-I local supplier/ Class-II local supplier/ Non-local supplier and purchase preference to Class-I local supplier, is as defined in Public Procurement (Preference to Make in India), Order 2017 Dtd. 04.06.2020, issued by DPIIT. In case of subsequent orders issued by the nodal ministry, changing the definition of local content for the items of the NIT, the same shall be applicable even if issued after issue of this NIT but before opening of part-II bids against this NIT.

"Bidder to specify the percentage of local content as per the format of self-declaration for local content" as per **Annexure-V.**

"This tender is not a global tender and only Class-I suppliers as defined under the DPIIT Order No. P-45021/2/2017-PP (BE-II) Dtd. 04.06.2020 and subsequent orders are eligible to bid in this tender. **Bids received from Class II & Non-local supplier shall be rejected**."

18 Compliance to GOI order for restrictions under Rule 144 (xi) of General Financial Rules (GFRS), 2017 (Annexure-XI) :

Refer clause at **Annexure-XI** and Certification at **Annexure-XII/ Annexure-XIII** (whichever is applicable) regarding restrictions under Rule 144 (xi) of General Financial Rules (GFRs), 2017. Bidder to comply the clause and submit the certification. Non-compliance/ Non-submission of certification will lead to rejection of Offer.

19 MoP Circular (Annexure-XIV):

Bidder to comply the MOP circular dated 02-07-2020 **(Annexure-XIV)** and its subsequent amendment, if any, in prescribed format **(Annexure-XV)**. Non-compliance/ Non-submission will lead to rejection of Offer **(Not Applicable for cases where local content is 100%).**

20 Variation in Contract Value and Quantities:

BHEL shall have the right to variation in quantities of items within **+/- 10%** of the total Purchase Order / Contract value at the time of placement of PO or award of Contract on overall basis for all amendments together within two years from the date of original Purchase Order. The purchaser shall have the right to increase or decrease quantity and scope up to the above extent of value and seller/contractor shall be bound to accept the same at the contracted prices without any escalation.

21 Unpriced Bid:

Vendor to furnish unpriced bid mentioning "Quoted" against each BOQ line item and % of GST quoted in tender as per **Annexure-III.**

22 Details of Bidder:

Bidder to submit their complete contact information details as per **Annexure-IV.**

23 Evaluation Criteria:

Evaluation shall be done on total cost to BHEL basis.

24 Deviations:

a) Technical Deviation: No Technical Deviation is envisaged.
b) Commercial Deviation: No Commercial Deviation is envisaged.

25 Risk Purchase: (Also refer Annexure-VIII):

In case the Supplier/ Contractor fails to supply or fails to comply with terms & conditions of the Purchase Order/ Contract or delivers equipment/ material not of the contracted quality or fails to adhere to the contract specifications or fails to perform as per the activity schedule and there are sufficient reasons even before expiry of the delivery/ completion period to justify that supplies shall be inordinately delayed beyond contractual delivery/ completion period, BHEL reserve the right to cancel the Purchase Order/ Contract either in whole or in part thereof without compensation to Supplier/ Contractor and if BHEL so desires, may procure such equipment/ material/ items not delivered or others of similar description where equipment/ material/ items exactly complying with particulars are not readily procurable in the opinion of BHEL which is final and in such manner as deemed appropriate, at the risk and cost of the Supplier/ Contractor and the Supplier/ Contractor shall be liable to BHEL for any excess cost to BHEL. However, the Supplier/ Contractor shall continue execution of the Purchase Order/ Contract to the extent not cancelled under the provisions of this clause.

Recovery amount on account of purchases made by BHEL at the risk and cost of Supplier/ Contractor shall be the difference of total value of new Purchase Order (PO) value and total value of old Purchase Order for applicable items, where the total value of new PO is more than total value of old PO for applicable items, plus additional 5% of the total ex-works value of new PO as overheads.

The Supplier/ Contractor shall on no account be entitled to any gain on such risk & cost purchase. In case the purchase order (PO) value of the new PO is less than the PO value of the old PO, 5% of the total ex-works value of the new PO shall be recovered as overheads and the difference between the PO value of the old PO and the new PO shall not be considered for calculation of the recovery amount.

26 RXIL (TReDS) Platform:

TBG is registered with RXIL (TReDS) platform. MSME bidders are requested to get registered with RXIL (TReDS) platform to avail the facility as per GoI guidelines.

27 Latent Defect Warranty:

The period of latent defect warranty shall be 10 years reckoned from the completion of Guarantee period.

28 Bidder to submit **sealed and signed copy of the following** while uploading bid in GeM portal:

a) Bid Specific ATC: This document.
b) Annexure-I: Technical Pre-Qualification Requirement along with supporting documents.
c) Annexure-II: Activity Schedule
d) Annexure-III: Unpriced Bid
e) Annexure-IV: Contact Details of Bidder
f) Annexure-V: Local Content Self-Certification
g) Annexure-VI: Schedule of Commercial Deviation
h) Annexure-VII: Schedule of Technical Deviation
i) Annexure-X: Inspection Charges
j) Annexure-XII: Compliance to Government of India Order OM NO.6/18/2019-PPD Dtd. 23.07.2020 regarding restrictions under rule 144 (xi) of the General Financial Rules (GFRs), 2017
k) Annexure-XIII: Compliance to Government of India Order OM NO.6/18/2019-PPD Dtd. 23.07.2020 regarding restrictions under rule 144 (xi) of the General Financial Rules (GFRs), 2017
l) Annexure-XV: Vendor Compliance Format

Note: In case of non-receipt of above documents, the bidder is liable for rejection.

29 All other terms & conditions shall be as per GTC of GeM.

Signature of the authorized representative of

Place : ……..
Date : ……..

Bidder's Name : ……
Designation : ……
Company Seal : ……

PROJECT	**OPTCL NEW DUBURI, ODISHA (400 kV AIS-EXT)**
ITEM	**400/132kV ISOLATOR**
SUBJECT	**BID SPECIFIC ATC**

ANNEXURE-I

TECHNICAL QUALIFICATION REQUIREMENT FOR OPTCL DUBURI
The bidder must have, manufactured, tested and supplied 132kV or higher voltage class Isolator(s), which are in satisfactory operation for at least two (2) years as on the original scheduled date of tecno-commercial bid opening date of this tender.

Requisite documents for ROUTE

SUPPORTING DOCUMENTS TO BE SUBMITTED BY BIDDER ALONG WITH TECHNICAL BID		
Sr	Required Criteria	Supporting Documents
1	Manufacturing	Approved Drawings/ GTP /Approved Quality Plan/ Factory Inspection Test Report etc. establishing bidder as manufacturer of offered item in line with TQR.
2	Supply	PO/ Dispatch clearance/ LR/ Material Receipt certificate at site/ installation or commissioning certificate etc. establishing bidder as proven supplier of offered item in line with TQR
3	Type Test	TTR approval from customer / Type Test Report etc. establishing successful type tested design in line with TQR
4	Satisfactory operation	Successful operation means certificate issued by employer/end-customer or main contractor (along with chain of document from employer/end-customer) stating successful operation without any adverse remark.

PROJECT	**OPTCL NEW DUBURI, ODISHA (400 kV AIS-EXT)**
ITEM	**400/132kV ISOLATOR**
SUBJECT	**BID SPECIFIC ATC**

ANNEXURE-II

ACTIVITY SCHEDULE

SN	ACTIVITY	ACTIVITY TIME [in weeks]	REMARKS
	PO / Input receipt from BHEL	1	BHEL SCOPE
1.	Submission of Documents necessary for getting manufacturing clearance like Drawings, Data sheet MQP etc.	3	SUPPLIER SCOPE
2.	Manufacturing Clearance along with approved CAT-1 Drawings	2	BHEL SCOPE
3.	Manufacturing time and raising of Inspection Call	14	SUPPLIER SCOPE
4.	BHEL/Customer Inspection & Dispatch Clearance	3	BHEL SCOPE
5.	Dispatch	2	SUPPLIER SCOPE
Activity Time for supply:		**25 Weeks**	

1. Inspection call to be raised by vendor 1 week in advance.
2. Supplier must ensure the completeness and correctness of the requisite documents before submission for approval. Delay in approval on account of incomplete / inadequate information shall be the responsibility of supplier.
3. Inspection call should be given in the prescribed format only. Inspection calls not in the prescribed format shall not be entertained.
4. Vendor to ensure resubmission of drawings / documents within 1 Week from the date of comment given by BHEL
5. Qty to be offered for inspection should be in accordance within Delivery-schedule – lot. BHEL reserves the right not to entertain multiple inspection calls for a Delivery – lot and delay on this account shall be the responsibility of Supplier.

Signature of the authorized representative of

Place : ……..
Date : ……..

Bidder's Name : ……
Designation : ……
Company Seal : ……

PROJECT	**OPTCL NEW DUBURI, ODISHA (400 kV AIS-EXT)**
ITEM	**400/132kV ISOLATOR**
SUBJECT	**BID SPECIFIC ATC**

ANNEXURE-III

UNPRICED BID

Sl. No.	Item Description	Unit	Quantity	Total Ex-works	GST on Total Ex-works	Total F&I	GST on Total F&I	Total cost to BHEL
OPTCL DUBURI								
1.	SUPPLY- ISOLATOR : 400KV, 3150A, 63KA FOR 3S, 3X1 PHASE, HORIZONTAL DOUBLE BREAK (HDB) TYPE ISOLATOR, THREE POLE ELECTRICALLY GANGED, MOTOR OPERATED WITH ONE EARTH SWITCH, THREE POLE ELECTRICALLY GANGED, MOTOR OPERATED ALONG WITH OPERATING MECHANISM AND OTHER ACCESSORIES COMPLETE IN ALL RESPECT, EXCLUDING POST INSULATOR, STRUCTURE AND TERMINAL CONNECTOR ETC.	No	8	Quoted	Quoted **Mention GST % Quoted**	Quoted	Quoted **Mention GST % Quoted**	Quoted
2.	SUPPLY- ISOLATOR : 400KV, 3150A, 63KA FOR 3S, 3X1 PHASE, HORIZONTAL DOUBLE BREAK (HDB) TYPE ISOLATOR, THREE POLE ELECTRICALLY GANGED, MOTOR OPERATED WITH TWO EARTH SWITCH, THREE POLE ELECTRICALLY GANGED, MOTOR OPERATED ALONG WITH OPERATING MECHANISM AND OTHER ACCESSORIES COMPLETE IN ALL RESPECT, EXCLUDING POST INSULATOR, STRUCTURE AND TERMINAL CONNECTOR ETC.	No	2	Quoted	Quoted **Mention GST % Quoted**	NA	NA	Quoted

PROJECT	**OPTCL NEW DUBURI, ODISHA (400 kV AIS-EXT)**
ITEM	**400/132kV ISOLATOR**
SUBJECT	**BID SPECIFIC ATC**

3.	SUPPLY- ISOLATOR : 132KV, 2000A, 40KA FOR 3S, SINGLE PHASE, HORIZONTAL DOUBLE BREAK (HDB) TYPE ISOLATOR MOTOR OPERATED WITHOUT EARTH SWITCH ALONG WITH OPERATING MECHANISM & OTHER ACCESSORIES, BUT WITHOUT INSULATOR, STRUCTURE & TERMINAL CONNECTOR ETC.	No	2	Quoted	Quoted **Mention GST % Quoted**	**NA**	**NA**	Quoted
4.	SERVICES- ISOLATOR : 400KV, SUPERVISION OF ERECTION TESTING AND COMMISSIONING INCLUDING ALIGNMENT CHECK OF HORIZONTAL DOUBLE BREAK (HDB) TYPE ISOLATOR & EARTHSWITCH	No	10	Quoted	Quoted **Mention GST % Quoted**	NA	NA	Quoted
5.	SERVICES- ISOLATOR : 132KV, SUPERVISION OF ERECTION TESTING AND COMMISSIONING INCLUDING ALIGNMENT CHECK OF SINGLE PHASE, HORIZONTAL DOUBLE BREAK (HDB) TYPE ISOLATOR	No	2	Quoted	Quoted **Mention GST % Quoted**	NA	NA	Quoted
6.	SPARES- ISOLATOR : 400KV, MALE AND FEMALE CONTACT	Set	2	Quoted	Quoted **Mention GST % Quoted**	Quoted	Quoted **Mention GST % Quoted**	Quoted
7.	SPARES- ISOLATOR : 400KV, POWER CONTACTOR, RELAYS, MCBS, SWITCHES, FUSES, PUSH BUTTONS, RESISTORS ETC AS PER APPROVED SCHEMATIC	Set	1	Quoted	Quoted **Mention GST % Quoted**	Quoted	Quoted **Mention GST % Quoted**	Quoted
8.	SPARES- ISOLATOR : 400KV, LIMIT SWITCH	Set	2	Quoted	Quoted **Mention GST % Quoted**	Quoted	Quoted **Mention GST % Quoted**	Quoted
9.	SPARES- ISOLATOR : 400KV, MOTOR WITH GEAR ASSEMBLY & BEVEL GEAR ASSEMBLY	Set	1	Quoted	Quoted **Mention GST % Quoted**	Quoted	Quoted **Mention GST % Quoted**	Quoted

PROJECT	**OPTCL NEW DUBURI, ODISHA (400 kV AIS-EXT)**
ITEM	**400/132kV ISOLATOR**
SUBJECT	**BID SPECIFIC ATC**

10.	SPARES- ISOLATOR : 400KV, AUXILIARY SWITCH CONTACTS ASSEMBLY	Set	1	Quoted	Quoted **Mention GST % Quoted**	Quoted	Quoted **Mention GST % Quoted**	Quoted
11.	SPARES- ISOLATOR : 400KV, EARTHING ROD & BLADE CONTACT SIDE	Set	1	Quoted	Quoted **Mention GST % Quoted**	Quoted	Quoted **Mention GST % Quoted**	Quoted
12.	SPARES- ISOLATOR : 400KV, HINGE PINS AND TERMINAL PAD	Set	1	Quoted	Quoted **Mention GST % Quoted**	Quoted	Quoted **Mention GST % Quoted**	Quoted

Signature of the authorized representative of

Place : .....
Date : .....

Bidder's Name : .....
Designation : .....
Company Seal : .....

PROJECT	**OPTCL NEW DUBURI, ODISHA (400 kV AIS-EXT)**
ITEM	**400/132kV ISOLATOR**
SUBJECT	**BID SPECIFIC ATC**

ANNEXURE-IV

CONTACT DETAILS OF BIDDER

Work Address	
Correspondence Address	
PAN NO.	
GST No.	
Details of contact person for clarification regarding bid:	
Contact Person Name	
Designation	
email ID	
Mobile No.	
Landline No.	

Signature of the authorized representative of

Place : ……..
Date : ……..

Bidder's Name : ……
Designation : ……
Company Seal : ……

PROJECT	**OPTCL NEW DUBURI, ODISHA (400 kV AIS-EXT)**
ITEM	**400/132kV ISOLATOR**
SUBJECT	**BID SPECIFIC ATC**

ANNEXURE-V

Item/ Package Name	**400/132kV ISOLATOR**
GeM Bid No.	
Project	**OPTCL NEW DUBURI, ODISHA (400 kV AIS-EXT)**
Percentage of Local Content	**…….%**

Format of Self-certification regarding Local Content in line with PPP-MII order, 2017 and its revision Dtd. 04.06.2020.

Date: ……..

I …… S/o, D/o, W/o, …… Resident of …… hereby solemnly affirm and declare as under:

That I will agree to abide by the terms and conditions of the Public Procurement (Preference to Make in India) Order, 2017 (*hereinafter PPP-MII order*) of Government of India issued vide Notification No. P-45021/2/2017-BE-II Dtd. 15.06.2017, its revision Dtd. 04.06.2020 and any subsequent modifications/ amendments**,** if any**.**

That the information furnished hereinafter is correct to the best of my knowledge and belief and I undertake to produce relevant records before the procuring entity/ BHEL or any other Government authority for the purpose of assessing the local content of goods/ services/ works supplied by me for …… *(Enter the name of the Equipment/ Item for Project)*.

That the local content for all inputs which constitute the said goods/ services/ works has been verified by me and I am responsible for the correctness of the claims made therein.

That the goods/ services/ works supplied by me for …… *(Enter the name of the Equipment/Item for Project)* contains ……..% *(mention the Local content in %age)* Local Content.

That the value addition for the purpose of meeting the 'Minimum Local Content 'has been made by me at …… (*Enter the details of the location(s) at which value addition is made)*.

That in the event of the local content of the goods/ services/ works mentioned herein is found to be incorrect and not meeting the prescribed supplier class categorization criteria as per said order, based on the assessment of procuring agency(s)/ BHEL/ Government Authorities for the purpose of assessing the local content, action shall be taken against me in line with the PPP-MII order and provisions of the Integrity pact/ Bidding Documents.

I agree to maintain the following information in the Company's record for a period of 8 years and shall make this available for verification to any statutory authority:

i. Name and details of the Local Supplier
   (Registered Office, Manufacturing unit location, nature of legal entity)
ii. Date on which this certificate is issued
iii. Goods/ services/ works for which the certificate is produced
iv. Procuring entity to whom the certificate is furnished
v. Percentage of local content claimed and whether it meets the Minimum Local Content prescribed
vi. Name and contact details of the unit of the Local Supplier(s)
vii. Sale Price of the product
viii. Ex-Factory Price of the product

ix. Freight, insurance and handling
x. Total Bill of Material
xi. List and total cost value of input used to manufacture the Goods/ to provide services/ in construction of works
xii. List and total cost of input which are domestically sourced. Value addition certificates from suppliers, if the input is not in-house to be attached
xiii. List and cost of inputs which are imported, directly or indirectly

For and on behalf of …… *(Name of firm/ entity)*

Authorized signatory (To be duly authorized by the Board of Directors)
(Insert Name, Designation and Contact No.)

PROJECT	**OPTCL NEW DUBURI, ODISHA (400 kV AIS-EXT)**
ITEM	**400/132kV ISOLATOR**
SUBJECT	**BID SPECIFIC ATC**

ANNEXURE-VI

SCHEDULE OF COMMERCIAL DEVIATION

The following are the deviations/ variations exception from the General Terms and Conditions:

Sl. No.	Clause No. of Terms and Conditions	Statement of Deviation
	Nil Deviation	**Nil Deviation**

In case, this schedule is not submitted, it will be presumed that the equipment/ material to be supplied under this contract is deemed to be in compliance with the General Terms and Conditions.

If there is **Nil Deviation**, even then the format to be filled as **Nil Deviation**.

Note:

1. Continuation sheets of like size and format may be used as per the Bidder's Requirement and shall be annexed to this schedule.
2. Deviation mentioned in this schedule shall only be considered.

This Format is to be submitted in original duly signed by bidder. Reproduction of the same in any sort is not acceptable.

Signature of the authorized representative of

Place : ……..

Date : ……..

Bidder's Name : ……

Designation : ……

Company Seal : ……

PROJECT	**OPTCL NEW DUBURI, ODISHA (400 kV AIS-EXT)**
ITEM	**400/132kV ISOLATOR**
SUBJECT	**BID SPECIFIC ATC**

ANNEXURE-VII

SCHEDULE OF TECHNICAL DEVIATION

The following are the deviations/ variations exception from the Technical Specifications:

Sl. No.	Clause No. of Technical Specifications	Statement of Deviation
	Nil Deviation	**Nil Deviation**

In case, this schedule is not submitted, it will be presumed that the equipment/ material to be supplied under this contract is deemed to be in compliance with the Technical Specifications.

If there is **Nil Deviation**, even then the format to be filled as **Nil Deviation**.

Note:

3. Continuation sheets of like size and format may be used as per the Bidder's Requirement and shall be annexed to this schedule.
4. Deviation mentioned in this schedule shall only be considered.

This Format is to be submitted in original duly signed by bidder. Reproduction of the same in any sort is not acceptable.

Signature of the authorized representative of

Place : ……..

Date : ……..

Bidder's Name : ……

Designation : ……

Company Seal : ……

PROJECT	**OPTCL NEW DUBURI, ODISHA (400 kV AIS-EXT)**
ITEM	**400/132kV ISOLATOR**
SUBJECT	**BID SPECIFIC ATC**

ANNEXURE-VIII

RISK PURCHASE

1.1 In case the Supplier/ Contractor fails to supply or fails to comply with terms & conditions of the Purchase Order/ Contract or delivers equipment/ material not of the contracted quality or fails to adhere to the contract specifications or fails to perform as per the activity schedule and there are sufficient reasons even before expiry of the delivery/ completion period to justify that supplies shall be inordinately delayed beyond contractual delivery/ completion period, BHEL reserve the right to cancel the Purchase Order/ Contract either in whole or in part thereof without compensation to Supplier/ Contractor and if BHEL so desires, may procure such equipment/ material/ items not delivered or others of similar description where equipment/ material/ items exactly complying with particulars are not readily procurable in the opinion of BHEL which is final and in such manner as deemed appropriate, at the risk and cost of the Supplier/ Contractor and the Supplier/ Contractor shall be liable to BHEL for any excess cost to BHEL. However, the Supplier/ Contractor shall continue execution of the Purchase Order/ Contract to the extent not cancelled under the provisions of this clause.

1.2 Risk & Cost Clause, in line with Conditions of Contract may be invoked in any of the following cases:

a) Contractor/ supplier's poor progress of the work vis-à-vis execution timeline as stipulated in the Contract, backlog attributable to contractor/ supplier including unexecuted portion of work/ supply does not appear to be executable within balance available period considering its performance of execution.
b) Withdrawal from or abandonment of the work by contractor/ supplier before completion as per contract.
c) Non-completion of work/ Non-supply by the Contractor/ supplier within scheduled completion/delivery period as per Contract or as extended from time to time, for the reasons attributable to the contractor/ supplier.
d) Termination of Contract on account of any other reason(s) attributable to Contractor/ Supplier.
e) Assignment, transfer, subletting of Contract without BHEL's written permission resulting in termination of Contract or part thereof by BHEL.
f) Non-compliance to any contractual condition or any other default attributable to Contractor/ Supplier.

1.3 Risk and Cost amount against Balance Work:

In case Risk & Cost is invoked, the amount of Risk & Cost against balance work shall be calculated as under:

Risk & Cost Amount = [(A-B) + (A x H/100)]

where,
A = Value of Balance scope of Work/ Supply (*) as per rates of new contract
B = Value of Balance scope of Works/ Supply (*) as per rates of old contract being paid to the contractor/ supplier at the time of termination of contract i.e. inclusive of PVC & ORC, if any.
H = Overhead Factor to be taken as 5 (five)

In case (A-B) is less than 0 (zero), value of (A-B) shall be taken as 0 (zero).

***(Balance scope of work/ supply)**

Difference of Contract Quantities and Executed Quantities as on the date of issue of Letter for 'Termination of Contract', shall be taken as balance scope of Work/ Supply for calculating risk & cost amount.

Contract quantities are the quantities as per original contract. If Contract has been amended, quantities as per amended Contract shall be considered as Contract Quantities.

Items for which total quantities to be executed have exceeded the Contract Quantities based on drawings issued to contractor from time to time till issue of Termination letter, then for these items total Quantities as per issued drawings would be deemed to be contract quantities.

Substitute/ extra items whose rates have already been approved would form part of contract quantities for this purpose. Substitute/ extra items which have been executed but rates have not been approved, would also form part of contract quantities for this purpose and rates of such items shall be determined in line with contractual provisions.

However, increase in quantities on account of additional scope in new tender shall not be considered for this purpose.

Note: Incase portion of work is being withdrawn, contract quantities pertaining to portion of work withdrawn shall be considered as 'Balance scope of work/ supply' for calculating Risk & Cost amount.

1.4 LD against delay in executed Work/ Supply in case of Termination of Contract:

LD against delay in executed Work/ Supply shall be calculated in line with LD clause of the contract for the delay attributable to contractor/ supplier. For this purpose, contract value shall be taken as Executed Value of work/supply for the purpose of limiting maximum LD value.

Method for calculation of "LD against delay in executed Work/ supply" is given below:

a) Let the time period from scheduled date of start of work till termination of contract excluding the period of Hold (if any) not attributable to contractor/ supplier = T1
b) Let the value of executed work/ supply till the time of termination of contract = X
c) Let the Total Executable Value of work/ supply for which inputs/ fronts were made available to contractor/ supplier and were planned for execution till termination of contract = Y
d) Delay in executed work/ supply attributable to contractor/ supplier i.e. T2 = [1-(X/Y)] x T1
e) LD shall be calculated in line with LD clause of the Contract for the delay attributable to contractor/ supplier taking "X" as Contract Value and "T2" as delay attributable to contractor/ supplier.

Note: In case portion of service/ supply is withdrawn, no LD shall be applicable for portion of service/ supply withdrawn.

1.5 Recovery from Supplier:

Recoveries from contractor/ supplier on whom risk & cost has been invoked shall be as per Clause No. 25 of Bid Specific ATC.

PROJECT	**OPTCL NEW DUBURI, ODISHA (400 kV AIS-EXT)**
ITEM	**400/132kV ISOLATOR**
SUBJECT	**BID SPECIFIC ATC**

ANNEXURE-IX

CHECKLIST FOR SUPPLY BILLS

Name of Project	
Package Description	
Invoice No. & Date	
PO No. & Date	

Sl. No.	Documents Required	Copies	Check Points	Page No.	Vendor Remarks (Y/ N/ NA)	Verification by MM (Y/ N/ NA)	Verification by Finance (Y/ N/ NA)
1	Original for Buyer Invoice - GST compliant invoice	1 Original + 2 Copy	1. Please ensure GST complaint invoice in original				
			2. Consignee address: BHEL C/o followed by site address				
			3. Item description and unit of quantity are matched with PO				
			4. Buyer address and GSTN No. as required (TBG Noida or Nodal agency)				
			5. PO No. and Date, LR No. and Date, Vehicle No. and Project Name are mentioned				
			6. Invoiced quantity are not more than the PO quantity and MICC quantity				
			7. Ex-works unit rate, Taxes and F&I rates are same as per PO				
			8. Signed and stamped by vendor				
2	Receipted LR (signed & stamped)/ confirmation from site regarding receipt of packages/ boxes	1 Original + 2 Copy	2. Consignee address: BHEL C/o followed by site address				
			2. In case of material purchased from sub vendor, Consignee address Vendor's name C/o BHEL C/o site address				
			3. Vendor's Invoice No. and Vehicle No. are mentioned				
			4. No. of boxes/ No. of packages are same as per Packing List				
			5. In case of and adverse remark on LR (Like shortages/ damages/ broken, etc.), clarification from site/ MM/ Commercial is needed				
			6. LR is readable				
			7. In case of photocopy, LR is verified by MM				
			8. LR Date is after the Date of MICC/ (MDCC if issued) or same Date				
3	Packing list - showing number of packages, and gross weight/ net weight (if applicable)	1 Original + 2 Copy	1. PO No. and Date, LR No. and Date, Invoice No. and Date, Site Name and Address, Consignor and Consignee Address are mentioned				

PROJECT	**OPTCL NEW DUBURI, ODISHA (400 kV AIS-EXT)**
ITEM	**400/132kV ISOLATOR**
SUBJECT	**BID SPECIFIC ATC**

			2. Item description and quantity are matched with Invoice and PO				
			3. Signed and stamped by vendor				
			4. No. of packages/ Item descriptions are matched with MRC and LR				
4	MICC from BHEL	1 Original + 2 Copy	1. BHEL MICC has been issued prior to the Date of dispatch or on same Date				
			2. In case where MICC Date is after the Date of dispatch then MDCC Date is same or prior to the Date of dispatch				
			3. Project Name, PO, PO Date, Vendor's Name and Address is correct				
			4. Item description, Quantity and unit of quantity are same as per PO and Invoice				
			5. All hold point in MICC, if any, have been resolved before submission of bill				
			6. Signed and stamped by BHEL Executive				
			7. MICC and MDCC quantity are not less than Invoice quantity and cover all invoiced items				
5	Guarantee Certificate	1 Original + 2 Copy	1. Project Name, PO No., Invoice No., LR No. and Date are mentioned				
			2. Guarantee Certificate is strictly matched with PO T&C				
			3. Signed and stamped by vendor				
6	Bank Guarantee	1 Copy	1. Ensure submission of BG directly from Bank before supply of material so that BG confirmation may be arranged before processing the bill				
			2. Bill can be processed only after receipt of BG confirmation directly from bank				
			3. It should be in the name of BHEL, TBG Noida with registered office address Siri Fort, New Delhi				
			4. It should be in prescribed format				
			5. BG value and validity plus claim period should be minimum as specified in PO/ RC. Please check before supply. If BG extension is required please arrange the same				
			6. Vendor's name address should be same as per PO				
			7. PO No./ RC No. and Date should be correct				

PROJECT	**OPTCL NEW DUBURI, ODISHA (400 kV AIS-EXT)**
ITEM	**400/132kV ISOLATOR**
SUBJECT	**BID SPECIFIC ATC**

7	Insurance Certificate	1 Original + 2 Copy	1. Invoice No. and Date, Vendor's Name, Place from Consignor to Consignee are mentioned				
			2. It has not been issued later than the LR Date				
			3. Insured value is not less than the Invoice value				
			4. Signed and stamped by Insurance Company				
			5. In case of Open Insurance Policy, declaration has been submitted to Insurance Company as per declaration clause of Open policy and copy of open policy is also enclosed				
			6. In case of any discrepancy, consent of Commercial is required for processing the bill and amount will be deducted for invalid Insurance certificate				
8	PVC (if applicable) Invoice is submitted along with the Dispatch Invoice	1 Original + 2 Copy	PVC (If applicable) Invoice is submitted along with the Dispatch Invoice				
			1. PVC Invoice is attached along with Supply Invoice				
			2. Calculation sheet and applicable PVC indices are also enclosed				
			3. If delay in delivery, then PVC indices are as per PO conditions				
9	Material Receipt Certificate		1. LR No. and Date, Invoice No. and Date, Vehicle No. and Date, Site Name an address are mentioned				
			2. Date of receipt of material				
			3. Item description and quantity are same as per Invoice/ Packing List				
			4. It is signed and stamped by Site Executive				
			5. In case of any shortages/ damages/ adverse remark, clarification is needed				
10	Other Documents		To be seen as per specific requirement of PO				
To be filled by BHEL-MM only							
11	Date of Submission of Last Billing Document		Date to be mentioned		**Not to be filled by Vendor**		
12	LD Calculation, if applicable, as per PO		Calculation Sheet of LD due to delay in delivery is attached				
13	Receipted LR (signed & stamped)/ confirmation from site regarding receipt of packages/ Boxes	1 Copy	Damages, if any mentioned in the Receipted LR have been accounted for. Withheld amount, if any_____				

PROJECT	**OPTCL NEW DUBURI, ODISHA (400 kV AIS-EXT)**
ITEM	**400/132kV ISOLATOR**
SUBJECT	**BID SPECIFIC ATC**

14	Packing List - showing number of packages and gross weight & net weight (if applicable)	1 Original	If Packing List does not match with Purchase order (with reference to Sl. No. 4 above), Engineering/ MM acceptance as to the completeness is enclosed				
15	PO copy	1 Copy	PO copy with original seal and signature is attached along with amendment, if any				
16	DAN	1 Copy	Relevant DANs are attached duly signed by MM representative				
***Note:**	**Every field to be ticked. If some document is not applicable, same should be mentioned. All Pages to be numbered upward from the bottom page**						
	Invoice Control No.				Vendor Signature	MM Signature	Finance Signature
					Date:	Date:	Date:

PROJECT	OPTCL NEW DUBURI, ODISHA (400 kV AIS-EXT)
ITEM	400/132kV ISOLATOR
SUBJECT	BID SPECIFIC ATC

ANNEXURE-X

38.0 INSPECTION COST: (REF CL NO. 18 OF ITB--Section-II of Vol-I):

38.1 Expenses in respect of OPTCL's representative for witnessing the inspection & testing of the offered equipment/materials at the inspection and testing site.

- The testing and inspection of the equipment/ materials at manufacturer works are in the scope of work of the Contractor/Supplier. Travel Expenses of OPTCL Representative & Third Party Inspecting Agency (TPIA) shall be borne by the Contractor. However the Inspection Fees payable to TPIA will be borne by OPTCL.
- OPTCL inspecting officer and Third Party Inspecting Agency (TPIA), on receipt of offer for inspection from the contractor/supplier, shall proceed to the manufacturer works to witness the Type/Acceptance/Routine test.

38.2 The travel expenses under the following heads, in respect of OPTCL's representative and TPIA for witnessing the inspection & testing of the offered equipment/materials at the inspection and testing site, shall be borne by the contractor.

a) Hotel Accommodation:

I. Single room accommodation in 4 star hotel for OPTCL/TPIA inspecting officer, not below the rank of Assistant General Manager (Grade E-6),

II. Single room accommodation in 3 star hotel for OPTCL/TPIA inspecting officer of the rank below Assistant General Manager (Grade E-6).

N.B.: It is the responsibility of the contractor to arrange the hotel accommodation matching with their inspection and testing schedule. In case of extended duration of inspection or non-availability of the return ticket, Contractor shall arrange for the extended stay of the inspecting officer in the Hotel accordingly. In case, there is no hotel with prescribed standard in and around the place of inspection, the contractor shall suggest alternative suitable arrangement at the time of offer for inspection, which is subjected to acceptability of OPTCL inspecting officer.

b) Journey of the Inspecting Officer:

(i) To and fro travel expenditure from the Head Quarters of the inspecting officer to the place of inspection/testing shall be borne by the contractor as per the following.

- Journey from the Head Quarters to the nearest Airport by train (Ist/IInd A/C) or Taxi (A/C).
- Journey from destination Airport to the place of inspection/testing by train (Ist/IInd A/C) or Taxi (A/C).
- For train journey, inspecting officer, not below the rank of Assistant General Manager shall be provided with 1st class AC ticket and inspecting officer below the rank of Assistant General Manager shall be provided with 2nd class AC ticket.

(ii) Booking/cancellation of Air-ticket / Train-ticket is the responsibility of the contractor.

(iii) Moreover, if during the journey there is an unavoidable necessity for intermediate travel by road/ waterway/sea-route, the contractor/supplier shall provide suitable conveyance to the inspecting officer for travel this stretch of journey or bear the cost towards this. Any such possibilities shall be duly *intimated to OPTCL at the time of their offer for inspection.*

c) Local Conveyance:

Local journey for the inspecting officer between Hotel and the place of the inspection/testing site, Air-conditioned four wheeler vehicles in good condition shall be provided by the contractor.

PROJECT	**OPTCL NEW DUBURI, ODISHA (400 kV AIS-EXT)**
ITEM	**400/132kV ISOLATOR**
SUBJECT	**BID SPECIFIC ATC**

ANNEXURE-XI

CLAUSE REGARDING RESTRICTIONS UNDER RULE 144 (XI) OF THE GENERAL FINANCIAL RULES (GFRS), 2017 AS PER GOVERNMENT OF INDIA ORDER OM NO.6/18/2019-PPD DTD. 23.07.2020

I. Any bidder from a country which shares a land border with India will be eligible to bid in this tender only if the bidder is registered with the Competent Authority.

II. "Bidder" (including the term 'tenderer', 'consultant' or 'service provider' in certain contexts) means any person or firm or company including any member of a consortium or joint venture (that is an association of several persons, or firms or companies), every artificial juridical person not failing in any of the descriptions of bidders stated hereinbefore, including any agency branch or office controlled by such person, participating in a procurement process.

III. "Bidder from a country which shares a land border with India" for the purpose of this Order means:

a) An entity Incorporated, established or registered in such a country; or
b) A subsidiary of an entity Incorporated, established or registered in such a country; or
c) An entity substantially controlled through entitles incorporated, established or registered in such a country; or
d) An entity whose beneficial owner is situated in such a country, or
e) An Indian (or other) agent of such an entity; or
f) A natural person who is a citizen of such a country; or
g) A consortium or joint venture where any member of the consortium or joint venture falls under any of the above

IV. The beneficial owner for the purpose of (iii) above will be as under:

1. In case of a company or Limited Liability Partnership, the beneficial owner is the natural person(s), who, whether acting alone or together, or through one or more juridical person, has a controlling ownership interest or who exercises control through other means.

   Explanation:
   a) "Controlling ownership interest" means ownership of or entitlement to more than twenty-five per cent. of shares or capital or profits of the company;
   b) "Control" shall include the right to appoint majority of the directors or to control the management or policy decisions including by virtue of their shareholding or management rights or shareholder's agreements or voting agreements;

2. In case of a partnership firm, the beneficial owner is the natural person(s) who, whether acting alone or together, or through one or more juridical person, has ownership of entitlement to more than fifteen percent of capital or profits of the partnership;

3. In case of an unincorporated association or body of individuals, the beneficial owner is the natural person(s), who, whether acting alone or together, or through one or more juridical person, has ownership of or entitlement to more than fifteen percent of the property or capital or profits of such association or body of Individuals;

4. Where no natural person is Identified under (1) or (2) or (3) above the beneficial owner is the relevant natural person who holds the position of senior managing official;

5. In case of a trust, the identification of beneficial owner(s) shall include identification of the author of the trust, the trustee, the beneficiaries with fifteen percent or more interest in the trust and any other natural person exercising ultimate effective control over the trust through a chain of control or ownership.

V. An Agent is a person employed to do any act for another or to represent another in dealings with third person.

VI. The successful bidder shall not be allowed to sub-contract works to any contractor from a country which shares a land border with India unless such contractor is registered with the Competent Authority.

- The above clause is not applicable to the bidders from those countries (even if sharing a land border with India) to which the GoI has extended lines of credit or in which the GoI is engaged in development projects.
- List of countries to which lines of credit have been extended or in which development projects are undertaken are available on the Ministry of External affairs website (https://www.mea.gov.in/).

PROJECT	**OPTCL NEW DUBURI, ODISHA (400 kV AIS-EXT)**
ITEM	**400/132kV ISOLATOR**
SUBJECT	**BID SPECIFIC ATC**

ANNEXURE-XII

VENDOR COMPLIANCE FORMAT IN BIDDER LETTER HEAD

COMPLIANCE TO GOVERNMENT OF INDIA ORDER OM NO.6/18/2019-PPD DATED 23.07.2020 REGARDING RESTRICTIONS UNDER RULE 144 (XI) OF THE GENERAL FINANCIAL RULES (GFRS), 2017

Sl. No.	Description	Bidder's confirmation
1.	*We, M/s …… have read the clause regarding restrictions on procurement from a bidder of a country which shares a land border with India; We hereby certify that we are not from such a country.*	Agreed

Note: Non-compliance of above said GoI Order and its subsequent amendment, (if any), by any bidder(s) shall lead for commercial rejection of their bids by BHEL.

Signature of the authorized representative of

Place : ……..

Date : ……..

Bidder's Name : ……

Designation : ……

Company Seal : ……

PROJECT	**OPTCL NEW DUBURI, ODISHA (400 kV AIS-EXT)**
ITEM	**400/132kV ISOLATOR**
SUBJECT	**BID SPECIFIC ATC**

ANNEXURE-XIII

VENDOR COMPLIANCE FORMAT IN BIDDER LETTER HEAD

COMPLIANCE TO GOVERNMENT OF INDIA ORDER OM NO.6/18/2019-PPD DATED 23.07.2020 REGARDING RESTRICTIONS UNDER RULE 144 (XI) OF THE GENERAL FINANCIAL RULES (GFRS), 2017

Sl. No.	Description	Bidder's confirmation
1.	*We, M/s …… have read the clause regarding restrictions on procurement from a bidder of a country which shares a land border with India. We are from such a country which shares a land border with India & have been registered with the Competent Authority as specified in above said order. We hereby certify that we fulfil all requirements in this regard and are eligible to be considered.* ***Evidence of valid registration by the Competent Authority is attached.***	Agreed

Note: Non-compliance of above said GoI Order and its subsequent amendment, (if any), by any bidder(s) shall lead for commercial rejection of their bids by BHEL.

Signature of the authorized representative of

Place : ……..
Date : ……..

Bidder's Name : ……
Designation : ……
Company Seal : ……

PROJECT	**OPTCL NEW DUBURI, ODISHA (400 kV AIS-EXT)**
ITEM	**400/132kV ISOLATOR**
SUBJECT	**BID SPECIFIC ATC**

ANNEXURE-XIV

No.25-111612018-PG
Government of India
Ministry of Power
Shram Shakti Bhawan, Rafi Marg, New Delhi • — 110001
Tele Fax: 011-23730264

Dated 02/07/2020

ORDER

Power Supply System is a sensitive and critical infrastructure that supports not only our national defence, vital emergency services including health, disaster response, critical national infrastructure including classified data & communication services, defence installations and manufacturing establishments, logistics services but also the entire economy and the day-today life of the citizens of the country. Any danger or threat to Power Supply System can have catastrophic effects and has the potential to cripple the entire country. Therefore, the Power Sector is a strategic and critical sector.

The vulnerabilities in the Power Supply System & Network mainly arise out of the possibilities of cyber attacks through malware / Trojans etc. embedded in imported equipment. Hence, to protect the security, integrity and reliability of the strategically important and critical Power Supply System & Network in the country, the following directions are hereby issued:-

1. All equipment, components, and parts imported for use in the Power Supply System and Network shall be tested in the country to check for any kind of embedded malware/trojans/cyber threat and for adherence to Indian Standards.
2. All such testings shall be done in certified laboratories that will be designated by the Ministry of Power (MOP).
3. Any import of equipment/components/parts from "prior reference" countries as specified or by persons owned by, controlled by, or subject to the jurisdiction or the directions of these "prior reference" countries will require prior permission of the Government of India
4. Where the equipment/components/parts are imported from "prior reference" countries, with special permission, the protocol for testing in certified and designated laboratories shall be approved by the Ministry of Power (MOP).

This order shall apply to any item imported for end use or to be used as a component, or as a part in manufacturing, assembling of any equipment or to be used in power supply system or any activity directly or indirectly related to power supply system.

This issues with the approval of Hon'ble Minister of State for Power and New & Renewable Energy (Independent Charge).

(Goutam Ghosh)
Director Tel: 011-23716674 To:

1. All Ministries/Departments of Government of India (As per list)
2. Secretary (Coordination),Cabinet Secretariat
3. Vice Chairman, NITI Aayog

PROJECT	**OPTCL NEW DUBURI, ODISHA (400 kV AIS-EXT)**
ITEM	**400/132kV ISOLATOR**
SUBJECT	**BID SPECIFIC ATC**

ANNEXURE-XV

VENDOR COMPLIANCE FORMAT IN BIDDER LETTER HEAD

In view of order No. 25-111612018-PG, Dated 02.07.2020 of Ministry of Power, GOI

GEM BID NO.	
PROJECT	**OPTCL NEW DUBURI, ODISHA (400 kV AIS-EXT)**
ITEM	**400/132kV ISOLATOR**

This is to certify that all equipment, components, and parts imported for use in the Power Supply System and Network are in strict compliance to directions issued by Ministry of Power, Govt. of India vide order No. 25-111612018-PG Dtd. 02.07.2020. The imported component(s), part or assembly item(s) does not carry any malware/ Trojan, etc.

Note: Non-compliance of MoP Order and its subsequent amendment(s), (if any), by vendor shall lead to rejection of their offer or cancellation of contract, which is awarded by BHEL.

Signature of the authorized representative of

Place : ……..
Date : ……..

Bidder's Name : ……
Designation : ……
Company Seal : ……

Project: 400kV AIS Subsation Extension at New Duburi
Customer: Odisha Power Transmission Corporation Limited (OPTCL)
Name of Item: 400 &132kV Isolator, along with its accessories and services
Ref. No. OPTCL/Isolator/PQR REV 00

TECHNICAL QUALIFICATION REQUIREMENT
The bidder must have, manufactured, tested and supplied 132kV or higher voltage class Isolator(s), which are in satisfactory operation for at least two (2) years as on the original scheduled date of tecno-commercial bid opening date of this tender.

Requisite documents for ROUTE

SUPPORTING DOCUMENTS TO BE SUBMITTED BY BIDDER ALONG WITH TECHNICAL BID		
Sr	Required Criteria	Supporting Documents
1	Manufacturing	Approved Drawings/ GTP /Approved Quality Plan/ Factory Inspection Test Report etc. establishing bidder as manufacturer of offered item in line with TQR.
2	Supply	PO/ Dispatch clearance/ LR/ Material Receipt certificate at site/ installation or commissioning certificate etc. establishing bidder as proven supplier of offered item in line with TQR
3	Type Test	TTR approval from customer / Type Test Report etc. establishing successful type tested design in line with TQR
4	satisfactory operation	Successful operation means certificate issued by employer/end-customer or main contractor (along with chain of document from employer/end-customer) stating successful operation without any adverse remark.

9/5/23
PREPARED BY

09/05/23
REVIEWED BY

9.5.23
APPROVED BY

BHARAT HEAVY ELECTRICALS LIMITED

TRANSMISSION BUSINESS ENGINEERING MANAGEMENT

NOIDA

DOCUMENT NO.	TB-420B-316-005	REV 00	Prepared	Checked	Approved
TYPE OF DOC.	TECHNICAL SPECFICATION	NAME	BY	DKS	VK
Title: 400kV & 132kV Isolator with/without earth Switch *(Suitable for coastal areas)*		SIGN			
		DATE	09.05.2023	09.05.2023	09.05.2023
		GROUP	TBEM		
		WO No.			

CUSTOMER	ODISHA POWER TRANSMISSION CORPORATION LIMITED
PROJECT	400/220 kV GIS SUB STATION AT ERSAMA, PARADEEP, ODISHA

Contents

Remarks: Bidder to note that data and details of Annexure-D (Guaranteed Technical Particulars) shall not be reviewed during technical evaluation/ scrutiny, hence compliance of guaranteed technical particulars in line with technical specification shall be bidder's responsibility.

Rev. No.	Date	Altered	Checked	Approved	
Distribution				To	
				Copies	

CHECKLIST FOR TECHNICAL EVALUATION

Along with the technical offer/ bids, the bidder should submit this checklist confirming the inclusion of the enclosures as listed below,

Sl. No.	Documents to be enclosed	Bidder to confirm (Please tick "Confirmed")
1.	Supporting documents for compliance of Technical Qualifying Requirement.	Confirmed
2.	Unpriced BOQ duly mentioning "Quoted" for all the items, signed and sealed.	Confirmed
3.	Annexure- A duly signed and sealed & Annexure- B duly filled, signed and sealed.	Confirmed

Note: Any bidder not meeting the above requirement shall be liable for non-evaluation. The above checklist is reviewed and verified for,

NIT Reference No.:

Name of Bidder:

Name of Project: **400kV AIS Subsation Extension at New Duburi**

Date: Bidder's Stamp & Signature

Contents

SECTION 1:
SCOPE, PROJECT SPECIFIC TECHNICAL REQUIREMENTS & BILL OF QUANTITIES

1. Scope

This technical specification covers the requirements of design, manufacture, inspection including third party inspection and testing at manufacturer's work before supply, proper packing and delivery to project site and supervision of installation and commissioning of equipment **(400kV & 132kV Isolator with/without earth Switch)** complete with all fittings, accessories and associated auxiliary equipment, mandatory spares of the equipment complete in all respects for efficient & trouble-free working mentioned under this specification.

This section covers the specific technical requirements of equipment. This constitutes minimum technical parameters for the above item as specified by the BHEL/ OPTCL. The offered equipment Insulated Switchgear shall also comply with the Section-3 (Project Details and General technical requirements for all equipment under the Project) of this specification.

The specification comprises of following sections:

Section-1	:	Scope, Project Specific Technical Requirements & Bill of Quantities
Section-2	:	Equipment Specification under scope of Supplies/ Service
Section-3	:	Project Details & General Technical Requirements (For All Equipment under the Project)
Section-4	:	Annexures Annexure-A: Compliance Certificate to Technical Specification Annexure-B: Deviation/ Change Request to Technical Specification Annexure C: Technical Checklist Annexure-D: Guaranteed Technical Particulars

The following order of priority shall be followed. In case of conflict between requirements specified in various documents, the more stringent one shall be followed. BHEL/ OPTCL concurrence shall, however, be obtained before taking a final decision in such matters.

1. Statutory Regulations
   In particular, the latest version of the following statutory regulations, as applicable, shall be followed for system,
   - o Indian Electricity Act
   - o CEA regulations
   - o The Factory Act
   - o Requirements of other statutory bodies as applicable, e.g. CEA etc.
2. Section-1
3. Section-2
4. Section-3
5. Codes & Standards

Bidder shall furnish list of conflicts/ ambiguities/ deviations, if any, along with their technical offer and also furnish the basis that is considered for submitting technical offer. BHEL/ OPTCL will resolve listed conflicts prior to award. In case of ambiguity, bidder shall inform BHEL/ OPTCL of their interpretation. In case bidder fails to convey the same prior to award, BHEL/ OPTCL decision

on interpretation shall be considered final if need arises during the execution. No additional cost or extra time on account of conflicts/ ambiguities/ deviations shall be admissible.

In general, no deviation from the requirements specified in various clauses of this specification shall be allowed and hence, a certificate to this effect shall have to be furnished along with the offer (Annexure-A), however bidder shall furnish list of conflicts/ ambiguities/ deviations (Annexure-B), if any. Any conflicts/ ambiguities/ deviations mentioned elsewhere in technical offer shall not be reviewed.

The equipment is required for the following project:

Name of the Customer	:	**Odisha Power Transmission Corporation Limited**
Name of Main Contractor	:	**Bharat Heavy Electricals Limited**
Name of the Project	:	**400kV AIS Substation Extension at New Duburi, Odisha**

The scope of supplies shall be as per commercial terms and conditions enclosed separately with the notice inviting tender/ enquiry.

2. Codes & Standards

1. The rating as well as performance and testing of the equipment shall comply with the latest editions and amendments of the following standards as applicable, unless otherwise specified elsewhere in this specification,
   IEC 62271-102 Alternating current isolators (dis-connectors) and earthing switches
   IS:9921 Alternating current isolators (dis-connectors) and earthing switches
   IS:2544 Insulators
   IS:2147 Degree of protection provided by enclosure
   IS:4691 Degree of protection provided by enclosure
   IS:325 Three phase induction motors
   IS:4722 Rotating electrical machines
   IS:262 Recommended practice for hot dip galvanizing of iron & steel
   IS:4759 Hot dip galvanization coating on structural steel
   IS:2633 Method of testing weight, thickness and uniformity
   IS:1573 Electroplated coating of zinc on iron and steel
   IS:6735 Spring washers
   IS:2016 Plain washers.
2. For the purpose of this specification all technical terms used hereinafter shall have the meaning as per IEC/ ISS specification.
3. The equipment meeting with the requirements of other authoritative standards, which ensure equal or better quality than the standards mentioned above shall also be acceptable. Where the equipment offered by the bidder confirms to other standards, salient points of difference between the standards adopted and the specified standards shall be clearly brought out in the offer.
4. In case of imported equipment, standards of the country of origin shall be applicable, if these standards are equivalent or stringent than the applicable Indian standards.
5. The equipment shall also conform to the provisions of Indian Electricity Rules, 1956 and other statutory regulations currently in force in the country.

6. In case Indian standards are not available for any equipment, standards issued by IEC/ BS/ VDE/ IEEE/ NEMA or equivalent agency shall be applicable.

3. Specific Technical Requirements

1. The equipment shall perform satisfactorily under various other electrical, electromechanical and meteorological conditions of the site of installation.
2. The equipment shall be able to withstand all external and internal mechanical, thermal and electromechanical forces due to various factors like wind load, temperature variation, ice & snow, (wherever applicable) short circuit etc. for the equipment.
3. The equipment shall also comply with the following,
   a. To facilitate erection of equipment, all items to be assembled at site shall be "match marked".
   b. All piping, if any between equipment control cabinet/ operating mechanisms to marshalling box of the equipment, shall bear proper identification to facilitate the connection at site.
4. In addition to this, the other specific technical requirements for the equipment shall be as follows,

Sl. No.	Technical Parameters	400kV	132kV	
1	Equipment	400kV Isolator with Earth Switch- Outdoor, off-load type, horizontal double break	132kV Isolator without Earth Switch- Outdoor, off-load type, horizontal double break	
2	Service	Outdoor		
3	Applicable standard	IS 9921/ IEC 62271-102		
4	No. of phases	3 phase		
5	Design ambient temperature	50°C		
6	Type of operation	Electrically ganged	Mechanically ganged	
7	Rated voltage (in KV)			
	a) Nominal	400	132	
	b) Maximum	420	145	
8	Rated current (A)	3150	1600	
9	Short time current (kA)	63	40	
10	Rated Frequency	50 Hz±3%		
11	System earthing	Effectively earthed		
12	Temperature rise	As per relevant IS/ IEC standards		

13	Lightening impulse withstand voltage (kVp)			
	a) Across Isolating distance	1425(+240)	750	
	b) To earth	1425	650	
14	One minute power frequency withstand voltage (in kV)			
	a) Across Isolating distance	610	315	
	b) To earth	520	275	
15	Switching Impulse withstand voltage (In kVp)			
	a) Across Isolating distance	900(+345)	--	
	b) To earth	1050	--	
16	Maximum RIV for frequency between 0.5MHz to 2MHz (micro-volt)	1000 at 267kV	500 at 92kV	
17	Corona Extinction Voltage (in kV)	320	--	
18	Operating mechanism			
	a) Isolator	Motor	Motor	
	b) Earth-switch	Motor	Motor	
19	Auxiliary voltage			
	a) Control & interlock voltage	220V, 80% to 110%		
	b) Motor (AC motor/ PMDC) voltage	3 Phase, 415V, 50Hz/ 1 Phase, 240V, 50Hz		
	c) Heater, Lamp & Socket	1 Phase, 240V, 50Hz		
20	Safe duration of overload			
	a) 150% of rated current	5 minute		
	b) 120% of rated current	30 minute		
21	Mounting structure	Tubular	Tubular/ Lattice	
22	Operating time	Less than 12 sec		
23	Height details			
	a) Height of center line of terminal pad above ground level/ Centre-line of bus bar for equipment connection from the base of support structure (plinth level) (mm)	8000	4600	

	b) Plinth height from ground level (mm)	375	375	
24	Phase spacing (mm)	7000	3000	
25	Minimum clearance			
	a) Phase to phase	4000	1300	
	b) Phase to earth	3500	1300	
	c) Sectional clearance	6500	4000	
26	Mounting arrangement	On structure		
27	Number of auxiliary switches for main isolator	12NO+12NC	12NO+12NC	
28	Number of Make before break and break after break auxiliary switches	4NO+4NC	4NO+4NC	
29	Temperature rise above ambient temperature of 40 deg C corresponding to maximum continuous current (°C) silver faced copper, copper alloy or aluminum alloy	Maximum temperature: 105°C Temperature Rise: 65°C As per IS: 9921		
30	All contacts	Silver faced copper or electrolytic copper alloy		
31	Rated magnetizing/ capacitive current make and break	0.7 A at 0.15PF		
32	Number of terminals in control cabinet	(1) All contacts and control circuits are to be wired up to control cabinet including potential free auxiliary contacts of Isolator/ Earth Switch. (2) Additional 24 nos. evenly distributed spare TBs in Master to be provided for inter pole cabling of auxiliary contacts (employer's use).		
33	System x earthing	Solidly Earthed		
34	Rating of auxiliary contacts			
	a) Thermal rating of auxiliary contracts	10A at 220Vdc		
	b) Breaking capacity of auxiliary contacts	2A at 220Vdc with circuit time constant of not less than 20ms		
35	TB size and type	TBs shall be stud type		

		Power Cable-Each TBs Should be Suitable for terminating two wires of 16sqmm size on each side		
		Control cable- Each TBs Should be Suitable for terminating two wires of 2.5sqmm size on each side		
36	Local/ Remote switch indication of Isolator for remote status	Yes		
37	Electrical interlock with circuit breaker	Required		
D	**Insulator Data**			
1	Type of Insulator	Porcelain type as per IEC: 60168 & IS: 2544	Porcelain type as per IEC: 60168 & IS: 2544	
2	a) Cantilever strength of insulator (Kgf)	800	800	
	b) Height of insulator (mm)	3650	1500	
	c) Bottom PCD (mm)	300	184	
	d) No. of holes & hole dia	8X18	4X18	
	e) Top PCD	127	127	
	f) No. of holes & hole dia	4XM16	4XM16	
21	g) Minimum creepage distance of Insulator (mm)	10500	3625	

4. General Technical Requirements

The general technical requirements for the equipment shall be as follows,

1. Terminal Blocks (for AC power cable) shall be suitable for cable size upto 16sqmm Aluminum.
2. Bidder shall provide adequate power distribution circuit & terminal block in Isolator/ earth switch marshalling box. Bidder shall provide Power circuit diagram for all isolator/ earth switch during detailed engineering stage. Duplicated wiring on TB shall not be allowed.
3. Cable gland plate in Isolator/ earth switch marshalling box shall be suitable for cable entry of all power (4 no. x 4CX16sqmm, as applicable) / control cables.
4. Flexible Cu braided earthing for Isolator/ earth switch marshalling box (2 number/ box), size equivalent to 75X10 mm GS flat. Bidder to provide minimum cross section of 270Sq mm flexible copper braid on each side of marshaling box. Hole to hole distance for flexible copper braid shall be minimum 200mm. Hardwires for installation of flexible Cu braid for fixing on marshalling box shall be under bidder's scope.
5. Earth switch shall have grounded connection with minimum 2 number's 155sqmm Cu flexible

braid.

6. LED light is to be provided with each marshalling box / drive unit of isolator & earth switch as per technical requirement (min. 7 watt).
7. The commencement of erection, testing and commissioning activities of Isolators shall be communicated to manufacturers from time to time as per front readiness at site.
8. Any special tools and tackle, which are specifically required for the equipment and are proprietary in nature shall be included in offer. List of such special tools and tackle should be clearly listed along with the technical offer. Any special tool which is not listed in the list but required during the erection/ testing/ commissioning of equipment shall also be deemed in bidder's scope.
9. Supervision of erection, testing and commissioning of all supplied isolator with earth switch shall be carried out under the supervision of the Isolator manufacturer's representative. The commissioning report shall be prepared and signed by the manufacturer's representative. However, required BHEL shall extend all the support including manpower, general tools & plants required for erection work.
10. The bidder must fill up all the details required for offered item/s. Instead of indicating "refer drawing, or as per IS/IEC", the exact value/s must be filled in.

5. Bill of Quantities

1. Quantities for supply and services for the equipment shall be as per **Annexure- 400kV & 132kV Isolator with/without earth Switch**. However, any item not appearing herein but required for completeness of the work is deemed to be included in bidder's scope.
2. The quantities in BOQ may vary up to **±10%** in line with quantity variation clause. However, individual quantities may be deleted or vary up to any extent.

6. Drawings / Documents required for Technical Clearance for Manufacturing

The engineering drawings/ documents, shall be used for providing technical clearance for manufacturing of the equipment, which shall be used for delay analysis, if applicable, by TBMM.

1	400kV Isolators & earth switch- Drawings & Guaranteed Technical Particulars
2	400kV Isolators & earth switch- Type Test Reports
3	400kV Isolators & earth switch- Quality Assurance Plan & Inspection Test Schedule
1	132kV Isolators & earth switch- Drawings & Guaranteed Technical Particulars
2	132kV Isolators & earth switch- Type Test Reports
3	132kV Isolators & earth switch- Quality Assurance Plan & Inspection Test Schedule

Technical clearance for manufacturing shall be issued after approval of drawings in category-I (approval without any comments)/ category-II (approval with comments) from customer/ BHEL. In case drawing/ document are not duly stamped in category-1/ category-2 by customer, BHEL stamp in Category-1 & 2 shall be treated final to proceed further.

The successful bidder shall have to extend all possible supports like timely submission/ re-submission of drawings, visit to end customer to facilitate documents approval without any commercial implications to BHEL. Acceptance of bidder's documents shall be subject to end

customer/ OPTCL approval.

7. Type Testing

Bidder shall ensure that the equipment being procured shall be of proven design and should have valid type test certificates as per specified in IS/ IEC standards (amended up to date) at any NABL accredited laboratories.

The validity of type test reports shall be as per the latest CEA guidelines for the validity period of type test(s) conducted on major electrical equipment in Power Transmission system.

In case any of Type tests have not been conducted on the offered design or there has been a change in the design due to high altitude requirement/ any other technical issue after the type tests. The requisite tests shall be conducted by bidder on the offered design without any extra cost and delivery impact to BHEL/ Customer.

Bidder shall provide, but not limited to, following type tests reports,

a) Short time withstands & peak withstand current test for Isolator.
b) Power frequency (Dry & Wet), Lightening Impulse dry withstand.
c) Radio interference voltage (RIV) test
d) Mechanical endurance Test & Terminal load test
e) Degree of Protection test (IP-55)
f) Corona Test (For 400kV Only)
g) Temperature rise test
h) Blocked rotor test

8. Quality Plan

The successful bidder shall submit Quality Assurance Plan with in-process inspection methods, tests, records, etc. for BHEL/ OPTCL approval. Customer hold points will also be included in the plan, which shall be mutually agreed by the BHEL/ OPTCL. In case bidder has reference Quality Assurance Plan agreed with BHEL/ OPTCL same shall be submitted for specific project to BHEL/ OPTCL approval. There shall be no commercial implication to BHEL/ OPTCL on account of Quality Plan approval.

Superior quality control system shall be adopted to assure high product quality. Raw materials of the best commercial grade quality and high reliability shall be used in the manufacture of the equipment. All materials shall be procured, manufactured, inspected and tested by vendor/ sub-vendor as per approved quality plan. The supplier shall perform all tests necessary to ensure that the material and workmanship conform to the relevant standards and comply with the requirements of the specification. Charges for all tests for the equipment shall be deemed to be included in bidder's scope.

9. Inspection & Testing

1. Equipment shall be subject to inspection by BHEL/ OPTCL or authorized representative at bidder/ manufacturers' works. Hence, Bidder shall furnish all necessary information concerning the supply to BHEL/ OPTCL.
2. Routine and acceptance tests as listed in relevant standard and section-2, technical specifications shall be complied.

10. Makes of Equipment/ Components

3. The offered equipment shall be brand new with state of art technology and proven field track record. No prototype equipment shall be offered.
4. Bidder while ordering shall ensure the availability of spare parts and maintenance support services for the equipment at least for 10 years from the date of supply.
5. Bidder shall give a notice of at least one year to the BHEL/ OPTCL before phasing out the products/ spares to enable the owner for placement of order for spares and services.
6. The equipment offered by the bidder shall be complete in all respects. Any material and component not specifically stated in this specification but which are necessary for trouble free operation of the equipment and accessories specified in this specification shall be deemed to be included unless specifically excluded. All such equipment/ accessories shall be supplied without any extra cost. In addition to this, all similar components shall be interchangeable and shall be of same type and rating for easy maintenance and low spare inventory.
7. Specific reference in this specification and documents to any material by trade name, make or catalogue number shall be construed as establishing quality and performance requirements.

11. Packing and Dispatch

8. The equipment shall be properly packed for selected mode of transportation i.e. sea, rail and road in such a manner that it is protected against the climatic conditions and for any damage during transportation, transit and storage. The panels shall be wrapped in polyethylene sheets before being placed in wooden crates/ cases to prevent damage to the finish. Crates/ cases shall have skid bottoms for handling. Special notations such as 'Fragile', 'This side up', 'Weight', 'Owner's particulars\ 'PO nos.' etc., shall be clearly marked on the package together with other details as per purchase order.
9. The equipment may be stored outdoors for long periods before installation. The packing should also be suitable for outdoor storage areas with heavy rains/ high ambient temperature unless otherwise agreed and hence, Packing shall be suitable for long storage (minimum 1 year).

12. Exceptions

Followings are not in bidder's scope of supply (BHEL supplied items)

1. Post insulators
2. Terminal connectors
3. Equipment support structure
4. Inter-pole power and control cabling
5. Cable gland and lugs

However, equipment mounting hardware to be fixed on structure and post insulators shall be supplied by bidder.

13. Supervision of erection, testing & commissioning

The bidder shall quote lump sum price for supervision of installation and commissioning of all offered 400kV & 220kV isolators. Bidder's engineer shall bring all the special tools & tackles and testing instruments for the successful erection, testing and commissioning of 400kV & 220kV Isolator.

Any other instrument(s), if required for testing/ commissioning of 400kV & 220kV isolator shall be arranged by bidder without any price implication to BHEL, however general tools and tackles shall be arranged by BHEL/ its sub-contractor.

14. Terms Used

The terms used in this specification namely, "Employer/ Purchaser/ Owner" refers to OPTCL/ BHEL & "Contractor/ Sub-contractor/Manufacturer/ Bidder" refers to successful bidder.

Annexure- BOQ of 400kV &132kV Isolator with/without earth switch			
REV:00			
Sl. No.	**Description**	**Unit**	**Qty**
A	**SUPPLY**		
1	Supply- Isolator: 400kV, 3150A, 3x1 phase, 63kA for 3sec, horizontal double break (HDB) type isolator, three pole electrically ganged individual pole motor operated with one earth switch, three pole electrically ganged, individual pole motor operated along with operating mechanism and other accessories complete in all respect, excluding post insulator, structure and terminal connector etc.	Nos.	8
2	Supply- Isolator: 400kV, 3150A, 3x1 phase, 63kA for 3sec, horizontal double break (HDB) type isolator, three pole electrically ganged individual pole motor operated with two earth switch, three pole electrically ganged, individual pole motor operated along with operating mechanism and other accessories complete in all respect, excluding post insulator, structure and terminal connector etc.	Nos.	2
3	Supply- 132kV, 2000A, 40kA, Isolator: Single phase, Horizontal double break (HDB) type isolator single pole motor operated, electrically operated without earth switch, along with operating mechanism & other accessories, but without insulator, structure & terminal connector etc.	Nos.	2
B	**SERVICES**		
1	Services- Isolator: 400kV, 3150A, 3x1 phase, 63kA for 3sec, horizontal double break (HDB) type isolator, three pole electrically ganged individual pole motor operated with one earth switch, three pole electrically ganged, individual pole motor operated along with operating mechanism and other accessories complete in all respect.	Nos.	8

2	Services- Isolator: 400kV, 3150A, 3x1 phase, 63kA for 3sec, horizontal double break (HDB) type isolator, three pole electrically ganged individual pole motor operated with two earth switch, three pole electrically ganged, individual pole motor operated along with operating mechanism and other accessories complete in all respect.	Nos.	2
3	Services- 132kV, 2000A, 40KA, isolator : Single phase, horizontal double break (HDB) type isolator single pole motor operated, electrically operated without earth switch, along with operating mechanism & other accessories complete in all respect.	Nos.	2
C	**MANDATORY SPARES FOR 420 KV,2000A,63KA ISOLATORS**		
1	Male & female contacts	Set	2
2	Power contactor, relays, MCBs, switches, fuses, push buttons, resistors etc as per approved schematic.	Set	1
3	Limit switch	Set	2
4	Motor with gear assembly & bevel gear assembly complete.	Set	1
5	Auxiliary switch contacts assembly	Set	1
6	Earthing rod & blade contact side	Set	1
7	Hinge pins,terminal pad	Set	1

Contents

TECHNICAL SPECIFICATION FOR ISOLATORS

400KV SINGLE ISOLATOR WITH 1 EARTH SWITCH

220KV SINGLE ISOLATOR WITHEARTH SWITCH

33 KV SINGLE ISOLATOR WITH EARTH SWITCH

000518

TECHNICAL SPECIFICATION OF ISOLATOR:

(Maintenance free Motor Operated Isolator with Motor drive, Rotary Post Insulators & fixed Post Insulators, Base Frame, Clamp & Connectors and all other fitting & fixing complete in all respect with & without Earth switch).

TECHNICAL PARTICULARS OF 400 kV, 220 kV, 132 kV & 33 KV ISOLATOR

	Type:	400 kV	220 kV	132 kV	33 kV
1	Main switch	horizontal Double end break/center break rotary post insulators	horizontal Double end break rotary post insulators, gang operated		
2	Service	Outdoor			
3	Applicable standard	IS : 9921 / IEC-62271-102			
4	No. of Phases	3 phase			
5	Design Ambient temperature	50° C			
6	Type of operation	Electrically Ganged	Mechanically Ganged		
7	Rated voltage (kV)	In KV	In KV	In KV	In KV
	a) Nominal	400	220	132	33
	b) Maximum	420	245	145	36
8	Rated current (Amps)	3150	3150	1600	1250
9	Short time current for 3 sec. (kA)	63	40/50	40/31.5	31.5
10	Rated frequency	50 HZ ± 5%			
11	System earthing	Effectively earthed			
12	Temperature rise	As per relevant IS/IEC standards			
13	Lightening Impulse withstand voltage (kVp)				
	(a) Across Isolating distance	1425(+240)	1200	750	195
	(b) To earth	1425	1050	650	170
14	1 minute power frequency withstand voltage				

	a) Across Isolating distance	610	530	315	80
	b) To earth	520	460	275	70
15	Switching Impulse withstand voltage (kVp)				
	a) Across Isolating distance	900(+345)	-	-	-
	b) To earth	1050	-	-	-
16	Max. RIV for frequency between 0.5 MHz and 2 MHz (micro-volt)	1000 at 267kV	1000 at 156kV	500 at 92kV	-
17	Corona Extinction Voltage (kV)	320	-	-	-
18	Operating mechanism				
	a) Isolator	Motor	Motor	Motor	Motor
	b) Earth switch	Motor	Motor	Motor	Manual
19	Auxiliary voltage				
	a) Control & Inter lock	220V DC 80% to 110%			
	b) Motor (AC motor /PMDC) voltage	3 Phase 415V AC 50Hz/1Phase 230V AC			
	c) Heater, lamp & socket	Single phase 240 V 50HZ			
20	Safe duration of overload				
	150% of rated current	5 minute			
	120% of rated current	30 minute			
21	Minimum creepage distance of insulator (mm)				
22	Mounting structure	Tubular	Tubular / Lattice	Tubular / Lattice	Tubular / Lattice
23	Operating time	Less than 12 secs			
24	Insulator Data				
	a) Bending Strength (kgf)	800	800	800	600
	b) Height (mm)	3650	2300	1500	508
	c) Bottom PCD (mm)	300	254	184	76
	d) No. of holes & hole dia	8x18	8x18	4x18	4xM12
	e) Top PCD	127	127	127	76

	f) No. of holes & hole dia	4xM16	4xM16	4xM16	4xM12
	g) Minimum creepage distance (mm 31 mm/kV	13020	7595	3625	1612
25	Bus Bar height from Plinth level (mm)	8000	5900	4600	3700
26	Phase Spacing (mm)	7000	4500	3000	1500
27	Minimum clearances (mm)				
	a) Phase to Phase	4000	2100	1300	530
	b) Phase to earth	3500	2100	1300	480
	c) Sectional clearance	6500	5000	4000	3100
28	Mounting Condition	On Structure			
29	Number of auxiliary switches for main isolator	12NO+12NC	12NO+12NC	12NO+12NC	12NO+12NC
30	Number of Make before break and break after break auxiliary switches	4NO+4NC	4NO+4NC	4NO+4NC	4NO+4NC
31	Temperature rise above ambient temperature of 40 deg C corresponding to maximum continuous current (°C) Silver-faced copper, copper alloy or aluminum alloy	Max temp : 105 Deg C Temp Rise : 65 Deg C As per IS :9921			
32	All Contacts	silver faced copper or electrolytic copper alloy			
33	Rated magnetizing / capacitive current make and break	0.7 Amps at 0.15 PF			

1. SCOPE

The scope covers design, manufacture, testing, supply, delivery & supervision of erection, testing and commissioning of motor operated Isolator of rated current capacity as per technical specification enumerated herein for different switchyards of 400/220/132/33 Grid Substations.

2. GENERAL INFORMATION:

2.1. Isolators are 420/245/145/36 kV class and shall be reliable, satisfactory and trouble free operation at all time as to be integrated in SAS.

2.2. Isolators shall be out door and off-load type with three phases suitable for manual as well as local/remote electrical operation.

2.3. The Isolators with combined Earth switch shall be provided on isolator whenever specifically mentioned in the price schedule.

2.4. The Isolators may be installed in staggered or non-staggered position as per requirement in the Grid sub-stations.

2.5. The Isolators with base frame (scope of Isolator manufacturer) shall be fitted on the isolator equipment structures (pipe or lattice type) or gantry beam as beam mounted Isolators. Hence, structural drawings are to be obtained from OPTCL for necessary design of the isolator base frame for its proper erection at site wherever required. The rotation of the Base Insulators of Isolators shall be through double shaft (Pipe) for smooth operation.

2.6. Any material or accessories which may not have been specifically mentioned but which is usual and necessary for satisfactory and trouble free operation and maintenance of the equipment shall be within the scope of supply without any extra financial implication.

3. DESIGN CRITERIA:

3.1. The isolators shall be horizontal ~~center break (for 400 KV)/~~double break (for 400, 220, 33 KV) type. The base frame of the Isolator shall be of HDG steel & shall be capable of bearing the wind pressure having its velocity 55 mtrs/sec and also the force generated due to operation & or any electrical short circuit force. The design of the HDG Steel base frame shall be so designed that it should be cable of withstanding all the force at a time. No deformation of the base frame due to any of the reason as mentioned is not acceptable. The size of the base frame shall be so chosen that it shall take the load of Post Insulators, the moving blades, contacts etc and also the force due to the reason as explained.

3.2. The isolator including their operating mechanisms shall be designed in a manner such a way that they cannot come out of their open or closed position by gravity, wind pressure, vibrations, reasonable shocks or accidental touching of the connecting rods of their operating system. The mechanism should have preferably dead centre locking arrangement such that it prevents any change in end position due to external force on the arm.

3.3. The isolators should be supplied with manual as well as motor operated mechanism. Each three pole isolator will require only one mechanism for 220/132/33 KV & separate mechanism with proper synchronization facility for 400 KV. The coupling GI pipe (rotating shaft) shall be suitable for continuous adaption. No. of such rotating/moving shaft shall be two nos to have smooth operation of Isolator.

3.4. Arcing horn/guiding horn/Corona control ring shall be provided in all type isolators.

3.5. The moving contacts of 3-phase double/centre break type isolator shall rotate from their fully closed position to fully open position. The break shall be distinct and clearly visible from ground.

3.6. It should be suitable for continuous service at the system voltages specified herein. The Isolators shall be suitable to carry the rated current continuously and full short circuit current at site condition without any appreciable rise in temperature. These shall also be suitable for operation at 110% rated (normal) voltage

3.7. The Isolators are required to be used on electrically exposed installation and this should be taken into account while fixing the clearance between phases and between phase and earth.

4. DUTY REQUIREMENT:

4.1. The dis-connector shall be of class M2 class having mechanical endurance of 10,000 operating cycle.

4.2. Isolators shall be capable of withstanding the dynamic and thermal effect of maximum short circuit current of the system in their closed position. They shall be constructed such that they do not open under influence of short circuit current.

4.3. Isolator shall be capable of making/breaking normal current with no significant change in voltage occurs across the terminal of each pole of isolator on account of make / break operation.

4.4. The isolators shall be capable of making/breaking magnetizing current of 0.7A at 0.15 power factors and capacitive current of 0.7A at 0.15 power factors at rated voltage.

4.5. In addition to constructional interlock, isolator shall have provision to prevent their electrical and manual operation unless the associated and other interlocking conditions are met. Suitable individual interlocking coil arrangements shall be provided. The interlocking coil shall be suitable for continuous operation from DC supply and within a variation range as stipulated in „Specific Technical Parameter".

5. MAIN CONTACTS (MALE AND FEMALE)

5.1. The dis-connector shall be having main current carrying parts of Aluminum/Electrolytic Copper arm as per standard type tested design of the manufacture to be capable for continuous rated normal current and short time SC Current in accordance with the Standard Technical Parameters.

5.2. The Isolator's male and female contact shall be made of silver faced copper or electrolytic copper alloy capable of carrying continuous rated normal current and short time SC Current as per Standard Technical Parameters. The current carrying fingers should be fixed with the main arm without any holding spring attachment to avoid flashing and damage of contact fingers for failure of the holding springs. The main and secondary contact assembly should not use springs for holding contact fingers or maintaining contact pressure.

5.3. The contacts and other current carrying parts shall also be so designed that their temperature rise under different operating conditions shall not exceed the value specified in IS: 9921. Temporary rise of temperature due to passage of specified rated short circuit current for all voltage classes shall not cause any annealing or welding of contact surfaces.

5.4. The female contacts of the horizontal type isolators shall consist of properly tempered copper strip/electrolytic copper alloy suitable for rated and short time current rating of the respective voltage class. The hard drawn electrolytic copper strips/ electrolytic copper alloy shall be silver plated of minimum 25 micron thickness.

5.5. The dimensions of the contacts should conform to the drawing approved during type test. However the current density of the current carrying parts shall not be more than the values specified below.

Current Density in Amps/sq. mm

Tubes	Flats

Copper:	2.5	2.0
Aluminum:	1.25	1.0

5.6. These fixed and moving contacts shall be able to carry the rated current continuously and the maximum fault current without any appreciable rise in temperature. The Isolator blades shall retain their form and straightness under all conditions of operation including all mechanical stress arising out of operation as well as under rated short circuit condition.

5.7. The Isolator shall be self-cleaning type so that when Isolator remains closed for long periods in a heavily polluted atmosphere, binding does not occur. No undue wear or scuffing shall be evident during the mechanical endurance tests.

5.8 **EARTH SWITCH:**

Line earth switch shall consist of three earthing blades for Isolator which normally rest against the frame when the connected Isolator is in closed position. The earthing blades for three phase shall be mechanically linked to a coupling shaft which shall be capable of being fitted on either side of the Isolator. The earthing blades shall match and be similar to the main switch blades and shall be provided at the hinge; with suitable flexible conductors with terminal lugs for connecting to the station ground bus. The earthing blades shall be operated by a separate mechanism but shall be mechanically interlocked with the main switch so that the earthing blades can be closed only when the main switches are in open position and vice-versa. The earthing blades shall be gang operated and all the three blades will operate simultaneously.

6. BASE;

6.1. Each single pole of the isolator shall be provided with a complete galvanized steel base provided with holes and designed for mounting on existing supporting structure.

7 INSULATORS:

7.1. The insulators to be used shall conform to IS: 2544 and/or IEC-168 and shall be solid core type and shall be homogeneous; free from cavities, tough and impervious to moisture.

7.2. Glazing of porcelain shall be uniform brown colour free from blister, burns and other defects which may affect the mechanical and dielectric quality of the insulators.

7.3. All iron parts shall be hot dip galvanized. The joints shall be so designed that any thermal expansion of the metal and the porcelain parts shall not be loosened during the whole range of operation.

7.4. Puncture voltage of Insulator shall be greater than dry flashover voltage of respective Isolators.

7.5. The design of the isolator shall be such that pressure due to the contact shall not be transferred to the Insulators after the main blades are fully closed.

7.6. The cantilever strength (min) of solid core support insulator shall be as specified.

8. ARCING HORN AND GRADING HORN

Suitable arcing horn made of GI shall be provided on the fixed and moving contacts of Isolators if required. The contacts shall be of make before and break after" type.

9. ELECTRICAL INTERLOCK / MECHANICAL INTERLOCK

9.1. The Isolators shall be equipped with electrical interlock for interlocking with the associated circuit breakers. The interlocking scheme shall be approved by OPTCL.

9.2. Suitable mechanical / constructional interlock shall be provided between Isolator and earth switch which should be rigid in construction and properly mounted to ensure reliable operation. In case of Double Isolator with earth switch the earth switch mechanical interlock shall be provided for both the operating arms. Double isolators with or without earth switch shall be provided in the 132 & 33 KV level as the bus arrangements are of a main & a transfer scheme.

10. AUXILIARY SWITCHES

10.1. All isolators shall be provided with 220V DC (±20%) auxiliary switches for remote position indication on the control panel and for electrical inter locking with other equipment.

10.2. The auxiliary switch shall be provided with a minimum of auxiliary contacts-12 normally open and 12 normally closed. 4 sets of MBB contacts shall also be provided besides 12 sets as indicated above.

10.3. The auxiliary switches and auxiliary circuits shall have a continuous current carrying capacity of at least 10 Amps. Auxiliary switches shall not be used as limit switches. Details of make, rating and type of auxiliary switch along with the type test report shall be furnished in the offer.

10.4. The auxiliary contacts should be designed such that, it can be changed from NO to NC and vice versa at site.

11. OPERATING MECHANISM:

11.1. Control cabinet/operating mechanism box shall be made of aluminum sheet of adequate thickness (minimum 3 mm). The enclosure shall be painted with epoxy paint. Powder coated to the Shade no 631 of IS: 5 (for aluminum enclosure).

11.2. The operating mechanism shall be located such that it can be directly mounted on the support structure. There shall be provision of Green colour visible marks on the mechanism box for easy identifying of the earth switch mechanism.

11.3. A position indicator to show the isolator is in ON or OFF position to be provided at a suitable location

11.4 The enclosure of the operating mechanism Box shall conform to the degree of protection IP- 55.). The mechanism box shall have neoprene gasket hinged door at front with locking facility. All accessories inside the housing shall be easily accessible.

11.5 Linkage mechanism should be in built with **Teflon cup bushing** to accommodate minor misalignment & avoid rust in joints.

11.6 Insulator rotating arrangement should have **sealed double ball bearing** arrangement (bush bearing arrangement is not acceptable).

11.7 A Local/Remote selector switch and a set of open/ close push buttons shall be provided on the control cabinet of the isolator to permit its operation through local or remote push buttons.

11.8 Provision shall be made in the control cabinet to disconnect power supply through suitable MCBs to prevent local/remote power operation.

11.9 The motor shall be an AC motor /PMDC type and should run from 400V/230V AC mains. The motor should have smooth torque/speed characteristics.

11.10 Suitable reduction gearing shall be provided between the motor and the drive shaft of the isolator. The mechanism shall stop immediately when motor supply is switched off.

11.11 Suitable reduction gearing shall be provided between the motor and the drive shaft of the isolator. The mechanism shall stop immediately when motor supply is switched off. Gear should be of forged material suitably chosen to avoid bending/jamming on operation after a prolonged period of non-operation. Also all gear and connected material should be so chosen/surface treated to avoid rusting. The Gears shall be lubricated for life with graphite or better quality non-drawing and non-hardening type grease.

11.12 Manual operation facility (with handle) should be provided with necessary interlock to disconnect motor.

11.13 Provision shall be made in the control cabinet to disconnect power supply through suitable MCBs to prevent local/remote power operation. All control switches shall be of MCB/rotary switch type and Toggle/piano switches shall not be accepted.

11.14 Only stranded copper conductor (PVC,FRLS) shall be used for wiring. Minimum size of the Conductor for control circuit wiring shall be 2.5 sq.mm Copper.

11.15 Suitable anti condensation heaters with the provision of thermostat shall be provided.

11.16 Each operating mechanism shall be provided with 1100V grade stud type terminal block of Polyamide material. At least 20% spare terminals shall be provided.

11.17 A light fixture suitable for a 240 V CFL tube light shall be provided in each of the tor operated mechanism & shall be door operated type. A 240V, single phase, 50 Hz, 15 amp AC plug and socket shall be provided in the cabinet with ON-OFF switch for connection of hand lamps.

13. DESIGN, MATERIALS AND WORKMANSHIP

13.1. The live parts shall be designed to eliminate sharp points, edges and similar corona producing surfaces, where this is impracticable, adequate rings made out of aluminum tubes shall be provided. Corona shields are not acceptable.

13.2. All ferrous metal parts shall be hot dip galvanized, as per IS 2629.All metal parts shall be of such materials or treated in such a way so as to avoid rust, corrosion and deterioration due to continued exposure to atmosphere and rain.

13.3. Bolts, screws and pins shall be provided with standard locking device viz. Locknuts, spring washers, keys etc. and when used with current carrying parts, they shall be made of copper silicon or other high conductivity and wear resistant alloys.

13.4. The switches should not need lubrication of any parts except at very long interval of five year minimum.

13.5. Any fittings, accessories or apparatus which may not have been mentioned in this specification but which are necessary for efficient operation / performance shall deem to be included in the contract.

14. PROTECTIVE COATINGS

All ferrous parts including bolts, nuts and washers of the switches assembly shall be galvanised to withstand at least six one minute dips in copper sulphate solution of requisite strength except the threaded portions which should withstand four dips.

15. INSULATORS

15.1. Support insulators for all type of isolators shall be of solid core type.

15.2. The insulator shall be made of homogeneous and vitreous porcelain of high mechnical and dielectric strength. It shall have sufficient mechanical strength to sustain electrical and mechanical loading on account of wind load, short circuit forces etc. Glazing of the porcelains shall be of uniform dark brown colour with a smooth surface arranged to shed away raise water.

15.3. The porcelain shall be free from laminations and other flaws or imperfections that might affect the mechanical or dielectric quality. It shall be thoroughly vitrified, tough and impervious to moisture.

15.4. The porcelain and metal ports shall be assembled in such a manner and with such material that any thermal differential expansion between the metal and porcelain parts throughout the range of temperature specified in this specification shall not loosen the parts or create under internal stresses which may affect the mechanical or electrical strength or rigidity. The assembly shall not have excessive concentration of electrical stresses in any section or across leakage surfaces. The cement used shall not give rise to chemical reaction with metal fittings.

15.5. The insulator shall be suitable for water washing by rain or artificial means in service condition.

15.6. Profile of the insulator shall also conform to IEC-815.

15.7. Caps to be provided on top of the insulator shall be of high grade cast iron or malleable steel casting. It shall be machine faced and hot dip galvanized. The holes shall be suitable for bolts with threads having anti corrosive protection. The effective depth of threads shall not be less than the nominal diameter of the bolt. The cap shall be so designed that it shall be free from visible corona and shall have radio interference level within 500 micro volts.

15.8. Casting shall be free from blow holes cracks and such other defects.

16. NAME PLATE:

Isolator, earth switches and their operating devices shall be provided with name plate. The name plate shall be weather proof and corrosion proof. It shall be mounted in such a position that it shall be visible in the position of normal service and installation. It shall carry the following informations duly engraved or punched on it. Name plate shall be bilingual i.e. in English & Oriya.

16.1. Isolator Base

Name: - OPTCL

Name of manufacturer: -
Type Designation:
Manufacturer's serial No.: -
Rated voltage: -
Rated normal current: -
Rated short time current (rms) and duration: -
Rated short time peak current (KAP):-
Weight:-

16.2. Operating Device

Name - OPTCL
Name of manufacturer -
Type Designation -
Reduction gear ratio -
AC motor
i) Rated auxiliary voltage
ii) Starting current
iii) Designation of AC motor as per I.S 4722/325
iv) Starting torque at 80% of supply voltage
v) Over travel in degrees after cutting off supply Total operating time in seconds
i) Close operation - Electrical
ii) Open operation - electrical
Open operation - manual

16.3 All components shall be given adequate treatment of climate proofing as per IS: 3202 so as to withstand corrosive and severe service conditions. All metal parts not suitable for painting such as structural steel, pipes, rods ,levers, linkages, nuts and bolts used in other than current path etc. shall be hot dip gaivanised as per IS - 2629 Complete details of painting, galvanizing and climate proofing of the equipment shall be furnished in the offer.

17. TESTS

17.1. Type Tests:

Isolators offered, shall be fully type tested as per the relevant standards. The Bidder shall furnish one set of the following valid type test reports for their different type of offered Isolators along with the offer. The Purchaser reserves the right to demand repetition of some or all the type tests in the presence of purchaser's representative. For this purpose the Bidder may quote unit rates for carrying out each type test and this will be taken during bid price evaluation, if required. The following type test reports shall be submitted for evaluation purpose. In the absence of any one of the following, the bid is liable to reject.

a) Short time withstands & peak withstand current test for Isolator.
b) Power frequency (Dry & Wet), Lightening Impulse dry withstand.
c) Radio interference voltage (RIV) test
d) Mechanical endurance Test & Terminal load test
e) Degree of Protection test (IP-55)
f) Corona Test (For 400kV Only)

g) Temperature rise test
h) Blocked rotor test

During type tests the isolator shall be mounted on its own support structure or equivalent support structure and installed with its own operating mechanism to make the type tests representative. Drawing of equivalent support structure and mounting arrangements shall be furnished for Purchasers approval before conducting the type tests.

The type tests shall be conducted on the isolator along with approved insulators and terminal connectors.

Mechanical endurance test shall be conducted on the main switch as well as earth switch of one isolator of each voltage class for M2 class (10000 operations). as per IEC 62271-102 which shall be tested at any NABL accredited independent laboratory like CPRI/ERDA.

17.2. Acceptance and Routine Test:

All acceptance and routine test as stipulated in the relevant standards shall be carried out by the supplier in presence of Purchasers representative.

Mechanical operation test (routine test) shall be conducted on isolator (main switch and earth switch) at the supplier's works as well as purchasers substation site. Immediately after completion of the routine test, the supplier shall give 20 days advance intimation along with routine test certificates, valid calibration reports from Govt. approved test laboratories for the equipment, instruments to be used during testing for scrutiny by the purchaser to enable him to depute his representative for witnessing the tests. If there will be any discrepancies in the routine test certificates and calibration reports furnished by the manufacturer, then after settlement of the discrepancies only, purchase's representative will be deputed for witnessing the tests. Special tests proposed to be conducted (if decided to conduct) as type test on isolators, are given at Annexure. These special type test charges shall be quoted along with all other type tests as per relevant IEC standard and these charges shall be included in the total bid price. Test certificates of various raw materials and bought out items including but not limited to the following shall be furnished at the time of routine tests.

a) Chemical analysis of copper along with a copy of excise certificate indicating genuine source of procurement of electrolytic grade copper.
b) Aluminium extrusions
c) Aluminium ingots & castings
d) Fasteners
e) Insulators
f) Motor
g) Gears
h) Auxiliary switch
i) Limit switch
j) Overload / single phase preventer
k) Interlocking devices
l) Terminal block

18. INSPECTION

i) The Purchaser shall have access at all times to the works and all other places of manufacture, where the Isolators, earth switches and associated equipment are being manufactured and the supplier shall provide all facilities for unrestricted inspection of the works of raw materials manufacture of all the accessories and for conducting necessary tests as detailed herein.

ii) The supplier shall keep the purchaser informed in advance of the time of starting of the progress of manufacture of equipment in its various stages so that arrangements could be made for inspection.

iii) No material shall be dispatched from its point of manufacture unless the material has been satisfactorily inspected and tested.

iv) The acceptance of any quantity of the equipment shall in no way relieve the supplier of his responsibility for meeting all the requirements of this specification and shall not prevent subsequent rejection if such equipment is later found to be defective.

19. QUALITY ASSURANCE PLAN

The Bidder shall invariably furnish following information along with his offer, failing which his offer shall be liable for rejection.

(i) Names of sub suppliers for raw materials, list of standards according to which the raw materials are tested, list of tests normally carried out on raw materials in presence of Supplier's representative, copies of test certificate

(ii) Information and copies of test certificates as in (I) and (ii) above in respect of bought out accessories.

(iii) List of manufacturing facilities available

(iv) Level of automation achieved and list of areas where manual processing still exists.

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

(vi) List of testing equipment with calibration certificates from Govt. approved test house available with supplier for final testing equipment and test plant limitation if any, vis-à-vis the type, special acceptance and routine test specified in the relevant standards.

These limitations shall be very clearly brought out in the specified test requirements.

The supplier shall within 30 days of placement of order, submit following information to the purchaser.

i) List of raw material as well as bought out accessories and the names of sub-suppliers selected from the lists furnished along with offer.

ii) Type test certificates of the raw material and both bought out accessories.

iii) Quality Assurance Plan (QAP) with hold points for purchaser's inspection.

20. DOCUMENTATION

20.1. All drawings shall conform to relevant international standards organisation (ISO). All drawings shall be in ink and suitable for micro filming. All dimensions and data shall be in S.I. Units.

20.2. List of Drawings and Documents

The Bidder shall furnish four sets of following drawings / documents along with his offer.

a) General outline and assembly drawings of the dis-connector operating mechanism, structure, insulator and terminal connector.
b) Sectional views and descriptive details of items such as moving blades, contacts, arms contact pressure, contact support bearing housing of bearings, balancing of heights, phase coupling pipes, base plate, operating shaft, guides, swivel joint operating mechanism and its components etc.
c) Loading diagram.
d) Drawings with structure for the purpose of type tests.
e) Name plate.
f) Schematic drawing.
g) Type test reports.
h) Test reports, literature, pamphlets of the bought out items and raw material.

20.3. The supplier shall within 2 weeks of placement of order submit four sets of final versions of all the above said drawings for Purchaser"s approval. The purchaser shall communicate his comments / approval on the drawings to the supplier. The supplier shall, if necessary, modify the drawings and resubmit four copies of the modified drawings for Purchaser's approval within two weeks from the date of comments. After receipt of approval the supplier shall within three weeks submit 5 prints and soft copies in two CD of the approved drawings for purchaser's use.

20.4. Six sets of the type test reports, duly approved by the Purchaser shall be submitted by the supplier for distribution, before commencement of supply Adequate copies of acceptance and routine test certificates, duly approved by the Purchaser shall accompany the dispatched consignment.

20.5. The manufacturing of the equipment shall be strictly in accordance with the approved drawings and no deviation shall be permitted without the written approval of the purchaser. All manufacturing and fabrication work in connection with the equipment prior to the approval of the drawing shall be at the supplier risk.

21. INSTRUCTION MANUALS:

21.1. Five copies of the erection, operation and maintenance manuals in English are to be supplied for each type of Isolator one month prior to despatch of the equipment. The manual shall be bound volumes and shall contain all drawings and information required for erection, operation and maintenance of the Isolator including but not limited to the following particulars.

(a) Marked erection prints identifying the component parts of the Isolator as shipped with assembly drawings.
(b) Detailed dimensions and description of all auxiliaries.
(c) Detailed views of the insulator stacks, metallic, operating mechanism, structure, interlocks, spare parts etc.

22. PACKING AND FORWARDING.

The equipment shall be packed in crates suitable for vertical / horizontal transport, as the case may be and suitable to withstand handling during transport and outdoor storage during transit. The supplier shall be responsible for any damage to the equipment during transit, due to improper and inadequate packing. The easily damageable material shall be carefully packed and marked with the appropriate caution symbols. Wherever necessary, proper arrangement for lifting, such as lifting hooks etc. shall be provided. Any material found short inside the packing cases shall be supplied by supplier without any extra cost.

Each consignment shall be accompanied by a detailed packing list containing the following information:

(a) Name of the consignee.
(b) Details of consignment.
(c) Destination.
(d) Total weight of consignment.
(e) Handling and unpacking instructions.
(f) Bill of material indicating contents of each package.

The supplier shall ensure that the bill of material is approved by the purchaser before dispatch.

23. SUPERVISION OF ERECTION, TESTING & COMMISSIONING (ET&C).

Purchaser proposes to utilize the services of the supplier for supervision of testing and commissioning of the equipment being supplied by him, if it is required. For this purpose, the supplier should make available the services of trained personnel (Engineers) who shall correct in the field, any errors or omissions in order to make the equipment and material properly perform in accordance with the intent of this specification. The Engineer shall also instruct the plant operators in the operation and maintenance of the commissioned equipment. The supplier shall be responsible for any damage to the equipment on commissioning the same, if such damage results for the faulty or improper ET&C. Purchaser shall provide adequate number of skilled / semi skilled workers as well as general tools and equipment and cranes required for equipment erection, at his own expenses. Apart from the above, the Purchaser shall not be responsible for providing any other facilities to the supplier. Special tools if required for erection and commissioning shall be arranged by the supplier at his cost and on commissioning these shall be supplied to the purchaser free of cost for future use.

24. QUATITITY AND DELIVERY REQUIREMENTS:

The scope of supply shall include a supply of 2.5% extra quantity of galvanized bolts, nuts, washers, split pins, cotter pins and such other small loose items free of cost.

25. STANDARDS:

STANDARD	DESCRIPTION
IEC 62271-1	HIGH-VOLTAGE SWITCHGEAR AND CONTROLGEAR PART 1 COMMON SPECIFICATIONS
IEC 62271-102	HIGH-VOLTAGE SWITCHGEAR AND CONTROLGEAR PART 102 ALTERNATING CURRENT DISCONNECTORS AND

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	EARTHING SWITCH
IS 9921 PART 1 –PART 5	SPECIFICATION FOR ALTERNATING CURRENT DISCONNECTORS (ISOLATORS) AND EARTHING SWITCHES FOR VOLTAGES ABOVE 1000 V
IEC 60694	IEC 60694 COMMON SPECIFICATIONS FOR HIGH-VOLTAGE SWITCHGEAR AND CONTROLGEAR STANDARDS
IS 2544	SPECIFICATIONS FOR POST INSULATOR

GUARANTEED TECHNICAL PARTICULARS

(To be filled in & signed by the bidder)

NAME OF THE BIDDER:

SL. No.	**DESCRIPTION**
ISOLATOR	
1	**ISOLATOR : GENERAL:**
1.01	Name of Manufacturer
1.02	Type & Model of the Manufacturer
1.03	Date of Last Type Test
1.04	Type from Operation Point (Like HCB, CR, Pantograph)
1.05	Conforming Standard
1.06	Total Height of the Isolator with structure from Plinth level after complete Erection
1.07	Total weight of the Isolator
1.08	Total weight of the structure after complete Erection
1.09	Material of the Main Blades
1.10	Material of the Main Contacts
1.11	Whether spring is used in the main or secondary contact assembly
1.12	Rated Voltage (KV)
1.13	Maximum Voltage (KV)
1.14	Rated Frequency (Hz)
2	**INSULATION LEVEL** : 1.2/50 MICRO-SEC. L.I. WITHSTAND

	VOLTAGE:
2.01	Between line terminals and ground parts (KVp)
2.02	Between Isolating Arms (KVp)
2.03	One minute Power frequency withstand Voltage (KVrms)
2.03.1	Between line terminals and ground parts (KVp)
2.03.2	Between Isolating Arms (KVp)
3	**ISOLATOR CURRENT:**
3.01	Rated normal current Amps (rms)
3.02	Short time current rating (KA) (Sec. for 400KV & 3 Sec. for 220KV & below)
3.03	Temperature rise above ambient of 50oC at rated current (oC)

4	**ISOLATOR CLEARANCE:**
4.1	Clearance between : Phase to Phase (mm)
4.2	Clearance between : Phase to Earth (mm)
4.2	Clearance between Two arms in Open condition (mm)
4.5	Height of the Rotating Insulator (mm)
5	**ISOLATOR DRIVES:**
5.1	Type of Drive Motor (Like AC Squirrel Cage, DC Motor)
5.2	Voltage of Motor Drives
5.3	Provision of Manual Operation (Yes / No)
5.4	Rated auxiliary supply voltage to coil for close & Open Operation
6	**NUMBER AND TYPE OF AUXILIARY CONTACTS FOR :**
6.1	Main blade
6.2	Earth switch
6.3	Operating time for closing (secs.)
6.4	Operating time for opening (secs.)
7	**ISOLATOR: SUPPORT INSULATOR:**
7.1	Name of Manufacturer
7.2	Conforming Standard
7.3	Type & Designation
7.4	Cantilever Strength (Kgf)
7.5	Min. Creepage Distance(mm)
7.6	Weight of Unit (Kg)
7.7	Height of Unit (mm)
7.8	Insulation Level: One minute Power frequency voltage withstand test (KVrms)

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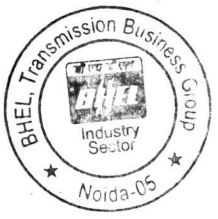
7.9	Insulation Level: 1.2/50 micro-sec. Lightning Impulse Voltage withstand test (KVp)
8	**ISOLATORS SPARES:**
8.01	The isolator spares will be available for total service life. (Yes/ No)
8.02	If offered designed isolator are out of manufacturing, the manufacturer will arrange spares for total service life (Yes/ No)



SECTION- 3

PROJECT DETAILS AND GENERAL SPECIFICATIONS

3.0 GENERAL

This section stipulates the General Technical Requirements under the Contract and will form an integral part of the Technical Specification.

The provisions under this section are intended to supplement general requirements for the materials, equipment and services covered under other sections of tender documents and are not exclusive. However, in case of conflict between the requirements specified in this section and requirements specified under other sections, the requirements specified under respective sections shall prevail.

3.1 PROJECT DETAILS

	Particular	Details
a)	Customer	ODISHA POWER TRANSMISSION CORPORATION LIMITED (OPTCL)
b)	Engineer/Consultant/ Inspector	-
c)	Project Title	2X500 MVA, 400/220 KV GIS S/S AT ERSAMA & ASSOCIATED 2 NOS 400 KV BAY EXTN AT DUBURI
d)	Project Location	**400/220kV GIS S/S** Place: Erasama, Paradeep District: Jagatsingha State: Odisha **400kV AIS S/S Bay Extn.** Place: Duburi District: Jajapur State: Odisha
e)	Latitude & Longitude	**400/220kV GIS S/S** North: 20º12'32" and East: 86º21'44" **400kV AIS S/S Bay Extn.** North: 20º56'14" and East: 86º00'23"
f)	Nearest Railway Station	Erasama – At a distance of about 32 km from Paradeep station Duburi – At a distance of about 14 km from Jajpur Road station
g)	Distance of project location from the Railway station	Erasama – At a distance of about 32 km from Paradeep station Duburi – At a distance of about 14 km from Jajpur Road station
h)	Nearest Major Town	Bhubaneswar
i)	Distance of the town from the project site	86 Km from Erasama & 120 Km from Duburi
j)	Nearest commercial airport	Biju Patnaik International Airport, Bhubaneswar

k)	Distance of airport from the project site	86 Km from Erasama & 120 Km from Duburi
	SITE CONDITIONS (for design purposes)	
a)	Annual mean if maximum monthly average temperature	50°C
b)	Annual mean if minimum monthly temperature	5°C
c)	Design ambient temperature	50°C
d)	Average Rainfall in mm	1500 mm
e)	Average thunderstorm days per year	77 days
f)	Maximum Relative humidity	100 %
g)	Average Relative humidity	85 %
h)	Height above mean sea level	Less than 1000 meters
i)	Pollution Severity	Heavily polluted
j)	Criteria for Wind Resistant design of structures and equipment	Standard Applicable - IS 875 (Part 3)
k)	Basic Wind speed "Vb" at ten meters above the mean ground level.	55m/ sec for Erasama 50 m/ sec for Duburi
l)	Risk Coefficient "K1"	1
m)	Seismic Co-efficient	0.06g Horizontal 0.01g Vertical

3.1.1 SYSTEM PARAMETERS

Sl.No.	Parameters	**400 kV**	**220 kV**	**33 kV**
1	Highest system voltage	420 kV rms	245 kVrms	36
2	System Frequency	50 Hz		
3	Variation in Frequency	+ - 2.5 %		
5	Lightning Impulse voltage	±1425kVp	± 1050kVp	170
6	Switching impulse voltage	±1050kVp	-	
7	Power frequency withstand for 1 min (rms)	630 kV (rms)	460 kV (rms)	70 kV (rms)
8	Max. fault level (3/1 sec.)	63 kA	50kA	31.5kA
9	Minimum creepage distance	13020 mm (Erasama) 10500 mm (Duburi)	7595mm (Erasama) -	1116mm (Ersama) 900mm (Duburi)
10	System Neutral Earthing	Effectively Earthed		
11	Corona Extinction Voltage	320kV	156kV	-
12	Radio Interference Voltage	500µV at 266kV	500µV at 167kV	-

3.1.2 AUXILIARY POWER

Nominal Voltage V	**Variation**	**Frequency Hz or DC**	**Phase**	**Wires**	**Neutral Connection**
430	±10%	50±5%	3	4	Solidly earthed
240	±10%	50±5%	1	2	Solidly earthed
220	187V - 242V	DC	DC	2	Isolated 2 wires
50	45V - 55V	DC	DC	2	+ve earthed

3.1.3 The minimum electrical clearances for 400/220/33kV switchyard shall be as given below:

	400kV	**220kV**	**33kV**
Phase to earth clearance	3400 mm	2160mm	320mm
Phase to phase clearance	3900 mm	2160mm	320mm
Section clearance	6500 mm	5000mm	3000mm
Ground Clearance	8000 mm	5500mm	4000mm

3.2 INSTRUCTION TO BIDDERS:

The bidders shall furnish technical data sheets, catalogues, engineering data, technical information, design documents, drawings etc. fully in conformity with the technical specification.

The supplier should be approved by Employer (OPTCL). If not, it is the responsibility of the vendor to be assessed and approved by Employer, before placement of order by BHEL. Any cost involved in vendor assessment/approval must be borne by the vendor himself.

The Bidder's proposal shall be based upon the use of equipment and material complying fully with the requirements specified herein. It is recognized that the Bidder may have standardized on the use of certain components, materials, processes or procedures different than those specified herein. Alternate proposals offering similar equipment based on the manufacturer's standard practice will also be considered, provided the base offer is in line with technical specifications and such proposals meet the specified design standards and performance requirement and are acceptable to the Purchaser. Sufficient amount of information for justifying such proposals shall be furnished to Purchaser along with the bid to enable the Purchaser to determine the acceptability of these proposals.

Wherever a material or article is specified or defined by the name of a particular brand, Manufacturer or Vendor, the specific name mentioned shall be understood to be indicative of the function and quality desired and not restrictive. Other manufacturer's products may be considered provided sufficient information is furnished to enable the Employer to determine that the products proposed are equivalent to those named.

Equipment furnished shall be complete in every respect with all mountings, fittings, fixtures and standard accessories normally provided with such equipment and/ or needed for erection, completion and safe operation of the equipment as required by applicable codes, though they may not have been specifically detailed in the Technical Specifications unless included in the list of exclusions. Materials and components not specifically stated in the specification but which are necessary for commissioning and satisfactory operation of the switchyard unless specifically excluded shall be deemed to be included in the scope of the specification and shall be supplied without any extra cost. All similar standard components/parts of similar standard equipment under supply shall be inter-changeable with one another.

The bidder shall supply type tested (including special tests as per tech. specification) equipment and materials. The test reports shall be furnished by the bidder along with equipment/ material drawings. In the event of any discrepancy in the test reports, (i.e., if any test report is not acceptable due to any design/ manufacturing changes or due to non-compliance with the Technical Specification and/ or applicable standard), the tests shall be carried out without any additional cost implication to the BHEL. BHEL reserves the right to get any or all type/tests conducted/repeated.

3.3 CODES AND STANDARDS

In addition to the codes and standards specifically mentioned in the relevant technical specifications for the equipment / plant / system, all equipment parts, systems and works covered under this specification shall comply with all currently applicable statutory regulations and safety codes of the Republic of India as well as of the locality where they will be installed.

Except where otherwise specified or implied, the bidder shall comply with the latest edition of the relevant Indian Standards, International Electrotechnical Commission (IEC) standards and any other standards mentioned in this Specification. The Bidder may submit for approval, equipment or materials conforming to technically equivalent National Standards. In such cases copies of the relevant Standards or part thereof, in the English language shall be submitted with the Tender.

In case of conflict the order of precedence shall be (1) IEC, (2) IS and (3) other alternative standard.

Reference to a particular standard or recommendation in this Specification does not relieve the Bidder of the necessity of providing the Contract Works complying with other relevant standards or recommendations.

The list of standards provided in the schedules of this Specification is not to be considered exhaustive and the Bidder shall ensure that equipment supplied under this contract meets the requirements of the relevant standard whether or not it is mentioned therein.

Other International/ National standards such as DIN, VDI, BS, GOST etc. shall also be accepted for only material codes and manufacturing standards, subject to the Employer's approval, for which the Bidder shall furnish, adequate information to justify that these standards are equivalent or superior to the standards mentioned above. In all such cases the Bidder shall furnish specifically the variations and deviations from the standards mentioned elsewhere in the specification together with the complete word to word translation of the standard that is normally not published in English.

3.4 LANGUAGE AND SYSTEM OF UNITS

The English language shall be used in all written communications between the Employer, the BHEL/OPTCL and the Bidder with respect to the services to be rendered and with respect to all documents and drawings procured or prepared by the Bidder pertaining to the work, unless otherwise agreed by the Employer.

It is required that danger plates, equipment designation labels or plates, instruction notices on plant and general substation notices be written in English, Hindi and Oriya. Control switch and lamp labels, indicator lamp and annunciator inscriptions shall be in English only.

The Bidder must furnish a schedule giving the English, Hindi and Oriya version of all labels, notices, etc., for approval.

The design features of all equipment shall be based on the SI system of units.

3.5 SERVICES TO BE PERFORMED BY THE EQUIPMENT BEING FURNISHED

The 400 kV system is being designed to limit the power frequency over voltage of 1.5 p.u. and the switching surge over voltage to 2.5 p.u. In 400 kV system the initial value of temporary over voltage could be 2.0 p.u. for 1-2 cycles. All the equipment/materials covered in this specification shall perform all its function satisfactorily without undue strain, restrike etc. under such over voltage conditions.

All equipment shall also perform satisfactorily under various other electrical, electromechanical and meteorological conditions of the site of installation. All equipment shall be able to withstand all external and internal mechanical, thermal and electromechanical forces due to various factors like wind load, temperature variation, ice & snow (not applicable for this project), short circuit etc for the equipment.

3.6 CORRESPONDENCE, DRAWINGS, APPROVAL PROCEDURE AND SAMPLES

3.6.1 Drawings & Document Submission

All drawings submitted by the supplier including those submitted at the time of bid shall be in sufficient detail to indicate the type, size, arrangement, material description, Bill of Materials, weight of each component, break-up for packing and shipment, the external connections, fixing arrangement required. The dimensions required for installation and interconnections with other equipment and materials, clearances and spaces required for installation and interconnections between various portions of equipment and any other information specifically requested in the specifications.

Each drawing submitted by the bidder (including those of sub-vendors) shall bear project specific title block at the right hand bottom corner with clear mention of the name of the Employer, the system designation, the specifications title, the specification number, the name of the Project, drawing number and revisions. If standard catalogue pages are submitted, the applicable items shall be indicated therein. All titles, noting, markings and writings on the drawing shall be in English. All the dimensions should be in metric units.

All dimensions marked on drawings shall be considered correct although measurement by scale may differ from general arrangement drawings. Detailed drawings shall be worked to where they differ from general arrangement drawings.

All drawings for approval shall have the OPTCL-LOGO and the name of the Employer.

For presentation of design drawings and circuit documents IEC Publication 617 or equivalent standards for graphical symbols are to be followed.

The review of these document/data/drawings by the purchaser will cover only general conformance of the document/data/drawings to the specification and contract, interfaces with the equipment provided under specification, external connections and of the dimensions which might affect plan layout. This review by the purchaser may not indicate a thorough review of the dimensions, quantities and details of the equipment, material, any devices or items indicated or the accuracy of the information submitted. The review and/or approval by the purchaser shall not be considered by the bidder, as limiting any of his responsibilities and liabilities for mistakes and deviations from the requirements, specified under these specifications and documents.

All manufacturing, fabrication and execution of work in connection with the equipment/system prior to the approval of the drawings shall be at the bidder's risk. The bidder is expected not to make any changes in the design of the equipment /system, once they are approved by the Purchaser. However, if some changes are necessitated in the design of the equipment/system at a later date, the bidder may do so, but such changes shall promptly be brought to the notice of the Purchaser indicating the reasons for the change and get the revised drawing approved again in strict conformance to the provisions of the Technical Specification. Approval of bidder's drawing or work by the Purchaser shall not relieve the bidder of any of his responsibilities and liabilities under the Contract.

3.6.2 Bidder's Drawing Submission and Approval Procedure

The following procedure for submission and review/approval of the drawings, data reports, information, etc. shall be followed by the bidder:

a. All data/information furnished by Vendor in the form of drawings, documents, Catalogues or in any other form for Employer's information/interface and/or review and approval are referred by the general term "drawings".

b. The 'Master drawings list' indicating titles, Drawing Number, Date of submission and approval etc. shall be furnished by the bidder. This list shall be updated if required at suitable interval during detailed engineering.

c. All drawings (including those of sub-vendor) shall bear at the right hand bottom corner the 'title plate' with all relevant information duly filled in. The bidder shall furnish this format to his sub-vendor along with his purchase order for sub-vendor's compliance.

d. Three copies of all drawings shall be submitted for approval and three copies for any subsequent revision. Employer shall forward their comments within four (4) weeks of receipt of drawings.

e. The OPTCL/BHEL reserves the right to request any additional information that may be considered necessary in order to fully review the drawings. Drawings for approval shall be submitted as paper prints and shall bear the approved contract references.

f. Upon review of each drawings, depending on the correctness and completeness of the drawings, the same will be categorised and approval accorded in one of the following categories:

CATEGORY I	Approved
CATEGORY II	Approved, subject to incorporation of comments/modification as noted. Resubmit revised drawing incorporating the comments
CATEGORY III	Not approved. Resubmit revised drawings for Approval after incorporating comments/modifications as noted
CATEGORY IV	For information and records

g. Bidder shall resubmit the drawings approved under Category II, III within one (1) week of receipt of comments on the drawings, incorporating all comments. Every revision of the drawing shall bear a revision index wherein such revisions shall be highlighted in the form of description or marked up in the drawing identifying the same with relevant revision number enclosed in a triangle (e.g 1.2.3. etc.).

h. In case Bidder does not agree with any specific comment, he shall furnish the explanation for the same to Employer for consideration. In all such cases Bidder shall necessarily enclose explanations along with the revised drawing (taking care of balance comments) to avoid any delay and/or duplication in review work.

i. It is the responsibility of the Bidder to get all the drawings approved in the Category I or IV (as the case may be) and complete engineering activities within the agreed schedule. Any delay arising out of submission and modification of drawings shall not alter the contract completion schedule.

j. Bidder shall not make any changes in the portions of the drawing other than those commented. If changes are required to be made in the portions already approved, the Bidder shall resubmit the drawings identifying the changes (along with reasons for changes) for Employer's review and approval. **Drawings resubmitted shall show clearly the portions where the same are revised marking the relevant revision numbers and Employer shall review only such revised portion of documents.**

3.6.3 As Built Drawings

After completion of work on site all drawings shall be revised where necessary to show the equipment as installed and three copies submitted duly signed by site-in-charge. Following approval, two reproducible transparencies and twenty prints shall then be provided as required by the OPTCL/BHEL and shall be of sufficient detail to enable all parts to be identified. The bidder shall also submit, where possible, digitally stored copies of all as-built drawings on disc or CD-ROM in a format compatible with the Employer's drawing system.

Approval of drawings will not in any way relieve the Bidder of his obligations of furnishing the equipment in accordance with the specification and shall not prevent subsequent rejection if such equipment is later found to be defective.

3.6.4 Operation and Maintenance Manual

a. The Bidder shall submit to the Employer preliminary instruction manuals for all the equipment for review. The final instructions manuals incorporating Employer's comments and complete in all respect shall be submitted at least sixty (60) days before the first shipment of the equipment. The instruction manuals shall contain full details and drawings of all the equipment, the transportation, storage, installation, testing, commissioning, operation and maintenance procedures, etc. separately for each component/equipment along with log record format. After approval by the Engg. In charge the Bidder shall deliver ten (10) copies of the complete manual.

b. If after commissioning and initial operation of the plant, the instruction manuals require any modifications/additions/changes, the same shall be incorporated and the updated final instruction manuals shall be submitted.

c. The operating and maintenance instructions together with drawings (other than shop drawings) of the equipment, as completed, shall have sufficient details to enable the Employer to maintain, dismantle, reassemble and adjust all parts of the equipment. They shall give a step by step procedure for all operations likely to be carried out during the life of the plant/equipment, including erection, testing, commissioning, operation, maintenance dismantling and repair. Each manual shall also include a complete set of approved drawings together with performance/rating curves of the equipment and test certificates, wherever applicable. The contract shall not be considered completed for purpose of taking over until such instructions and drawings have been supplied to the Employer.

d. A separate section of the manual shall be for each size/type of equipment and shall contain a detailed description of construction and operation, together will all relevant pamphlets.

e. The manuals shall include the following
   a) List of spare parts along with their drawing and catalogues and procedure for ordering spares.
   b) Lubrication Schedule including charts showing lubrication checking, testing and replacement procedure to be carried daily, weekly, monthly & at longer intervals to ensure trouble free operation.

The Contract shall not be considered to be completed for purposes of taking over until the final Instructions manuals (both erection and O & M manuals) have been supplied to the Employer.

3.6.5 Final Submission of drawings and documents

The Bidder shall furnish the following after approval of all drawings /documents and test reports:
a. List of drawings bearing the Employer's and Bidder's drawing number.

b. Six (6) bound sets along-with two (2) sets of CD-ROMs/ DVD/Portable hard disk of all final drawings/documents.
c. Bidder shall also furnish six (6) bound sets of all as-built drawings including the list of all as-built drawings bearing drawing numbers. The Bidder shall also furnish two (2) sets of CD-ROMs/ DVD/Portable hard disk of all as-built drawings as decided by the Employer.
d. The Bidder shall also furnish four (4) copies and two (2) sets of CD-ROMs/ DVD/Portable hard disk of instruction/ operations & maintenance manuals (after approval) for all the equipment.

3.6.6 Test Reports

Two (2) copies of all test reports shall be supplied for approval before shipment of Equipment. The report shall indicate clearly the standard value specified for each test to facilitate checking of the reports. After final approval six (6) bound copies and two (2) sets of CD-ROMs/ DVD/Portable hard disk of all type and routine test reports shall be submitted to Employer.

3.7 MATERIAL /WORKMANSHIP

Where the specification does not contain references to workmanship, equipment, materials and components of the covered equipment, it is essential that the same must be new, of highest grade of the best quality of their kind, conforming to best engineering practice and suitable for the purpose for which they are intended and shall ensure satisfactory performance throughout the service life.

In case where the equipment, materials or components are indicated in the specification as "similar" to any special standard the purchaser shall decide upon the question of similarity. When required by the specification or when required by the purchaser the bidder shall submit, for approval, all the information concerning the materials or components to be used in manufacture. Machinery, equipment, materials and components supplied, installed or used without such approval shall run the risk of subsequent rejection, it being understood that the cost as well as the time delay associated with the rejection shall be borne by the Bidder.

The design of the Works shall be such that installation, future expansions, replacements and general maintenance may be undertaken with a minimum of time and expenses. Each component shall be designed to be consistent with its duty and suitable factors of safety subject to mutual agreements. All joints and fastenings shall be devised, constructed and documented so that the component parts shall be accurately positioned and restrained to fulfill their required function. In general, screw threads shall be standard metric threads. The use of other thread forms will only be permitted when prior approval has been obtained from the Purchaser.

Whenever possible, all similar part of the works shall be made to gauge and shall also be made interchangeable with similar parts. All spare parts shall also be interchangeable and shall be made of the same materials and workmanship as the corresponding parts of the equipment supplied under the specification. Where feasible, common component units shall be employed in different pieces of equipment in order to minimize spare parts stocking requirements. All equipment of the same type and rating shall be physically and electrically interchangeable.
The equipment offered in the bid only shall be accepted for supply, with the minimum modifications as agreed/accepted.

3.8 PROVISIONS FOR EXPOSURE TO HOT AND HUMID CLIMATE

Outdoor equipment supplied under the specification shall be suitable for service and storage under tropical conditions of high temperature, high humidity' heavy rainfall and environment favorable to the growth of fungi and mildew. The indoor equipment located in non-air-conditioned areas shall also be of same type.

3.8.1 Space Heaters

Space heaters where provided shall be suitable for continuous operation at 240V supply voltage. On-off switch and fuse shall be provided.

One or more adequately rated permanently or thermostatically connected heaters shall be supplied to prevent condensation in any compartment. The heaters shall be installed in the lower portion of the compartment and electrical connections shall be made from below the heaters to minimise deterioration of supply wire insulation. The heaters shall be suitable to maintain the compartment temperature at approximately 10C, above the outside air temperature to prevent condensation. This shall be demonstrated by tests.

3.8.2 Fungi Static Varnish

Besides the space heaters, special moisture and fungus resistance varnish shall be applied on parts which may be subjected or predisposed to the formation of fungi due to the presence or deposit of nutrient substances. The varnish shall not be applied to any surface of part where the treatment will interfere with the operation or performance of the equipment. Such surfaces or parts shall be protected against the application of the varnish.

3.8.3 Ventilation Openings

In order to ensure adequate ventilation, compartments shall have ventilation openings provided with fine wire mesh of brass to prevent the entry of insects and to reduce to a minimum the entry of dirt and dust. Outdoor compartment openings shall be provided with shutter type blinds.

3.9 CLEANING, PAINTING AND TROPICALASATION

3.9.2 General

All paints shall be applied in strict accordance with the paint manufacturer's instructions.

All painting shall be carried out on dry and clean surfaces and under suitable atmospheric and other conditions in accordance with the paint manufacturer's recommendations.

An alternative method of coating equipment such as with epoxy resin-based coating powders will be permitted, subject to the approval of the Engg. In charge (Divisional Engr.), and such powders shall comply with the requirements of IEC 455. The Bidder shall provide full details of the coating process to the Engg. In charge (Divisional Engr.) for approval.

It is the responsibility of the Bidder to ensure that the quality of paints used shall withstand the tropical heat and extremes of weather conditions specified in the schedules. The paint shall not peel off, wrinkle, be removed by wind, storm and handling on site and the surface finish shall neither rust nor fade during the service life of the equipment.

The colors of paints for external and internal surfaces shall be in accordance with the approved color schemes.

3.9.3 Works Painting Process

All steelworks, plant supporting steelworks and metalwork, except galvanised surfaces or where otherwise specified, shall be shot blasted to BS 7079 or the equivalent ISO standard. All sheet steel work shall be degreased, pickled, phosphated in accordance with the IS 6005 "Code of Practice for phosphating iron and sheet steel". All surfaces shall then be painted with one coat of epoxy zinc rich primer, two pack type, to a film thickness of 50 microns. This primer shall be applied preferably by airless spray and within twenty minutes but not exceeding one hour of shot blasting.
All rough surfaces of coatings shall be filled with an approved two pack filler and rubbed down to a smooth surface.
The interior surfaces of all steel tanks and oil filled chambers shall be shot blasted in accordance with BS 7079 or the equivalent ISO, and painted within a period of preferably twenty minutes, but not exceeding one hour with an oil resisting coating of a type and make to the approval of the BHEL/OPTCL.
The interior surfaces of mechanism chambers, boxes and kiosks, after preparation, cleaning and priming as required above, shall be painted with one coat zinc chromate primer, one coat phenolic based undercoating, followed by one coat phenolic based finishing paint to a light or white colour. For equipment for outdoor use this shall be followed by a final coat of anti-condensation paint of a type and make to the approval of the BHEL/OPTCL, to a light or white colour. A minimum overall paint film thickness of 150 microns shall be maintained throughout.
All steelworks and metalwork, except where otherwise specified, after preparation and priming as required above shall be painted with one coat metallic zinc primer and two coats of micaceous iron oxide paint followed by two coats of either phenolic based or enamel hard gloss finished coloured paint to the approval to an overall minimum paint film thickness of 150 microns.
Galvanised surfaces shall not be painted in the works.
All nuts, bolts, washers etc., which may be fitted after fabrication of the plant shall be painted as described above after fabrication.
The painted metal works shall be subjected to paint qualification test as per draft ANSI/IEEE-Std 37.21 - 1985 clause 5.2.5.

3.9.4 Colour Schemes

The Bidder shall propose a colour scheme for the sub-station for the approval of BHEL/OPTCL. The decision of BHEL/OPTCL shall be final. The scheme shall include:

- Finishing colour of indoor equipment
- Finishing colour of outdoor equipment
- Finish colour of all cubicles
- Finishing colour of various auxiliary system equipment including piping.
- Finishing colour of various building items.

All steel structures, plates etc. shall be painted with non-corrosive paint on a suitable primer. It may be noted that normally all Employer"s electrical equipment in Employer"s switchyard are painted with shade 631 of IS: 5 and Employer will prefer to follow the same for this project also. All indoor cubicles shall be of same colour scheme and for other miscellaneous items colour scheme will be subject to the approval of the BHEL/OPTCL.

Sl. No.	Equipment	Application Environment			
		Indoor		Outdoor	
		Colour	Code IS:5	Colour	Code IS:5
400kV/220kV/132kV Class Equipment					
1	Transformers	—	—	Light grey	631
2	Marshalling boxes, CTs, PT's, CVT's, surge counter casings, junction boxes etc.	Light Admiralty grey.	697	Light Admiralty grey.	697
3	Control and relay panels, PLCC cabinets etc.	Smoke grey	692	—	—
4	Porcelain parts i.e. insulators	Dark brown	412	Dark brown	412
5	All structures/ metallic parts exposed to atmosphere	Hot dip galvanised			
33kV Class equipment					
6	Switchgear cubicles	Smoke grey	692	Light grey	631
7	Control and relay panels	Smoke grey	692	—	—
	LT switchgear				
8	LT switchgear exterior	Smoke grey	692	Light grey	631
9	ACDB/ MCC	Smoke grey	692	Light grey	631
10	DCDB	Smoke grey	692	—	—
11	LT bus duct in side enclosure	Matt Paint		—	—
12	LT bus duct outside enclosure	Smoke grey	692	—	—
13	Motors	Smoke grey	692	Light grey	631
14	Diesel generator engine	Smoke grey	692	—	—
15	Diesel generator	Smoke grey	692	—	—
16	LT transformers	Smoke grey	692	Light grey	631
17	Battery charger	Smoke grey	692	—	—
18	Mimic diagram 400kV 220kV 132kV 33kV 11kV 415V	 Dark violet Golden yellow Sky blue Signal red Canary yellow Middle brown	 796 356 101 537 309 411	 — — — — — —	 — — — — — —
	Miscellaneous				
19	Control modules and console inserts	Smoke grey	692	Light grey	631
20	Lighting package equipment outside	Light grey	631	Light grey	631
21	Lighting package equipment inside	Glossy white		Glossy white	
22	Water pipes	sea green	217	sea green	217
23	Air pipes	Sky blue	101	Sky blue	101
24	Transformer oil pipes	Light brown	410	Light brown	410
25	Fire Installations	Fire red	536	Fire red	536
26	Insulating oil/ gas treatment plant	Gulf red	473	Gulf red	473

Table 10.3.4. Recommended color schemes

3.10 DEGREES OF PROTECTION

Degrees of protection shall be provided in accordance with IEC 144 and IEC 529 and be as follows:

- For outdoor applications, IP 55.
- For indoor applications where purpose built accommodation is provided, e.g. switch and control and relay rooms in auxiliary plant buildings, IP 41.
- Where dust can adversely affect equipment within the enclosure, this equipment should be separately housed with a degree of protection of IP 51.

- For indoor applications where the equipment is housed in the same building as that enclosing water and steam operated equipment, the degrees of protection stated in the previous paragraph shall be up-rated to IP 44 and IP 54 respectively.

Where more severe environments exist, e.g. steam and oil vapour or other deleterious chemical environments, special measures will be necessary and the degree of protection required will be specified separately.
The Bidder shall submit a schedule for providing the degree protection to various control boxes, junction boxes etc. for the BHEL/OPTCL's approval.

3.11 RATING PLATES, NAME PLATES AND LABELS

a) All apparatus shall be clearly labelled indicating, where necessary, its purpose and service positions. Each phase of alternating current and each pole of direct current equipment and connections shall be coloured in an approved manner to distinguish phase or polarity.

b) The material of all labels and the dimensions, legend, and method of printing shall be to approval. The surface of indoor labels shall have a matt or satin finish to avoid dazzle from reflected light.

c) Colours shall be permanent and free from fading. Labels mounted on black surfaces shall have white lettering. „Danger" plates shall have red lettering on a white background.

d) All labels and plates for outdoor use shall be of non-corroding material. Where the use of enamelled iron plates is approved, the whole surface including the back and edges, shall be properly covered and resistant to corrosion. Protective washers of suitable material shall be provided front and back on the securing screws.

e) Labels shall be engraved in Hindi, English and Oriya. Name plates shall be white with black engraved lettering and shall carry all the applicable information specified in the applicable items of the Standards.

f) Any other relevant information which may be required for groups of smaller items for which this is not possible e.g. switch bays etc. a common name plate in Oriya with the title and special instructions on it shall be provided.

g) No scratching, corrections or changes will be allowed on name plates.

h) All equipment mounted on front and rear sides as well as equipment mounted inside the panels shall be provided with individual name plates with equipment designation engraved.

i) On the top of each panel on front as well as rear sides large name plates with bold size lettering shall be provided for circuit/ feeder/ cubicle box designation.

j) All front mounted equipment shall be also provided, at the rear, with individual name plates engraved with tag numbers corresponding to the one shown in the panel internal wiring to facilitate tracing of the wiring. The name plates shall be mounted directly by the side of the respective equipment wiring.

k) Name plates of cubicles and panels may be made of non rusting metal or 3 ply lamicoid. These name plates may be black with white engraved lettering.

l) The name plate inscription and size of name plates and letters shall be submitted to the BHEL/OPTCL/ Engineer for approval.

m) The nameplates of the apparatus shall include, at least, the information listed below, together with any other relevant information specified in the applicable standards:
- Concise descriptive title of the equipment
- Rating and circuit diagrams
- Manufacturer's name, trade-mark, model type, serial number
- Instruction book number
- Year of manufacture
- Total weight (for capacitor racks indicate weight, for capacitors indicate quantity of liquid)
- Special instructions, if any, about storage, transportation, handling etc.

n) Each measuring instrument and meter shall be prominently marked with the quantity measured e.g. kV, A, MW etc. All relays and other devices shall be clearly marked with manufacturers name, manufacturer's type, serial number and electrical rating data.

o) Danger plates and plates for phase colours shall be provided as per requirement. The Bidder shall devise a system to designate equipment and sub-systems. The nameplates/labels displaying these designations shall be installed at appropriate locations. Whenever motion or flow of fluids is involved, plates showing direction of motion or flow shall also be provided.

3.12 BOLTS AND NUTS

All bolts, studs, screw threads, pipe threads, bolt heads and nuts shall comply with the appropriate national standards for metric threads, or the technical equivalent.
Except for small wiring, current carrying terminal bolts or studs, for mechanical reasons, shall not be less than 6 mm in diameter.

All nuts and pins shall be adequately locked. 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.

All bolts, nuts and washers placed in outdoor positions shall be treated to prevent corrosion, by hot dip galvanising or electro galvanising to service condition 4. Appropriate precautions shall be taken to prevent electrolytic action between dissimilar metals.

Where bolts are used on external horizontal surfaces where water can collect, methods of preventing the ingress of moisture to the threads shall be provided.

Each bolt or stud shall project at least one thread but not more than three threads through its 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.

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. Taper washers shall be provided where necessary.

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

3.13 GALVANISING:

3.13.1 General

All machining, drilling, welding, engraving, scribing or other manufacturing activities which would damage the final surface treatment shall be completed before the specified surface treatment is carried out.

3.13.2 Galvanising

All metal surfaces shall be subjected to treatment for anti-corrosion protection. All ferrous surfaces for external use shall be hot dip galvanised. High tensile steel nuts, bolts and spring washers shall be electro galvanised to service condition 4. All steel conductors including those used for earthing and grounding (above ground level) shall also be galvanised according to IS 2629.

All galvanising shall be applied by the hot dip process and shall comply with IS 2629, IS 2633, IS 4759, IS 1367 or IS 6745.

All welds shall be de-scaled, all machining carried out and all parts shall be adequately cleaned prior to galvanising. The preparation for galvanising and the galvanising itself shall not adversely affect the mechanical properties of the coated material.

The threads of all galvanised bolts and screwed rods shall be cleared of spelter by spinning or brushing. A die shall not be used for cleaning the threads unless specially approved by the BHEL/OPTCL. All nuts shall be galvanised with the exception of the threads which shall be oiled. Surfaces which are in contact with oil shall not be galvanised or cadmium plated.

Partial immersion of the work will not be permitted and the galvanising tank must therefore be sufficiently large to permit galvanising to be carried out by one immersion.

Galvanising of wires shall be applied by the hot dip process and shall meet the requirements of IS 2141.

The minimum weight of the zinc coating and minimum thickness of coating for outdoor equipment shall be as follows:

a)	For sections & plates above 5mm of thickness	910 gm/sq.m	127 microns
b)	For sections & plates below 5mm of thickness	610 gm/sq.m	87 microns
c)	For surfaces embedded in concrete	800 gm/sq.m.	

The galvanised surfaces shall consist of a continuous and uniform thick coating of zinc, firmly adhering to the surface of steel. The finished surface shall be clean and smooth and shall be free from defects such as discoloured patches, bare spots, unevenness of coating, spelter which is loosely attached to the steel globules, spiky deposits, blistered surface, flaking or peeling off, etc. The presence of any of these defects noticed on visual or microscopic inspection shall render the material liable to rejection.

After galvanising no drilling or welding shall be performed on the galvanised parts of the equipment excepting that nuts may be threaded after galvanising. Sodium dichromate treatment shall be provided to avoid formation of white rust after hot dip galvanisation.

The galvanised steel shall be subjected to six one minute dips in copper sulphate solution as per IS 2633.

Sharp edges with radii less than 2.5 mm shall be able to withstand four immersions of the Standard Preece test. All other coatings shall withstand six immersions. The following galvanising tests should essentially be performed as per relevant Indian Standards.

- Coating thickness
- Uniformity of zinc
- Adhesion test
- Mass of zinc coating

Galvanised material must be transported properly to ensure that galvanised surfaces are not damaged during transit. Application of zinc rich paint at site shall not be allowed.

3.14 CLAMPS AND CONNECTORS INCLUDING TERMINAL CONNECTORS

The terminal connectors shall conform strictly to the requirements if the latest versions of following standards as amended up-to-date, except otherwise,

i)	IS: 5561	Power Connectors
ii)	IS: 617	Aluminium & Aluminium Alloy
iii)	IS: 2629	Recommended Practice for HDG of iron & steel
iv)	IS: 2633	Method of testing uniformity of coating of zinc coated articles

The material of clamps and connectors shall be Aluminium alloy casting conforming to designation A6 of IS: 617 for connecting to equipment terminals and conductors of aluminium. In case the terminals are of copper, the same clamps/connectors shall be used with 4mm thick bimetallic liner.

The material of clamps and connectors shall be Galvanised mild steel for connecting to shield wire.

Bolts, nuts and plain washers shall be hot dip galvanised mild steel for sizes M12 and above. For sizes below M12, they shall be electro-galvanised mild steel. The spring washers shall be electro-galvanised mild steel.

All castings shall be free from blow holes, surface blisters, cracks and cavities. All sharp edges and corners shall be rounded off to meet specified corona and radio interference requirements.

They shall have same current rating as that of the connected equipment. All current carrying parts shall be at least 10 mm thick. The connectors shall be manufactured to have minimum contact resistance.

Flexible connectors, braids or laminated strips shall be made up of copper/aluminium.

Current rating and size of terminal/conductor for which connector is suitable shall be put on a suitable sticker on each component which should last at least till erection time.

3.15 CABLE GLANDS AND LUGS/FERRULES

Cable shall be terminated using double compression type cable glands. Testing requirements of Cable glands shall conform to BS:6121 and gland shall be of robust construction capable of clamping cable and cable armour (for armoured cables) firmly without injury to insulation. Cable glands shall be made of heavy duty brass machine finished and nickel chrome plated. Thickness of plating shall not be less than 10 micron. All washers and hardware shall also be made of brass with nickel chrome plating Rubber components shall be of neoprene or better synthetic material and of tested quality. Cable glands shall be suitable for the sizes of cable supplied/erected.

Cable lugs/ferrules for power cables shall be tinned copper solderless crimping type suitable for aluminium compacted conductor cables. Cable lugs and ferrules for control cables shall be tinned copper type. The cable lugs for control cables shall be provided with insulating sleeve and shall suit the type of terminals provided on the equipment. Cable lugs and ferrule shall conform to DIN standards.

3.16 WIRING, CABLING AND CABLE INSTALLATION

3.16.1 Cubicle wiring

Panels shall be complete with interconnecting wiring between all electrical devices in the panels. External connections shall be achieved through terminal blocks. Where panels are required to be located adjacent to each other all inter panel wiring and connections between the panels shall be carried out internally. The Bidder shall furnish a detailed drawing of such inter panel wiring. The Bidder shall ensure the completeness and correctness of the internal wiring and the proper functioning of the connected equipment.
All wiring shall be carried out with 1.1 kV grade, PVC insulated, single core, stranded copper wires. The PVC shall have oxygen index not less than '29' and Temperature index not less than 250C. The wires shall have annealed copper conductors of adequate size comprise not less than three strands
The minimum cross sectional area of the stranded copper conductor used for internal wiring shall be as follows:

- All circuits excepting CT circuits and energy metering circuit of VT 2.5 sq.mm
- All CT circuits and metering circuit of VT 2.5 sq. mm

All internal wiring shall be supported, neatly arranged, readily accessible and connected to equipment terminals and terminal blocks. Wiring gutters and troughs shall be used for this purpose.
Cubicle connections shall be insulated with PVC to IEC 227. Wires shall not be jointed or teed between terminal points.
Bus wires shall be fully insulated and run separately from one another. Auxiliary bus wiring for AC and DC supplies, voltage transformer circuits, annunciation circuits and other common services shall be provided near the top of the panels running throughout the entire length of the panel suite. Longitudinal troughs extending throughout the full length of panel shall be preferred for inter panel wiring.
All inter connecting wires between adjacent panels shall be brought to a separate set of terminal blocks located near the slots of holes meant for the passage of the interconnecting wires. Interconnection of adjacent panels on site shall be straightforward and simple. The bus wires for this purposes shall be bunched properly inside each panel.
Wire termination shall be made with solderless crimping type and tinned copper lugs which firmly grip the conductor. Insulated sleeves shall be provided at all the wire terminations. Engraved core identification plastic ferrules marked to correspond with panel wiring diagram shall be fitted at both ends of each wire. Ferrules shall fit tightly on the wire and shall not fall off when the wire is disconnected from terminal blocks. Numbers 6 and 9 shall not be included for ferrules purposes unless the ferrules have numbers underscored to enable differentiation. (i.e. 6 and 9).
Fuses and links shall be provided to enable all circuits in a cubicle, except a lighting circuit, to be isolated from the bus wires.
The DC trip and AC voltage supplies and wiring to main protective gear shall be segregated from those for back-up protection and also from protective apparatus for special purposes. Each such group shall be fed through separate fuses from the bus wires. There shall not be more than one set of supplies to the apparatus comprising each group. All wires associated with the tripping circuits shall be provided with red ferrules marked "**Trip**".
It shall be possible to work on small wiring for maintenance or test purposes without making a switchboard dead.
The insulation material shall be suitably coloured in order to distinguish between the relevant phases of the circuit.

When connections rated at 380 volt and above are taken through junction boxes they shall be adequately screened and "**DANGE**R" notices shall be affixed to the outsides of junction boxes or marshalling kiosk.
Where connections to other equipment and supervisory equipment are required the connections shall be grouped together.

3.16.2 LV power cabling

LVAC cable terminals shall be provided with adequately sized, hot pressed, cast or crimp type lugs.
Where sweating sockets are provided they shall be without additional clamping or pinch bolts. Where crimp type lugs are provided they shall be applied with the correct tool and the crimping tool shall be checked regularly for correct calibration. Bi-metallic joints between the terminals and lugs shall be provided where necessary.
Terminals shall be marked with the phase colour in a clear and permanent manner.
A removable gland plate shall be provided by the Bidder. The Bidder shall be responsible for drilling the cable gland plate. ere
Armoured cables shall be provided with suitable glands for terminating the cable armour and shall be provided with an earthing ring and lug to facilitate connection of the gland to the earth bar.

3.17 PRODUCTION PROCESS REQUIREMENTS

3.17.1 CASTINGS

GENERAL

All castings shall be true to pattern, free from defects and of uniform quality and condition. The surfaces of castings which do not undergo machining, shall be free from foundry irregularities. The castings shall be subject to NDT, chemical, mechanical and metallographic tests. Details of the same shall be furnished to BHEL/OPTCLfor review/approval. Magnetic particle inspection (MPI) test, wherever applicable, shall be carried out in longitudinal and transverse direction to detect radial and axial cracks.

IRON CASTINGS

Iron casting material shall be in accordance with ASTM A 126 Class B. A copy of the ladle analysis shall be sent to the BHEL/OPTCL. Each casting shall have a test bar from which tension test specimens may be taken. Test specimen shall be in accordance with ASTM A 370 and tested in accordance with ASTM E8. The Bidder shall submit his procedures for testing and acceptance for iron castings for approval by the BHEL/OPTCL.

STEEL CASTINGS

Steel castings shall be manufactured in accordance with ASTM A 27 and shall be subjected to appropriate tests and inspection as detailed herein.
Copies of mandatory documentation, such as ladle analyses and mechanical test results, shall be sent to the BHEL/OPTCL. (Non-ferrous casting material and castings shall be manufactured in accordance with the appropriate ASTM standards for the material concerned).

3.17.2 FORGINGS

When requested by the BHEL/OPTCL, forgings will be subjected to inspection in the regions of fillets and changes of section by suitable method. Magnetic particle, dye-penetration, radiographic or ultrasonic, or any combination of these methods may be used to suit material type and forging design.
The testing is to be carried out after the rough machining operation and is to be conducted according to the appropriate ASTM standards.
MPI test on forging shall be carried out to detect both radial and axial cracks. Ferrous forgings shall be demagnetised after such tests.

Any indentations which prove to penetrate deeper than 2.5% of the finished thickness of the forging shall be reported to the BHEL/OPTCLgiving location, length, width and depth. Any indentations which will not machine out during final machining shall be gouged out and repaired using an approved repair procedure. Repair of rotating elements by welding will only be accepted subject to detailed examination of the proposal by the BHEL/OPTCLprior to the repair being carried out.
The forging shall be tested for mechanical and metallographic tests as per ASTM. The details shall be mutually discussed/agreed upon.

3.17.3 FABRICATED COMPONENTS

All components machined or fabricated from plate, sheet or bar stock shall meet the material requirements of ASTM or material specification approved by the BHEL/OPTCL.
Structural steel, rolled shapes, bars, etc. shall comply with the latest ASTM for A36.
Plate steel shall be of a designation and quality suitable for the function it is intended to perform. Insofar as it is compatible with its function, it shall comply with ASTM A283 structural quality.
All, or a representative number of such components, shall be subjected to one or more of the following tests: visual, dye penetration, magnetic particle (transverse and longitudinal), ultrasonic or radiographic. These tests shall be in accordance with the recommended practices of the ASTM. The terms of reference for acceptance shall be the applicable ASTM Specifications.

3.17.4 WELDING AND WELDERS QUALIFICATIONS

General

All welding shall be carried out by qualified welders only.

All welding shall be in accordance with the corresponding standards of the American Welding Society or the American Society of Mechanical Engineers.
Other standards to determine the quality of welding process and qualifications of welders may be considered, provided that sufficient information is first submitted for the approval of the BHEL/OPTCL.
Prior to the start of fabrication, the Bidder shall submit to the BHEL/OPTCLfor approval, a description of each of the welding procedures which he proposes to adopt, together with certified copies of reports of the results from tests made in accordance with these procedures.
The Bidder shall be responsible for the quality of the work performed by his welding organisation. All welding operators, to be assigned work, including repair of casting, shall pass the required tests for qualification of welding procedures and operators. The BHEL/OPTCL reserves the right to witness the qualification tests for welding procedures and operators and the mechanical tests at the samples.
The Bidder shall bear all his own expenses in connection with the qualification tests. If the work of any operator at any time appears questionable, such operator will be required to pass appropriate prequalification tests as specified by the Inspector and at the expense of the Bidder.

Welding

All welding shall be performed in accordance with the appropriate standards. The design and construction of welded joints subject to hydraulic pressure shall conform to the applicable requirement of ASME "Boiler and Pressure Vessel Code" shall be qualified in accordance with Section IX of this Code. The design and construction of welded joints not subjected to hydraulic pressure shall, as a minimum, conform to the requirements of AWS "Specification for Welded Highway and Railway Bridge" D2.0. Except for minor parts and items specifically exempted from stress relieving, all shop welded joints shall be stress relieved in accordance with the requirements of the ASME "Boiler and Pressure Vessel Code" Section VIII.
In addition to satisfying the procedural and quality requirements set forth in the applicable code and/or these Specifications, all welding shall meet the following requirements for workmanship and visual quality:

- Butt welds shall be slightly convex, of uniform height and shall have full penetration.
- Fillet welds shall be of the specified size, with full throat and legs of equal length.

- Repairing, chipping and grinding of welds shall be done in a manner which will not gouge, groove or reduce the thickness of the base metal.
- The edges of the member to be joined shall expose sound metal, free from laminations, surface defects caused by shearing or flame-cutting operations or other injurious defects.

Welded joints subject to critical working stress shall be tested by approved methods of non-destructive testing, such as radiographic and ultrasonic examination, magnetic particle and liquid penetration inspection. All expenses in connection with these tests shall be borne by the Bidder. The extent of testing shall be as stipulated by the ASME „Boiler and Pressure Vessel Code", Section VIII, but without prejudice to the rights of the Inspector or the BHEL/OPTCL to ask for additional tests,
The arc-welding process to be used and the welding qualifications of the welders employed on the work shall be used in accordance with AWS requirements and Section VIII and IX of the ASME (American Society of Mechanical Engineers) Code, latest edition, as they may apply. All welding rods shall conform to the requirements of the latest issue of Section It, part C of the ASME Code.
Gas shielded welding (TIG or MIG) used as appropriate for aluminium, stainless steel or other material shall be carried out in accordance with the best commercial practice and the following standard specifications:

- Specifications for copper and copper-alloy welding rods (AWS A5.7, ASTM B259)
- Specification for corrosion-resisting chromium and chromium-nickel steel welding rods and bare electrodes (AWS A5.9, ASTM A371)
- Specifications for aluminium and aluminium alloy rods and bare electrodes (AWS A5.10, ASTM B285).
- Specifications for nickel and nickel-base alloy bare welding filler metal (AWS A5.14, ASTM B304).

Gas welding will not normally be used in the equipment. When a particular equipment manufacture requires the use of gas welding, the proposed process and the welder"s qualification shall be in accordance with AWS B3.0.
Welding of galvanised components will not be allowed in the equipment.
Strict measures of quality control shall be exercised throughout the Equipment/ Works. The BHEL/OPTCL may call for an adequate NDT test of the work of any operator, who in his opinion is not maintaining the standard of workmanship. Should this NDT test prove defective, all work done by that operator, since his last test shall be tested at the Bidder"s expense. If three or more of these tests prove defective, the operator shall be removed from the project.
A procedure for the repair of defects shall be submitted to the BHEL/OPTCL for his approval prior to any repairs being made.

Welding of pipes
Before welding, the ends shall be cleaned by wire brushing, filing or machine grinding. Each weld-run shall be cleaned of slag before the next run is deposited.
Welding at any joint shall be completed uninterrupted. If this cannot be followed for some reason, the weld shall be insulated for slow and uniform cooling.
Welding shall be done by manual oxy-acetylene or manual shielded metal are process. Automatic or semi-automatic welding processes may be done only with the specific approval of BHEL/OPTCL.
As far as possible welding shall be carried out in flat position. If not possible, welding shall be done in a position as close to flat position as possible.
Downward technique is not allowed while welding pipes in horizontal position, unless permitted by the BHEL/OPTCL.
Combination of welding processes or usage of electrodes of different classes or makes in a particular joint shall be allowed only after the welding procedure has been duly qualified and approved by the BHEL/OPTCL.
No backing ring shall be used for circumferential butt welds.
Welding carried out in ambient temperature of 5C or below shall be heat treated.

A spacer wire of proper diameter may be used for weld root opening but must be removed after tack welding and before applying root run.
Tack welding for the alignment of pipe joints shall be done only by qualified welders. Since tack welds form part of final welding, they shall be executed carefully and shall be free from defects. Defective welds shall be removed prior to the welding of joints.
Electrodes size for tack welding shall be selected depending upon the root opening.
Tack welds should be equally spaced.
Root run shall be made with respective electrodes/filler wires. The size of the electrodes shall not be greater than 3.25 mm (10 SWG) and should preferably be 2.3 mm (12 SWG). Welding shall be done with direct current values recommended by the electrode manufacturers.
Upward technique shall be adopted for welding pipes in horizontally fixed position. For pipes with wall thickness less than 3 mm, oxyacetylene welding is recommended.
The root run of butt joints shall be such as to achieve full penetration with the complete fusion of root edges. The weld projection shall not exceed 3 mm inside the pipe.
On completion of each run craters, weld irregularities, slag etc. shall be removed by grinding or chipping.
During the process of welding, all movements, shocks, vibration or stresses shall be carefully avoided in order to prevent weld cracks.
Fillet welds shall be made by shielded metal arc process regardless of thickness and class of piping. Electrode size shall not exceed 10 SWG. (3.25 mm). At least two runs shall be made on socket weld joints.

3.18 QUALITY ASSURANCE

3.18.1 GENERAL

To ensure that the supply and services under the scope of this Contract, whether manufactured or performed within the Bidder's works or at his Sub-Bidder's premises or at Site or at any other place of work are in accordance with the Specification, with the Regulations and with relevant Indian or otherwise Authorized Standards the Bidder shall adopt suitable Quality Assurance Programs and Procedures to ensure that all activities are being controlled as necessary.

The quality assurance arrangements shall conform to the relevant requirements of ISO 9001 or ISO 9002 as appropriate.

Manufacturing Quality Plan will detail out for all the components and equipment, various tests/inspection, to be carried out as per the requirements of this specification and standards mentioned therein and quality practices and procedures followed by Bidder's/ Sub-bidder's/ sub-supplier's Quality Control Organisation, the relevant reference documents and standards, acceptance norms, inspection documents raised etc., during all stages of materials procurement, manufacture, assembly and final testing/performance testing. The Quality Plan shall be submitted on electronic media e.g. E-mail in addition to hard copy, for review. Once the same is finalised, hard copies shall be submitted for approval. After approval the same shall be submitted in compiled form on CD ROM.

The Bidder shall also furnish copies of the reference documents/plant standards/acceptance norms/tests and inspection procedure etc., as referred in Quality Plans along with Quality Plans. These Quality Plans and reference documents/standards etc. will be subject to Employer's approval without which manufacturer shall not proceed.

These approved documents shall form a part of the contract. In these approved Quality Plans, Employer shall identify customer hold points (CHP), i.e. test/checks which shall be carried out in presence of the Employer's Project Manager or his authorised representative and beyond which the work will not proceed without consent of Employer/Authorised representative in writing. All deviations to this specification,

approved quality plans and applicable standards must be documented and referred to Employer along with technical justification for approval and dispositioning.

No material shall be despatched from the manufacturer's works before the same is accepted subsequent to pre-despatch final inspection including verification of records of all previous tests/inspections by Employer's Project Manager/Authorised representative and duly authorised for despatch by issuance of Material Dispatch Clearance Certificate (MDCC).

All material used for equipment manufacture including casting and forging etc. shall be of tested quality as per relevant codes/standards. Details of results of the tests conducted to determine the mechanical properties, chemical analysis and details of heat treatment procedure recommended and actually followed shall be recorded on certificates and time temperature chart. Tests shall be carried out as per applicable material standards and/or agreed details.

For all spares and replacement items, the quality requirements as agreed for the main equipment supply shall be applicable.

Repair/rectification procedures to be adopted to make the job acceptable shall be subject to the approval of the Employer/ authorised representative.

3.18.2 SUB-VENDOR

The Bidder shall ensure that the Quality Assurance requirements of this Specification are followed by any sub-vendor appointed by him under the Contract.
The Bidder shall assess the sub-vendor's Quality Assurance arrangements prior to his appointment to ensure its compliance with the appropriate ISO 9000 standard and the Specification.
Auditing of the sub-vendor's Quality Assurance arrangements shall be carried out by the Bidder and recorded in such a manner that demonstrates to the OPTCL/BHEL the extent of the audits and their effectiveness.

3.18.3 QUALITY ASSURANCE DOCUMENTS

The Bidder shall be required to submit two hard copies and two sets on CDROM of the following Quality Assurance Documents as identified in respective quality plan with tick (√) mark.

Each QA Documentation shall have a project specific Cover Sheet bearing name & identification number of equipment and including an index of its contents with page control on each document.

The QA Documentation file shall be progressively completed by the Supplier's sub-supplier to allow regular reviews by all parties during the manufacturing.

The final quality document will be compiled and issued at the final assembly place of equipment before dispatch. However CD-Rom may be issued not later than three weeks.
Typical contents of Quality Assurance Document are as below:-

i) Quality Plan,
ii) Material mill test reports on components as specified by the specification and approved Quality Plans.
iii) Manufacturer / works test reports/results for testing required as per applicable codes and standard referred in the specification and approved Quality Plans.

iv) Non-destructive examination results /reports including radiography interpretation reports. Sketches/drawings used for indicating the method of traceability of the radiographs to the location on the equipment.
v) Heat Treatment Certificate/Record (Time- temperature Chart)
vi) All the accepted Non-conformance Reports (Major/Minor) / deviation, including complete technical details / repair procedure).
vii) CHP / Inspection reports duly signed by the Inspector of the Employer and Bidder for the agreed Customer Hold Points.
viii) Certificate of Conformance (COC) whoever applicable.
ix) MDCC

Before dispatch/ commissioning of any equipment, the Supplier shall make sure that the corresponding quality document or in the case of protracted phased deliveries, the applicable section of the quality document file is completed. The supplier will then notify the Inspector regarding the readiness of the quality document (or applicable section) for review.

i) If the result of the review carried out by the Inspector of the Quality document (or applicable section) is satisfactory, the Inspector shall stamp the quality document (or applicable section) for release.
ii) If the quality document is unsatisfactory, the Supplier shall endeavour to correct the incompleteness, thus allowing to finalize the quality document (or applicable section) by time compatible with the requirements as per contract documents. When it is done, the quality document (or applicable section) is stamped by the Inspector.
iii) If a decision is made for dispatch, whereas all outstanding actions cannot be readily cleared for the release of the quality document by that time, the supplier shall immediately, upon shipment of the equipment, send a copy of the quality document Review Status signed by the Supplier Representative to the Inspector and notify of the committed date for the completion of all outstanding actions & submission. The Inspector shall stamp the quality document for applicable section when it is effectively completed. The submission of QA documentation package shall not be later than 3 weeks after the dispatch of equipment.

3.18.4 TRANSMISSION OF QUALITY DOCUMENTS

As a general rule, two hard copies of the quality document and Two CD ROMs shall be issued to the Employer on release of QA Documentation by Inspector. One set of quality document shall be forwarded to Corporate Quality Assurance Department and other set to respective Site.
For the particular case of phased deliveries, the complete quality document to the Employer shall be issued not later than 3 weeks after the date of the last delivery similarly as stated above.

3.18.5 INSPECTION, TESTING & INSPECTION CERTIFICATE

i. The word 'Inspector' shall mean the Project Manager and/or his authorised representative and/or an outside inspection agency acting on behalf of the Employer to inspect and examine the materials and workmanship of the works during its manufacture or erection.

ii. The Project Manager or his duly authorised representative and/or an outside inspection agency acting on behalf of the Employer shall have access at all reasonable times to inspect and examine the materials and workmanship of the works during its manufacture or erection and if part of the works is being manufactured or assembled on other premises or works, the Bidder shall obtain for the Project Manager and for his duly authorised representative permission to inspect as if the works were manufactured or assembled on the Bidder's own premises or works.

iii. The Bidder shall give the Project Manager/Inspector fifteen (15) days written notice of any material being ready for testing. Such tests shall be to the Bidder's account except for the expenses of the Inspector's. The Project Manager/Inspector, unless the witnessing of the tests is virtually waived and confirmed in writing, will attend such tests within fifteen (15) days of the date on which the equipment is noticed as being ready for test/inspection failing which the Bidder may proceed with test which shall be deemed to have been made in the inspector's presence and he shall forthwith forward to the inspector duly certified copies of test reports in two (2) copies.

iv. The Project Manager or Inspector shall within fifteen (15) days from the date of inspection as defined herein give notice in writing to the Bidder, or any objection to any drawings and all or any equipment and workmanship which is in his opinion not in accordance with the contract. The Bidder shall give due consideration to such objections and shall either make modifications that may be necessary to meet the said objections or shall inform in writing to the Project Manager/Inspector giving reasons therein, that no modifications are necessary to comply with the contract.

v. When the factory tests have been completed at the Bidder's or sub-bidder's works, the Project Manager /Inspector shall issue a certificate to this effect fifteen (15) days after completion of tests but if the tests are not witnessed by the Project Manager /Inspectors, the certificate shall be issued within fifteen (15) days of the receipt of the Bidder's test certificate by the Project Manager /Inspector. Project Manager /Inspector to issue such a certificate shall not prevent the Bidder from proceeding with the works. The completion of these tests or the issue of the certificates shall not bind the Employer to accept the equipment should it, on further tests after erection be found not to comply with the contract.

vi. In all cases where the contract provides for tests whether at the premises or works of the Bidder or any sub-bidder, the Bidder, except where otherwise specified shall provide free of charge such items as labour, material, electricity, fuel, water, stores, apparatus and instruments as may be reasonably demanded by the Project Manager /Inspector or his authorised representatives to carry out effectively such tests on the equipment in accordance with the Bidder and shall give facilities to the Project Manager/Inspector or to his authorised representative to accomplish testing.

vii. The inspection by Project Manager / Inspector and issue of Inspection Certificate thereon shall in no way limit the liabilities and responsibilities of the Bidder in respect of the agreed Quality Assurance Programme forming a part of the contract.

viii. To facilitate advance planning of inspection in addition to giving inspection notice, the Bidder shall furnish quarterly inspection programme indicating schedule dates of inspection at Customer Hold Point and final inspection stages. Updated quarterly inspection plans will be made for each three consecutive months and shall be furnished before beginning of each calendar month.

ix. All inspection, measuring and test equipment used by bidder shall be calibrated periodically depending on its use and criticality of the test/measurement to be done. The Bidder shall maintain all the relevant records of periodic calibration and instrument identification, and shall produce the same for inspection by NTPC. Wherever asked specifically, the bidder shall re-calibrate the measuring/test equipment in the presence of Project Manager / Inspector.

3.19 TYPE, ROUTINE & ACCEPTANCE TESTS:

The Bidder shall carry out the tests stated in accordance with the conditions of this Specification, without extra charge for such additional tests as in the opinion of the BHEL/OPTCL are necessary to determine that the Contract Works comply with this Specification. The tests shall be carried out generally in accordance

with the relevant IEC"s or IS or equivalent standards. The specific details of testing and inspection are given in the appropriate section of this Specification.

The Bidder shall submit Type Test Reports for all equipment being supplied by him for the BHEL/OPTCL"s approval. The BHEL/OPTCL may also give instruction to carry out Type Tests, routine tests or acceptance tests. Type Test Charges shall be paid as per the rates indicated in the Price Schedules.

All materials used shall be subjected to such routine tests as are customary in the manufacture of the types of plant included in the Contract Works. These materials shall withstand satisfactorily all such tests.

All tests shall be carried out to the satisfaction of the BHEL/OPTCL, in his presence, at such reasonable times as he may require, unless agreed otherwise. Not less than three weeks' notice of all tests shall be given to the BHEL/OPTCL in order that he may be represented if he so desires. As many tests as possible shall be arranged together. Six copies of the Bidder"s test reports and test sheets shall be supplied to the BHEL/OPTCL for approval.
Measuring apparatus shall be approved by the OPTCL/BHEL (Divisional Engr) and if required shall be calibrated at the expense of the Bidder at an approved laboratory.

The Bidder shall be responsible for the proper testing of the work completed or plant or materials supplied by a sub-bidder to the same extent as if the work, plant or materials were completed or supplied by the Bidder himself.

All apparatus, instruments and connections required for the above tests shall be provided by the Bidder, but the BHEL/OPTCL may permit the use for the tests on site, any instruments and apparatus which may be provided permanently on site as part of the contract works conditional upon the Bidder accepting liability for any damage which may be sustained by such equipment during the test.

The bidder shall supply suitable test pieces of all materials as required by the BHEL/OPTCL. If required by the BHEL/OPTCL, test specimens shall be prepared for check testing and forwarded at the expense of the Bidder to an independent testing authority selected by the BHEL/OPTCL.

Any costs incurred by the Employer in connection with inspection and re-testing as a result of a failure of the subject under test, or damage during transport, or erection on site before take-over by the Employer, shall be to the account of the Bidder.

No inspection or lack of inspection or passing by the BHEL/OPTCLof work, plant or materials, whether carried out or supplied by the Bidder or sub-bidder, shall relieve the Bidder from his liability to complete the Contract Works in accordance with the Contract or exonerate him from any of his guarantees.

3.20.1 TYPE TEST REQUIREMENTS FOR EQUIPMENTS OTHER THAN GIS

a) All equipment to be supplied shall be of type tested design. During detail engineering, the bidder shall submit for Owner's approval the reports of all the type tests as listed in this specification and carried out not earlier than ten years prior to the date of techno-commercial bid opening (03-March-2017). These reports should be for the test conducted on the equipment similar to those proposed to be supplied under this contract and the test(s) should have been either conducted at an independent laboratory or should have been witnessed by a Client.
b) However if bidder is not able to submit report of the type test(s) conducted not earlier than ten years prior to the date of techno-commercial bid opening **(11-February-2022),** or in the case of type test report(s) are not found to be meeting the specification requirements, the bidder shall conduct all such

tests under this contract at no additional cost to the owner either at third party lab or in presence of client/ owners representative and submit the reports for approval.

c) All acceptance and routine tests as per the specification and relevant standards shall be carried out. Charges for these shall be deemed to be included in the equipment price.

3.20 PACKAGING & TRANSPORTATION

The Bidder shall be responsible for the packing, loading and transport of the plant and equipment from the place of manufacture, whether this is at his own works or those of any Bidder, to Site, and for off-loading at site.

All apparatus and equipment shall be carefully packed for transport by air, sea, rail and road as necessary and in such a manner that it is protected against tropical climate conditions and transport in rough terrain and cross country road conditions. The method of packing shall provide complete protection to all apparatus and equipment during transport and storage at site in heavy rain. The method of packing shall provide adequate protection to main items of plant and those parts contained within and attached without, for transportation.

Precautions shall be taken to protect parts containing electrical insulation against the ingress of moisture.

All bright parts liable to rust shall receive a coat of anti-rusting composition and shall be suitably protected.

The machined face of all flanges shall be protected by means of a blank disc bolted to each face.

Where appropriate all parts shall be boxed in substantial crates or containers to facilitate handling in a safe and secure manner. Each crate or container shall be marked clearly on the outside of the case to show "TOP" and "BOTTOM" positions with appropriate signs, and where the mass is bearing and the correct position for slings. Each crate or container shall also be marked with the notation of the part or parts contained therein, contract number and port of destination. It shall be the Bidder"s responsibility to dispose of all such packing.

Any damage due to defective or insufficient packing shall be made good by the Bidder at his own expense and within reasonable time when called upon by the BHEL/OPTCL to do so. Four (4) copies of complete packing lists showing the number, size, marks, mass and contents of each package shall be delivered to the BHEL/OPTCL immediately the material is despatched.

The Bidder shall inform himself fully as to all relevant transport facilities and requirements and loading gauges and ensure that the equipment as packed for transport shall conform to these limitations. The Bidder shall also be responsible for verifying the access facilities specified.

The Bidder shall be responsible for all costs of repair or replacement of the equipment, including those incurred by the Employer, arising from damage during transport, off-loading or erection on site, until take-over by the Employer.

The Bidder shall be responsible for the transportation of all loads associated with the contract works and shall take all reasonable steps to prevent any highways or bridges from being damaged by his traffic and shall select routes, choose and use vehicles and restrict and distribute loads so that the risk of damage shall be avoided. The Bidder shall immediately report to the BHEL/OPTCL any claims made against the Bidder arising out of alleged damage to a highway or bridge.

3.21 ENCLOSURES:

1. ANNEXURE – A: SPECIFICATION FOR ELECTRICAL COMPONENTS

NOTE:
Contractor is to be replaced with subcontractor/vendor.

1. MOTORS

1.1 General

All motors shall comply with IEC 34 / IS 335 and dimensions with IEC 72, however they shall be capable of operating continuously under actual service conditions without exceeding the specified temperature rises, determined by resistance, at any frequency between 48 and 51.5Hertz together with any voltage between ±10per cent of the nominal value.

All motors shall be totally enclosed, and if situated in the open they shall be weatherproof and suitable for outdoor working. They shall be provided with a suitable means of drainage to prevent accumulation of water due to condensation and with suitable means of breathing.

Motors operating in an ambient temperature not exceeding 40°C shall have insulation to at least ClassB and preferably ClassF standards. The temperature rise shall be restricted to that associated with ClassB insulation. Where the motor may be appreciably affected by conducted heat the class of insulation shall be to approval.

All motors shall be suitable for direct starting at full voltage.

Motors shall have sealed ball or roller bearings.

The three line connections of AC motors shall be brought out to a terminal box. The terminal arrangement shall be suitable for the reception of aluminium cable. Terminal markings shall be made in a clear and permanent manner and shall comply with IEC 34. A permanently attached diagram or instruction sheet shall be provided giving the connections for the required direction of rotation. All terminal boxes shall be of the totally enclosed type designed to exclude the entry of dust and moisture and sealed from the internal air circuit of the motor. All joints shall be flanged with gaskets of neoprene or other approved material. Natural rubber insulation shall not be used.

Motors rated above 1 kW shall be three phase motors. Where single phase motors are employed the motors shall be grouped so as to form an approximately balanced three phase load.

1.2 Motor control gear

Control gear shall comply with the requirements of IEC292, the control gear being rated according to the duty imposed by the particular application.

Motor contactors shall comply with IEC158 class of intermittent duty 0-3 with type 52 enclosure protection. Apparatus shall be capable of switching the stalled current, and shall have a continuous current rating of at least 50per cent greater than the full load current of the motors they control.

The operating currents of overload trips fitted to motor contactors shall be substantially independent of ambient temperature conditions, including the effect of direct sunlight on the enclosure in which the contactors are installed.

Where small motors are connected in groups, the group protection shall be arranged so that it will operate satisfactorily in the event of a fault occurring on a single motor. The control and protection equipment shall be accommodated in the control cabinet or marshalling kiosk.

Each motor or group of motors shall be provided with control gear for starting and stopping by hand and automatically. Overload and single-phasing protection shall be provided.

2.0 CABLE BOXES

Cable boxes shall be suitable for cables entering from above or below as may be required. They shall be weatherproof, rodent and insect-proof and be complete with all gaskets, compression glands, wiping glands and all associated fittings as may be required to make-off the cables.

Gland plates shall be insulated from the cable boxes and, in the case of single core cables, shall be of non-magnetic or insulating material. If metallic gland plates are used, single core cable glands shall be insulated from the gland plate. Gland plate insulation shall be capable of withstanding a dry high voltage test of 2000volts ac for one minute.

Where cable boxes are provided for three core cables, the sockets on the outer phases shall be inclined towards the centre to minimise opening of the cable cores. Cable sockets shall be supplied under this Contract.

Cable boxes for voltages up to and including 11kV shall be suitable for PVC or XLPE insulated steel wire-armoured PVC served cables. The boxes shall be air insulated and designed to accommodate all the fittings required by the cable manufacturer. Front covers and gland plates shall be removable and a 12mm diameter breathing hole covered with a wire gauze shall be provided.

Cable boxes shall be capable of withstanding on site the cable high voltage test level in accordance with IEC 502.

The drilling of gland plates, supply and fitting of compression glands and connecting up of power cables not included in the Contract scope of work shall be carried out under a separate contract.

Connection of the power cables included in the Contract scope of works shall be carried out under this Contract.

3.0 TERMINAL BOARDS AND TERMINAL BLOCKS

Terminal boards shall be of good quality non-flammable insulating material with a comparative tracking index (CTI) of not less than 500 to IEC112.

Terminal boards shall be spaced not less than 150 mm apart. For relay panels, they shall be mounted at the sides of the cubicle, and set obliquely towards the rear doors to give easy access to termination and to enable ferrule numbers to be read without difficulty.

Studs of stud type terminal boards shall be locked in the base to prevent turning and all connections shall be made on the front of the terminal board using lock nuts or lock washers. Where crimped type termination are provided at least two sets of crimping tools for each size of crimp must be supplied for each installation.

Terminals shall be of the insertion clamp type incorporating captive pressure screws which do not bear directly on the wire but on a serrated clamping plate. The pressure screws shall have an inherent locking feature.

Where connections are to be made between multi-core cables and telephone type multi-pair cables, the terminal blocks shall be of the insulation displacement type and shall have a withdrawable insulated link in order to facilitate isolation (or busy out in the case of the apparatus associated with the telephone system) of the individual circuits. These terminals shall also be provided with facilities for the insertion of test probes on both sides of the link.

All terminations shall be numbered for identification and grouped according to function. Engraved white on black labels shall be provided on the terminal blocks.

Terminals for connections which exceed 110 Volts shall be separated from those of other circuits and shall be fitted with insulating screens and “DANGER” notices.

The use of terminal blocks as junction points for wires which are not required in the associated cubicle shall be avoided wherever practicable.

All termination racks shall have a minimum of 20 per cent spare terminals blocks. At least 20% spare terminals shall be provided on each panel and these spare terminals shall be uniformly distributed on all terminal blocks.

All internal wiring to be connected to external equipments shall terminate on terminal blocks, preferably vertically mounted on the side of each panel. Terminal blocks shall be 650 V grade and have

10A continuous rating. Terminal blocks shall be moulded in one piece, complete with insulated barriers, stud type terminals, washers, nuts and lock nuts. Terminal blocks shall include a white fibre marking strip with clear plastic, slip-on/clip-on terminal covers. Markings on the terminal strips shall correspond to terminal numbers on the wiring diagrams.

Terminal blocks for current transformer and voltage transformer secondary leads shall be provided with test links and isolating facilities. Current transformer secondary leads shall be provided with short circuiting and earthing facilities.

All terminal blocks shall be suitable for terminating on each side, two by 2.5 mm^2 standard copper conductors.

Wherever duplication of a terminal block is necessary it shall be achieved by solid bonding links.

Unless otherwise specified, terminal blocks shall be suitable for connecting the following conductors on each side :

- All CT and VT circuits : Minimum of two 2.5 mm^2 copper stranded.
- AC/DC power supply circuits : One 16 mm^2 aluminium.
- All other circuits : Minimum of one of 2.5 mm^2 copper stranded

There shall be a minimum clearance of 250 mm between the first row of terminal blocks and the associated cable gland plate or panel side wall, as per the terminal block mounting arrangement adopted. Also the clearance between the edges of two rows of terminal blocks shall be minimum of 150 mm.

Arrangement of the terminal block assemblies and the wiring channel within the enclosure shall be such that a row of terminal blocks is run in parallel and close proximity along each side of the wiring duct to provide for convenient attachment of internal panel wiring. The side of the terminal blocks opposite the wiring duct shall be reserved for external cable connections. All adjacent terminal blocks shall also share this field wiring corridor. All wiring shall be provided with adequate support inside the panels to hold it firmly and to enable free and flexible termination without causing strain on terminals.

All necessary cable terminating accessories such as gland plates, supporting clamps and brackets, wiring troughs and gutters etc. including glands and lugs for cable shall be in bidders scope of supply.

4.0 FUSES AND LINKS

Carriers and bases for fuses and links shall be in accordance with IEC 269 and colour coded to permit identification of the circuit rating.

The fuses and links mounted in cubicles for tripping circuits and protective gear test links shall be mounted on the front of the panel. Other links and fuses shall be accommodated within the cubicle or above the cubicle doors. Fuses and links shall be grouped and spaced according to their function in order to facilitate identification.

All incoming circuits in which the voltage exceeds 125V shall be fed through insulated fuses and/or links, the supplies being connected to the bottom terminal. The contacts of the fixed portion of the fuse or link shall be shrouded so that accidental contact with live metal cannot be made when the moving portion is withdrawn.

Main supply fuse links shall be of the high rupturing capacity cartridge type.

Where fuse carriers are mounted vertically the incoming (supply) side shall be the bottom terminal.

Where either fuses or circuit breakers are used it should be ensured that proper discrimination between main and sub-circuits is maintained.

5.0 COMMUNICATIONS CABLES

All cables and wiring shall have copper conductors and PVC insulation and shall comply with IEC 227. Telephone type cables shall comply with IEC 96 and IEC 189.

Cabling and wiring installations shall be arranged to minimise the risk of fire and damage which may be caused in the event of fire.

For telephone type cables conductor wires with a cross sectional area of less than 0.2 mm^2 shall not be used. Where twin or quad make up is required in any cable the cores shall be uniformly twisted and the lays arranged such that crosstalk is reduced to a minimum.

No conductor smaller than 32/0.2mm (1mm^2), or having less than three strands shall be used for interconnecting cabling except in the case of telephone cables. All cables shall have insulation which will withstand the highest temperature to be experienced in service.

Each conductor of a multi-core cable shall be readily identified by a numbered marker tape or, in the case of telephone type cables, colour coded insulation.

The Bidder shall submit full details of all loading on cables and in the case of interposing current transformer connections, the loop resistance of each circuit.

Apparatus cubicles, cabinets, racks and panels shall be provided with gland plates and all necessary equipment for the termination of cables. The Contract Works shall include for the checking, termination and ferruling of the cable cores and their lacing into cable forms and connection to the equipment terminal boards or tag blocks using claw washers. Crimping ferrules shall be used for each conductor.

6.0 MARSHALLING KIOSKS AND CONTROL CABINETS

The bidder shall provide within every bay of the switch yard a bay marshalling kiosk to which all incoming and outgoing connections to and from the associated bay equipment will be run. The terminal blocks within the kiosks shall be grouped together by function and shall be properly labelled and segregated. Transformer and circuit breaker control/marshalling kiosks will be provided under a separate contract, but it shall be the contractor"s responsibility to cable up to the control/marshalling kiosks as provided by the transformer and circuit breaker suppliers. The Contractor shall provide a separate stand alone kiosk for busbar protection CT marshalling and the kiosk shall house the CT shorting and switching relays required for the correct function of the busbar protection scheme.

All outdoor cabinets and kiosks shall be protected in accordance with Class IP55 of IEC 947-1 and shall be insect and rodent proof. The minimum sheet steel thickness for all cubicles, kiosks and panels shall be not less than 2 mm cold rolled or 2.5 mm hot rolled sheet steel. The top of the outdoor boxes/kiosks shall be provided with Aluminium alloy sheets having 2 mm thick with proper sloping for easy discharge of water.

Anti-condensation heaters, 240V AC single phase, shall be provided and shall be controlled by a watertight switch mounted externally. Ventilation louvres shall be provided, suitably lined internally with a mesh screen, and divisions between compartments shall be perforated.

Control cabinets shall be illuminated with a switch operated and fused 240V CFL tube. Control cabinets shall be provided with a switch operated single phase 240V 15A power socket.

All cables shall enter cabinets and kiosks at the base.

Each compartment of all kiosks and cabinets shall be provided with access doors at the front and rear. Doors and access covers shall not be secured by nuts and bolts but shall be fastened with integral handles with provision for locking with a padlock.

Doors for kiosks shall be of the lift off and hinged type and shall be provided with glazed windows of adequate size to facilitate reading of indicators from outside the kiosk. Facilities shall be provided to permit removal of the temperature indicators without the need to pass the capillary tubing and bulb through the various compartments.

Doors and covers under 15kg mass may be of the slide on pattern, but above this mass hinged doors shall be used. Door shall be provided with padlocking facilities.

When three phase connections rated at 380V and above are taken through cabinets or kiosks, the terminal blocks shall be adequately screened, insulated and suitably marked with the phase colour; "DANGER" notices shall be affixed to the terminal blocks and a DANGER notice stating the voltage shall be fixed on the inside and outside of the kiosk or cabinet. Exterior DANGER notices shall be stove enamelled and shall be written in English and Oriya and shall be of an approved class/grade.

A durable copy of the circuit wiring diagram shall be affixed to the back of the kiosk door and labels shall be provided inside each kiosk or box to describe the functions of the various items of equipment.

When the marshalling kiosks are positioned in side the switchyard , flood water shall not ingress in to the marshalling kisok. The contractor/bidder may achieve the same either positioning the marshalling kiosk appropriately or providing adequate water proof arrangement.

CT, CVT & IVT outdoor kiosks shall be of Aluminium alloy sheets having 3mm thickness. It shall have proper slop canopy for easy drainage of water.

7.0 AUXILIARY SWITCHES

With each disconnector, contactor and earthing device, there shall be supplied all necessary auxiliary switches and mechanisms for indication, protection, control, interlocking, supervisory and other services as specified. Not less than four spare auxiliary switches of each type shall be provided.

All auxiliary switches shall be wired up to a suitable terminal board on the fixed portion of the switchgear whether they are in use or not in the first instance, and shall be arranged in the same sequence on all similar items of equipment. Switches shall be provided to interrupt the supply of current to the tripping mechanism of the circuit breakers and latched contactors. All such switches and mechanisms shall be mounted in accessible positions clear of the operating mechanism, and shall be adequately protected.

The contacts of all auxiliary switches shall be strong and be capable of adjustment in relation to the movement of the circuit breaker or other item of equipment. Auxiliary switches and auxiliary circuits shall be capable of carrying a continuous current of 10 Amps.

8.0 MINIATURE OR MOULDED CASE CIRCUIT BREAKERS

Miniature or moulded case circuit breakers (MCB"s or MCCB"s) shall be designed and tested in accordance with IEC 157 and supplementary requirements of this specification. They shall be suitable for use over the full range of expected voltage variation as specified in the Schedules.

MCB"s and MCCB"s shall be suitably rated for both the continuous and short circuit loading of the circuits they are protecting under all service and atmospheric conditions stated in the specification. The bidder shall ensure that correct discrimination is maintained between main and sub-circuits.

For three phase circuits, the miniature circuit breakers shall be of the three pole type; for single phase circuits they shall be of the single pole type and for dc circuits they shall be of the double pole type.

Where miniature circuit breakers are used in circuits containing inductive loads, e.g. operating coils, it is essential that they are suitable for satisfactory operation in the circuit in which they are used, i.e. account is taken of the circuit time constant.

All miniature circuit breakers shall be provided with an auxiliary contact for remote indication of circuit breaker operation.

Means shall be provided to prevent the miniature circuit breakers being inadvertently switched to the „OFF" position.

Miniature circuit breakers shall be mounted in such a manner so as to give easily visible indication of breaker position and shall be grouped and spaced according to their function in order to facilitate identification and easy replacement.

9.0 SPACE HEATERS

Heaters shall be suitably designed to prevent any contact between the heater wire and the air. They shall consist of coiled resistance wire centred in a metal sheath and completely encased in a highly compacted powder of magnesium oxide or other material having equal heat conducting and electrical insulation properties, or they shall consist of resistance wire wound on a ceramic and completely covered with a ceramic material to prevent any contact between the wire and the air.

Alternatively, they may consist of a resistance wire mounted into a tubular ceramic body built into an envelop of stainless steel or the resistance wire wound on a tubular ceramic body and embedded in vitreous glaze. The surface temperature of the heaters shall be restricted to a value which will not shorten the life of the heater sheaths or that of insulated wire or other component in the compartments.

10.0 LVAC CABLES (NOT APPLICABLE)

10.1 General

LVAC power cables shall have aluminium conductors with XLPE insulation, galvanised steel wire armour and PVC oversheath and shall comply with the requirements of IEC 227, 228 and 502 as applicable. Cables shall be sized to carry the highest anticipated load under the worst case ambient conditions. Where a three, three and a half or four core power cable is provided, the cores shall be coloured to distinguish the relevant phases.

All sheaths shall be free from defects and impervious to water.

10.2 1.1kV grade power and control cables

10.2.1 Codes and Standards

The design, manufacture, testing and performance of cables covered under this specification shall comply with latest edition of the standards including amendments as indicated in the relevant schedules attached to this specification.

10.2.2 Technical requirements

The cables shall be suitable for laying in racks, ducts, trenches, conduits and underground buried installation with uncontrolled backfill and chances of flooding by water.

They shall be designed to withstand all mechanical, electrical and thermal stresses under steady state and transient operating conditions. The XLPE insulated LV power cables shall withstand without damage a three phase fault current of at least 45 kA for a minimum of 0.12 seconds, with an initial peak of 105 kA in one of the phases. The armour for XLPE insulated power cables shall be capable of carrying 45 kA for at least 0.12 seconds without exceeding the maximum allowable temperature of PVC outer sheath.

Progressive sequential marking of the length of cable in metres at every one metre shall be provided on the outer sheath of all cables.

Strip wire armouring following method (a) of the relevant IS shall not be accepted for any of the cables. For control cables round wire armouring only shall be used.

Cables shall have outer sheath of a material with an oxygen index of not less than 29 and a temperature index of not less than 250°C.

All the cables shall pass fire resistance test as per IS 1554 (Part-I)

The normal current rating of all PVC insulated cables shall be as per IS 3961.

Repaired cables shall not be accepted.

10.3 LV XLPE power cables

XLPE insulated cables shall conform to IS 7098 (Part-I) and its amendments read along with this Specification. The conductor shall be stranded aluminium circular/sector shaped and compacted. In multi-core cables, the core shall be identified by red, yellow, blue and black coloured strips or colouring of insulation. A distinct inner sheath shall be provided in all multi-core cables even if they are unarmoured. For armoured or unarmoured cables, the inner sheath shall be of extruded PVC to type ST-2 of IS 5831. When armouring is specified for single core cables, the same shall consist of aluminium wires/strips.

10.4 LV XLPE power cables

PVC (70C) insulated 1100V grade power cables shall conform to IS 1554 (Part-I) and its amendments, read along with this Specification and shall be suitable for a steady conductor temperature of 70°C . The conductor shall be stranded aluminium. Insulation shall be extruded PVC to type-A of IS 5831. A distinct inner sheath shall be provided in all multi-core cables. For multi-core armoured cables, the inner sheath shall be of extruded PVC. The outer sheath shall be extruded PVC to Type ST-1 of IS 5831 for all cables.

10.5 LV PVC control cables

The 1100V grade control cables shall conform to IS 1554 (Part-1) and its amendments, read along with this specification. The conductor shall be stranded copper. The insulation shall be extruded PVC to type A of IS 5831. A distinct inner sheath shall be provided in all cables whether armoured or not. The oversheath shall be extruded PVC to type ST-1 of IS 5831 and shall be grey in colour except where specifically advised by the Project Manager to be black.

Cores shall be identified as per IS 1554 (Part-1) for cables up to five cores and for cables with more than five cores the identification of cores shall additionally be done by printing legible alphabets on all cores. The alphabets shall be white and shall be printed at approximately 100 mm intervals along the cable length. Cables without such core identifications will not be accepted.

10.6 Cable drums

Cables shall be supplied non-returnable wooden or steel drums of heavy construction. Wooden drums shall be properly seasoned sound and free from defects. Wood preservative shall be applied to the entire drum.

Standard lengths for each size of power and control cables shall be 500/1000 meters. The cable length per drum shall be subject to a tolerance of plus or minus 5% of the standard drum length. The Project Manager shall have the option of rejecting cable drums with shorter lengths. However, the total quantity of cables after taking into consideration of all cable drums for each size shall be within the tolerance of ± 2%.

A layer of water proof paper shall be applied to the surface of the drums and over the outer most cable layer.

10.7 Tests

All cables shall conform to all type, routine and acceptance tests listed in the relevant IS.

The temperature index tests shall be carried out as per ASTM-D-2863.

All cables shall meet the fire-resistance test as per IS 1554 (Part-I)

10.8 Cable sizes

Following standard sizes of cables shall be considered by Bidder for various power distribution and protection,control and metering purposes in the system:

- XLPE power cables: 1c 630 mm^2, 1c 300 mm^2, 3 $^1/_2$c 300 mm^2. (armoured)
- LV XLPE power cables: (armoured)1c 150 mm^2, 3½ c70 mm^2, 3½c 35 mm^2, 4c 16 mm^2, 4c 6 mm^2, 2c 6 mm^2.
- PVC control cables: 2c 2.5 mm^2, 3c 2.5 mm^2, 5c 2.5 mm^2, 7c 2.5 mm^2, 10c 2.5 mm^2, 14c 2.5 mm^2, 19c 2.5 mm^2, 27c 2.5 mm^2

11.0 BUSHINGS

All bushings shall comply with the requirements of IEC 137 and the associated barrel porcelains shall comply with IEC 233 together with the requirements of this Specification. Provision shall be made for the fitting of arcing horns.

Transformer bushings rated at 66 kV and above shall be either of the oil impregnated paper or resin impregnated type. When filled with transformer oil there shall be no connection with the oil in the transformer and an oil gauge shall be provided. The visible oil levels in the gauge shall correspond to the range of average oil temperatures, from the minimum ambient stated in the Schedules to plus 70C. The oil level at 15C shall be marked. Connections from the main windings to bushings shall be flexible and shall be such that undue mechanical stresses are not imposed on them during assembly on site.

Terminal clamps shall be supplied with each bushing for flexible or rigid busbars as may be required. The material of the clamps shall be as stated in the Schedules.

12.0 BUSHINGS, HOLLOW COLUMN INSULATORS, SUPPORT INSULATORS

Bushings shall be manufactured and tested in accordance with IS 2099 and IEC 137 while hollow column insulators shall be manufactured and tested in accordance with IEC 233/IS 5621. The support insulators shall be manufactured and tested as per IS 2544/IEC 168 and IS 2099/IEC 273. The insulators shall also conform to IEC 815 as applicable.

The bidder may also offer composite silicon insulators conforming to IEC 36.

Support insulators, bushings and hollow column insulators shall be manufactured from high quality porcelain. Porcelain used shall be homogeneous, free from laminations, cavities and other flaws or imperfections that might affect the mechanical or dielectric quality and shall be thoroughly vitrified tough and impervious to moisture.

Glazing of the porcelain shall be uniform brown in colour, free from blisters, burrs and other similar defects.

Support insulators, bushings and hollow column insulators shall be designed to have ample insulation, mechanical strength and rigidity for the conditions under which they will be used.

When operating at normal rated voltage there shall be no electric discharge between the conductors and bushing which would cause corrosion or injury to conductors, insulators or supports by the formation of substances produced by chemical action. No radio interference shall be caused by the insulators or bushings when operating at the normal rated voltage.

Bushing porcelain shall be robust and capable of withstanding the internal pressures likely to occur in service. The design and location of clamps and the shape and the strength of the porcelain flange securing the bushing to the tank shall be such that there is no risk of fracture. All portions of the assembled porcelain enclosures and supports other than gaskets, which may in any way be exposed to the atmosphere shall be composed of completely non hygroscopic material such as metal or glazed porcelain.

All iron parts shall be hot dip galvanised and all joints shall be air tight. Surface of joints shall be trued up, porcelain parts by grinding and metal parts by machining. Insulator and bushing design shall be such as to ensure a uniform compressive pressure on the joints.

12.1 Tests

In accordance with the requirements stipulated above bushing, hollow column insulators and support insulators shall conform to type tests and shall be subjected to routine tests in accordance with IS 2099 and IS 2544.

All routine tests shall be conducted on hollow column insulators as per IEC 233. In addition the following tests shall also be conducted

1. Ultrasonic test as a routine test.
2. Pressure test as a routine test.
3. Bending load test in four directions at 50% specified bending load, as a routine test.
4. Bending load test in four directions at 100% specified bending load, as a sample test on each lot.
5. Burst pressure test as a sample test on each lot.
6. Hollow porcelain insulators should be in one integral piece in green and fired stage. No jointed porcelain will be acceptable.

12.2 Technical parameters of bushings, hollow column insulators and support insulators:

Parameter	420kV	245kV	145kV	36kV
Rated voltage kV	420	245	145	36
Impulse withstand (wet and dry) kVp	±1425	±1050	±650	±170
Switching surge withstand (wet and dry) kVp	±1050			
Power frequency withstand (wet and dry) kVrms	630	460	275	70
Total creepage distance mm	10500	6125	3625	900

Pollution level shall be Class III Heavy as per IEC 71, and as specified in Schedules for all classes of equipment.

Insulators shall also meet the requirements of IEC 815 for 420kV, 245kV and 145kV systems as applicable having alternate long and short sheds.

13.0 CIRCUIT BREAKERS

13.1 General

Circuit breakers shall be of three pole air break design, horizontal draw out type in accordance with IEC 947-2. In particular, evidence shall be provided of the performance when switching currents in the critical current range. They shall be capable of the ratings specified in the Schedules, when mounted in the switchboard.

Circuit breakers shall be fitted with trip-free, spring-operated mechanisms of the independent manually operated type and be provided with making and over current release facilities. A push-button shall be provided to trip the breaker electrically.

The breaker shall be provided with **`OPEN'. `CLOSE', `SERVICE', `TEST'** and **`SPRING CHARGED'** position indicators and shall be provided with the necessary number of auxiliary contacts for interlocking, indication and tripping purposes plus two spare.

Each incoming circuit shall be provided with thermal overload relays and short circuit protection relays; they shall also be provided with an undervoltage relay to trip breaker in the event of a supply failure.

There shall be `**SERVICE**', `**TEST**' and fully withdrawn positions for the breakers. It shall be possible to close the door in „**TEST'** position.

Movement of a circuit breaker between „**SERVICE'** and „**TEST'** positions shall not be possible unless it is in „**OPEN'** position. Attempted withdrawal of a closed circuit breaker shall not trip the circuit breaker.

Closing of a circuit breaker shall not be possible unless it is in „**SERVICE'**, „**TEST'** or fully withdrawn positions.

A breaker of particular rating shall be prevented from insertion in a cubicle of a different rating.

Circuit breakers shall be provided with electrical anti-pumping and trip free feature.

Means shall be provided to slowly close the circuit breaker in withdrawn position if required for inspection and setting of contacts. In service position slow closing shall not be possible.

Circuit breakers shall be provided with the following mechanism as specified in the Bill of Material.

13.2 Power operated mechanism

Power operated mechanism shall be provided with a universal motor suitable for operation 220V DC control supply with voltage variation from 90% to 110% rated voltage. Motor insulation shall be class `E' or better.

The motor shall be such that it requires not more than 30 seconds for fully charging the closing spring.

Once the closing springs are discharged, after the one closing operation of circuit breaker, it shall automatically initiate, recharging of the spring.

The mechanism shall be such that as long as power is available to the motor, a continuous sequence of closing and opening operations shall be possible. After failure of power supply at least one open-close-open operation shall be possible.

Provision shall be made for emergency manual charging and as soon as this manual charging handle is coupled, the motor shall automatically be mechanically decoupled.

All circuit breakers shall be provided with closing and tripping coils. The closing coils shall operate correctly at all values of voltage between 85% to 110% at rated control voltage. Tripping coils shall operate satisfactorily under all values of supply voltage between 70% to 110% of rated control voltage.

Provision for mechanical closing of the breaker only in `**TEST**' and withdrawn positions shall be made.

14.0 RELAYS

All relays and timers in protective circuits shall be flush mounted on panel front with connections from the inside. They shall have transparent dust tight covers removable from the front. All protective relays shall have a drawout construction for easy replacement from the front. They shall either have built-in test facilities, or shall be provided with necessary test blocks and test switches located immediately below each relay. Auxiliary relays and timers may be furnished in non-drawout cases.

All AC relays shall be suitable for operation at 50 Hz with 110 volts VT secondary and 1A or 5A CT secondary.

All protective relays and timers shall have at least two potential free output contacts. Relays shall have contacts as required for protection schemes. Contacts of relays and timers shall be silver faced and shall have a spring action. Adequate numbers of terminals shall be available on the relay cases for applicable relaying schemes.

All protective relays, auxiliary relays and timers shall be provided with hand reset operation indicators (flags) for analysing the cause of operation.

All relays shall withstand a test voltage of 2kV (rms) for one minute.

Motor starters shall be provided with three element, ambient temperature compensated, time lagged, hand reset type terminal overload relays with adjustable settings. The setting ranges shall be properly selected to suit the motor ratings. These relays shall have a separate black coloured hand reset push button mounted on compartment door and shall have at least one changeover contact.

All fuse protected, contactor controlled motors shall have single phasing protection, either as a distinct feature in the overload relays (by differential movement of bi-metallic strips), or as a separate device. The single phasing protection shall operate with 80% of the set current flowing in two of the phases.

15.0 CONTACTORS

Motor starter contactors shall be of air break, electromagnetic type rated for uninterrupted duty as per IS 2959.

Contactors shall be double break, non-gravity type and their main contacts shall be silver faced.

Direct line starter contactors shall be of utilisation category AC2. These contactors shall be as per IS 1822.

Each contactor shall be provided with two normally open (NO) and two normally close (NC) auxiliary contacts.

Operating coils of contactors shall be of 240V AC unless otherwise specified elsewhere. The Contactors shall operate satisfactorily between 85% to 110% of the rated voltage. Contactors shall drop out at 70% of the rated voltage.

16.0 INSTRUMENT TRANSFORMERS

All current and voltage transformers shall be completely encapsulated cast resin insulated type suitable for continuous operation at the temperature prevailing inside the switchgear enclosure, when the switchboard is operating at its rated condition and the outside ambient temperature is 50°C.

All instrument transformers shall be able to withstand the thermal and mechanical stresses resulting from the maximum short circuit and momentary current ratings of the associated switchgear.

All instrument transformer shall have clear indelible polarity markings. All secondary terminals shall be wired to a separate terminal on an accessible terminal block where star-point formation and earthing shall be done.

Current transformers may be multi or single core type. All voltage transformers shall be single phase type. Busbar VT"s shall be housed in a separate compartment.

All VT"s shall have readily accessible HRC current limiting fuses on both primary and secondary sides.

17.0 INDICATING INSTRUMENTS

All indicating and integrating meters shall be flush mounted on panel front. The instruments shall be of at least 96 mm square size with 90 degree scales, and shall have an accuracy class of 2.5 or better. The covers and cases of instruments and meters shall provide a dust and vermin proof construction.

All instruments shall be compensated for temperature errors and factory calibrated to directly read the primary quantities. Means shall be provided for zero adjustment without removing or dismantling the instruments.

All instruments shall have white dials with black numerals and lettering. Black knife edge pointer with parallax free dials will be preferred.

Ammeters provided on motor feeders shall have a compressed scale at the upper current region to cover the starting current.

Watt-hour meters shall be of three phase, three element type. Maximum demand indicators need not be provided.

18.0 CONTROL AND SELECTOR SWITCHES

Control and instrument switches shall be rotary operated type with escutcheon plates clearly marked to show the function and positions. Switches shall be suitable for flush mounting with only switch front plate and operating handle projecting from the panel front. Switches shall be of sturdy construction suitable for mounting on panel front. Switches with shrouding of live parts and sealing of contacts against dust ingress shall be preferred. Handles of different shapes along with suitable inscriptions on switches shall be provided as an aid to switch identification. The selection of operating handles for the different types of switches shall be as follows :

Switch Type	Application	Specification
Switchgear control switches	For closing and opening of breakers and isolators.	Pistol grip, black, three position type.
Synchronising switches	For synchronising check bypass facilities	Oval, black, keyed (common removable handle, or with locking facility and common key).
Selector switches	Auto, manual, local, remote and test facilities	Oval or knob, black
Instrument switches	Phase or meter selection	Round, knurled, black
Protection transfer switch	Transfer of protection.	Pistol grip, lockable and black.

TABLE 18.1 Switch operating handles

The control switches of breakers and isolators shall be of spring return to neutral type. The control springs shall be strong and robust enough to prevent inadvertent operation due to light touch. The spring return type switch shall have spring return from close and trip positions to "after close" and "after trip" positions respectively. They shall have at least two (2) contacts closing in close positions, and two (2) contacts closing in Trip positions unless specified otherwise.

Circuit breaker selector switches for breaker controlled motors shall have three stay put positions marked „**AUTO'**, „**MANUAL'** and „**TEST'** respectively. They shall have two contacts each of three positions and shall have black, pistol grip handles.

Instrument selection switches shall be of maintained contact stayput type. Ammeter selection switches shall have make-before-break type contacts so as to prevent open circuiting of CT secondaries when changing the position of the switch. Voltmeter transfer switches for AC shall be suitable for reading all line-to-line and line-to-neutral voltages for non effectively earthed systems, and for reading all line to line voltages for effectively earthed systems. Ammeter and voltmeter selector switches shall have four stayput positions with an adequate number of contacts for three phase four wire systems. These shall have black oval handles

Synchronising switches shall be of maintained contact stayput type having a common removable handle for a group of switches. The handle shall be removable only in the „**OFF'** position and it shall be co-ordinated to fit in to all the synchronising switches. These switches shall be arranged to connect the synchronising equipment when turned to the „**ON**" position. One contact of each switch shall be connected in the closing circuit of the respective breaker so that the breaker cannot be closed until the switch is turned to the „**ON**" position.

Lockable type switches which can be locked in particular positions shall be provided when specified. The key locks shall be fitted on the operating handles.

The contacts of all switches shall preferably open and close with snap action to minimise arcing. Contacts of switches shall be spring assisted and contact faces shall be with rivets of pure silver or silver alloy. Springs shall not be used as current carrying parts.

The contact combination and their operation shall be such as to give completeness to the interlocking and function of the scheme. The contact rating of the switches shall be as follows :

	Contact rating in Amps		
Description	**220V DC**	**50V DC**	**240V AC**
Make and carry continuously	10A	10A	10A
Make and carry Make and carry for 0.5 sec.	30A	30A	30A
Break			
Resistive load	3A	20A	7A
Inductive Load with L/R=40ms	0.2A	—	—

TABLE 18.2 Contact ratings of switches

19.0 AIR BREAK SWITCHES

Air breaker switches shall be of the heavy duty, single throw group operated, load break, fault make type complying with IS 4064.

The Bidder shall ensure that all switches are adequately rated so as to be fully protected by the associated fuses during all abnormal operating conditions such as overload, locked motor, short circuit etc.

Switch operating handles shall be provided with padlocking facilities to lock them in `OFF' position.

Interlocks shall be provided such that it is possible to open the cubicle door only when the switch is in `OFF' position and to close the switch only when the door is closed. However suitable means shall be provided to intentionally defeat the interlocks explained above.

Switches and fuses for AC/DC control supply and heater supply wherever required shall be mounted inside and cubicles.

20.0 PUSH BUTTONS

Push-buttons shall be of spring return, push to actuate type. Their contacts shall be rated to make, continuously carry and break 10A at 240V and 0.5A (inductive) at 220V DC.

All push-buttons shall have one normally open and one normally closed contact, unless specified otherwise. The contact faces shall be of silver or silver alloy.

All push-buttons shall be provided with integral escutcheon plates marked with the appropriate function.

The colour of the button shall be as follows :

GREEN : For motor **START**, breaker **CLOSE,** valve /damper **OPEN**

RED : For motor **TRIP**, breaker **OPEN,** valve /damper **CLOSE**

BLACK : For overload reset, all annunciator and miscellaneous functions.

All push-buttons on panels shall be located in such a way that red push buttons shall always be to the left of green push buttons.

21.0 INDICATING LAMPS

Indicating lamps shall be of the panel mounting filament type and low watt consumption. Lamps shall be provided with series resistors, preferably built-in the lamps assembly. The lamps shall have

escutcheon plates marked with its function, wherever necessary. Lamps shall have translucent lamp covers of colours appropriate to the application as indicated in Table 21.1

Colour	Indication
RED	For motor **ON**, breaker/isolator **CLOSED**, valve/damper **OPEN**
GREEN	For motor **OFF**, breaker /isolator **OPEN**, valve/damper **CLOSE**
WHITE	For motor **Auto-Trip**
BLUE	For all healthy conditions (e.g. control supply) and also for **'SPRING CHARGED"**
AMBER	For all alarm conditions (e.g. overload) Also for `**SERVICE**' and `**TEST**' positions indicators.

TABLE 21.1 Indicating lamp colours

Indication lamps should be located just above the associated push buttons/control switches. Red lamps shall invariable be located to the right of green lamps. In case a white lamp is also provided, it shall be placed between the red and green lamps along with the centre line of control switch/push button pair. Blue and amber lamps should normally be located above the red and green lamps.

When associated with push-buttons, red lamps shall be directly above the green push button, and green lamps shall be directly above the red push-button.

The wattage and resistance of the lamps shall be as follows:

- 220/250V 5 - 10W 4000 - 8000 ohms
- 110V 5 - 10W 1000 - 2000 ohms

Neon indicating lamps or LED"s shall be provided when specified. The wattage of the neon lamp shall be 0.25 to 0.5W.

Bulbs and lenses shall be interchangeable and easily replaceable from the front of the panel. Tools, if required for replacing the bulbs and lenses shall also be included in the scope of supply.

All indicating lamps shall be suitable for continuous operation at 90 to 110% of their rated voltage.

22.0 FUSES

All fuses shall be of HRC cartridge fuse link type. Screw type fuses shall not be accepted. Fuses for AC circuits shall be of Class 2 type, 20kA (RMS) breaking current at 415V AC, and for DC circuits Class 1 type 4kA breaking current.

Fuses shall have visible operation indicators.

Fuses shall be mounted on fuse carriers, which are mounted on fuse bases. Wherever it is not possible to mount fuses on carriers, they shall be directly mounted on plug in type bases. In such cases one set of insulated fuse pulling handles shall be supplied with each switchgear.

Fuse ratings shall be chosen by the bidder depending upon the circuit requirements and these shall be subject to approval of Project Manager.

23.0 NAME PLATES AND LABELS

All switchgears and ACDC distribution boards etc. shall be provided with prominent, engraved identification plates. The module identification plate shall clearly give the feeder number and feeder designation. For single front switchboards, similar panel and board identification labels shall be provided at the rear also. Language shall coform to the requirements stipulated elsewhere in the technical specification..

All name plates shall be of non-rusting metal or 3-ply lamicoid with white engraved lettering on black back ground. Inscriptions and lettering sizes shall be subject to Project Manager"s approval.

Suitable plastic sticker labels shall be provided for easy identification of all equipment, located inside the panel or module. These labels shall be positioned so as to be clearly visible and shall give the device number as mentioned in the module wiring drawings.

24.0 ELECTRIC MOTORS (LV)

24.1 Codes and Standards

All motors shall conform to the latest revisions of the relevant IEC, Indian Standards, British Standards given in the schedules, except where modified or supplemented by this Specification.

The design, manufacture, installation and performance of motors shall conform to the provisions of latest Indian Electricity Act and Indian Electricity Rules. Nothing in these specifications shall be construed to relieve the bidder of his responsibility in this regard.

In case of contradiction between this specification and IS or BS or IEC, the stipulations on this specification shall prevail.

National Electrical Code for Hazardous locations and relevant NEMA standard shall also be applicable for motors located in hazardous location.

24.2 Service conditions and temperature rise

Unless otherwise specified, machines shall be designed for a maximum ambient air temperature of 50C. Accordingly the temperature rise of the stator winding by resistance method over the ambient air temperature shall not exceed 70C.

For applications where the motor temperatures may be appreciably affected by conducted or radiated heat, the amount of heat must be specified by the bidder and the appropriate temperature rises agreed.

24.3 AC Motors

24.3.1 General

All AC motors shall be of squirrel cage type, unless otherwise specified and shall be suitable for direct on line starting.

Each motor shall be assigned a maximum continuous rating (MCR) corresponding to 70C temperature. Maximum continuous motor rating shall be at least ten percent above the maximum load demand of the driven equipment at designed capacity.

Rated voltage for AC motors shall be as given below for various MCR"s of the motor, unless specified otherwise:

- From 0.2 kW to 220 kW 415 V, three phase, 50 Hz
- Below 0.2 kW 240 V, single phase, 50 Hz

Voltage and frequency variations shall be as per clause 3.3 of IS 325.

The lowest voltage at the motor terminals throughout the starting period, with which the driven equipment shall satisfactorily start up even under the most arduous conditions specified, shall be 85% for motors rated up to 110 kW, and 80% for motors rated above.

The accelerating torque at any speed with the lowest starting voltage shall be at least ten (10) percent of rated full load torque of the motor.

The motors shall be suitable for two starts in succession under the specified conditions of load, torque and inertia, with the motor initially at its normal running temperature.

The ratio of locked rotor kVA at rated voltage to rated kW (MCR corresponding to 70C temperature rises) shall not exceed the following (without any further tolerance):

Motor MCR kW	Start kVA/Rated kW
Up to 110kW	1.0
Above 110kW	10.0

When tests to determine the breakaway starting current of cage induction motors are taken at reduced voltage, due allowance shall be made for the effect of saturation. The estimated value of breakaway starting current at rated voltage shall be given on all test certificates.

All motors shall be so designed that the maximum inrush currents and locked rotor and pull out torque, developed by them at 110% of the rated voltage, do not endanger the motor or the driven equipment.

The pull out torque at rated voltage shall not be less than 200 percent of the full load torque.

Motors for reciprocating compressors etc. shall be specially designed/rated to withstand the torque pulsation produced by the driven equipment.

24.3.2 Transient recovery

The motors shall be capable of resuming normal operation after a system disturbance causing temporary loss of supply voltage for periods of up to 0.2 second (fault clearance time), followed by sudden restoration to 70 percent rated voltage. From this voltage the motors shall be capable of acceleration and ultimate recovery under the most arduous load conditions.

24.4 DC Motors

DC motors shall comply with IS 4722 and shall be shunt wound type rated for 220V. Motor MCR kW rating at 50C ambient shall be at least ten percent higher than the power requirement of the driven equipment under the most onerous operating conditions foreseen during the plant's life.

DC motors which are to operate from batteries shall be capable of operating continuously under actual service conditions at any voltage between 190V and 240V.

DC motors supplied from rectifier equipment connected to AC power supplies shall meet the voltage and frequency variations specified for AC motors.

Rectifier equipment shall be capable of meeting the condition of transient recovery given above for AC motors and shall be provided with the necessary current limiting devices.

The pull-out torque of DC motors at the rated voltage shall not be less than 200 percent of the full load torque.

24.5 Enclosure and method of cooling

The following types of enclosure may be supplied:

- Totally enclosed, fan ventilated.
- Totally enclosed, closed air circuit, integral heat exchanger.
- Totally enclosed, closed air circuit, machine mounted heat exchanger.

In all cases protective enclosure and method of cooling of motors shall be IP 54 and IC 0141 in accordance with IS 4691 and IS 6362 respectively.

Cooling fans shall be directly driven from the motor shaft.

Motors situated outdoors or exposed to the weather shall be weather protected (IPW-55).

All totally enclosed type of motors shall have a dust tight construction with suitable means of breathing and of drainage to prevent accumulation of water from condensation. Drain holes shall exclude bodies greater than 6 mm diameter.

24.6 Constructional features

All components shall be of adequate mechanical strength and robustness and shall be constructed of metal unless otherwise approved. Glass fibre or plastic components, where employed, shall be of adequate design and robustness taking into account the conditions of service required and the effects of operating temperatures, ageing and thermal stability of the material. The material shall be resistant to flame propagation.

Rotors shall be so designed as to keep the combined critical speeds with the driven equipment away from the running speed by at least 20%.

Motors and their major components such as stators, rotors, terminal boxes, bearings and heat exchangers shall be designed to be readily interchangeable as integral units.

All motor rotors shall be dynamically balanced.

The enclosures shall be designed to provide an effective sealing between the primary and secondary air circuits.

The radial air gap between stator and rotor shall have an adequate margin to minimise the possibility of rubbing between the stator and rotor due to eccentric positioning, play and wear, shaft deflection due to rotor weight and unbalanced magnetic pull etc. The minimum radial air gap for all motors shall be in accordance with Clause 5.1.5 of IS 6381.

All requirements of clause 5.1.4 of IS 6381 shall also be complied with.

All the induction motors shall be capable of running at 75% of rated voltage for a period of 5 minutes.

Induction motors shall be designed to be capable of withstanding the voltage and torque stresses developed due to the difference between motor residual voltage and incoming supply voltage equal to 150% of the rated motor voltage during fast changeover of buses. The necessary features incorporated in the design to comply with this requirement shall be clearly indicated in this proposal.

24.7 Variable speed motors

Variable speed motors shall be such that the speed can be continuously adjusted over the required range. The speed control gear shall be provided with an interlock to ensure that the motor can only be started when its control sequence is at the correct setting. When the motor is switched off, the speed control sequence shall automatically return to this position.

24.8 Brush gear, commutators and slip-rings

Brush gear, commutators and slip-rings shall be designed to operate without injurious sparking and to run for at least three months without the need for adjustment or replacement of brushes.

Brushes shall be of electro graphite or metal graphite type. Adequate precautions shall be taken to protect the windings, commutators, slip-rings and brush gear against deposits of entrained carbon dust.

Removable covers shall be fitted to provide access to the brush gear, commutators and slip-rings. For totally enclosed type motors, windows shall be provided to permit observation of the brush gear whilst the motor is running.

Brush holders shall be of non-ferrous materials and located securely to accurately position the brushes on the commutator. Means for adjusting brush pressure and brush assembly shall be provided.

24.9 Internal electric heaters

Internal electric heaters shall be provided on motors rated above 30 kW, to maintain the windings in a dry condition during periods of standstill. The heater shall be suitable for use on a 240V, 50 Hz, AC supply.

24.10 Lifting facilities

All heavy parts of the motors shall be provided with adequate arrangements for lifting or handling during erection or overhaul.

All material used for equipment construction including castings and forging etc. shall be of tested quality as per relevant codes and standards. No welding shall be carried out on cast iron components for repair or any other purpose.

24.11 Winding and insulation

Winding insulation shall be of class B or better and of proven high quality and reliability.

All winding insulation shall be non-hygroscopic, oil resistant and of materials resistant to flame propagation. All windings shall be impregnated and suitably processed to effectively seal them to prevent deterioration from adverse environmental conditions at site during the installation period and also during normal operation.

All winding overhangs and leads shall be adequately supported, braced and blocked to provide sufficient rigidity during all normal conditions of service.

Cage windings and all joints shall be designed to give an adequate safety factor on fatigue due to thermal and mechanical stresses, taking into account the specified starting and running conditions. The short-circuiting and rings shall be of joint less construction. All electrical joints and connections shall be of brazed or welded construction.

Motors shall be designed to give a life endurance of at least 18000 starts.

24.12 Bearings

Bearings shall be of rolling type. Vertical motors shall normally have rolling type guide and thrust bearings.

Bearings shall be designed to prevent ingress of dust and water and shall be sealed against leakage of lubricant along the shaft.

When the motor shaft is not located axially by its own bearings, it shall be permanently marked to indicate its normal running position and the extent of float in either direction.

Bearings shall comply with the relevant Indian or International Standards. The bearing housing shall be correctly packed with lithium based grease at the time of assembly. Construction shall be such that the bearings can be dismantled without risk of damage.

For direct drives, bearings shall have an expected life of at least 40,000 running hours. For motors with significant external radial or axial loads, e.g. belt drives, bearing shall have a life of at least 15000 running hours. The bearing assembly shall be provided with a grease relief device to eject any surplus grease in to a separate container.

Lubrication shall be possible without removal of the guarding. All grease nipples, oil cups and dip sticks shall be readily accessible.

24.13 Heat exchangers

An adequate margin shall be included in the design of heat exchangers to allow for fouling of cooling tubes or ducts under service conditions. Provision shall be made for the easy cleaning of the cooling tubes or ducts, preferably on load.

The cooling tubes or ducts shall be adequately braced and supported to prevent vibration and premature fatigue or fracture.

24.14 Noise level

Noise levels shall comply with BS 4999, Part-51.

24.15 Vibration level

The double amplitude of vibrations as measured at motor bearings shall be within the limits specified in IS 4729, and the limits specified for the driven equipment.

24.16 Earthing terminals

Two independent earthing points shall be provided in accordance with IS 3043(1966), on opposite sides of the motor for bolted connection of Employer's earthing conductor.

24.17 Terminal boxes and associated fittings

Terminal boxes for motors rated above 110 kW shall be capable of withstanding a system fault level of 31 MVA for 0.12 seconds.

Unless otherwise approved, the terminal box shall be capable of being turned through 360 degrees in steps of 90 degrees.

415 volt terminals shall be suitable for receiving 1.1 kV grade PVC or XLPE, unarmoured or armoured power cables.

Only three line terminals need be brought out from each three phase primary winding. All inter phase connections whether star or delta shall be made inside the machine.

Marking of all terminals shall be in accordance with IS 4728.

Leads from terminals to the windings shall be adequately sized and braced to withstand heating and forces produced by maximum fault current.

Cable boxes and terminations shall be designed to enable easy disconnection and replacement of cables.

All joints other than those on cable glands shall be gasketted with neoprene, neoprene bonded cork or other approved material.

For single core cables, gland plates shall be effectively non-magnetic.

The following shall be supplied along with each motor :

1. Crimping type tinned copper lugs for power cables, with all necessary hardware.
2. Compression type tinned brass cable glands for power cables (to be supplied loose).
3. Removable type undrilled gland plate.
4. Terminal boxes shall of weather proof construction with a degree of protection of IP-55. At least one motor of each batch shall be type tested to comply with the following : the terminal boxes shall be subject to an internal air pressure of 0.207 bar g for 12 hours. After this period the pressure shall not be less than 0.104 bar g (after correcting for any change in temperature).

24.18 Rating plate

In addition to the requirements as called for in General Technical Clauses and relevant IS, the rating plate shall indicate the following:

- Maximum continuous rating in kW for 70C temperature rise.
- Bearing identification numbers (in case of ball or roller bearings) and recommended lubricant.

24.19 Paint and finish

All external parts shall be finished and painted to produce a neat and durable surface which would prevent rusting and corrosion. The equipment shall be thoroughly degreased, and sharp edges and scales removed and treated with one coat of primer and two coats of grey enamel paint. Motor colour codes shall comply with the requirements indicated elsewhere in this Specification.

All fasteners used in the construction of the equipment shall be either of corrosion resistant material or electro galvanised to service condition 4. Current carrying fasteners shall be either of stainless steel or high tensile brass or copper.

24.20 Tests

Induction motors shall be subjected to the following routine and type tests.

24.20.1 Routine Tests

Visual Checks of the following:

- Marking on rating plates
- Appearance and painting
- Location and details of terminal boxes and accessories.
- In order to observe compliance to degree of protection, following test will be performed. It shall not be possible to insert a feeler gauge of 1 mm thick in the enclosure or flange faces.

Dimensional checks

Measurement of Insulation Resistance (IR) of windings, and space heaters.

Measurement of winding resistance, and space heater resistance at ambient temperature.

High voltage test on main windings, and space heaters.

IR measurement after HV test in main windings, and space heaters.

No load running test (reading of current, voltage input and speed measurement).

Measurement of bearing temperature during steady state conditions.

Vibration measurement at rated speed and rated voltage, also measurement of vibration during coasting down.

Reduced voltage running test at no load

Locked rotor test.

Phase sequence polarity check and check for terminal markings.

Over speed test

Measurement of air gap

Functional check on auxiliaries

24.20.2 Type Tests

All tests as listed under routine tests

Measurement of noise at no load

Locked rotor test - measurement of VA power input

Momentary overload test

Temperature rise test at rated conditions as well as at maximum input conditions (during heat run test, measurement of bearing temperature, winding temperature, core temperature, coolant flow and coolant temperature). In case the temperature rise test is carried at other load than rated load, specified approval for the test method and procedure shall be obtained from the Project Manager.

Degree of protection test for the enclosure followed by IR, HV and no load run test.

Terminal box - fault level withstand test and pressure test.

Pull out torque measurement

Measurement of no-load starting time.

24.20.3 DC motors

DC motors shall be subjected to all routine and type tests as per IS 4722. In addition, following tests shall be carried out:

- Noise level measurement as type test.
- Vibration measurement as routine test
- Degree of protection test as per IS 4691 as type test.

24.21 Junction boxes and cables

Design and selection of all the components shall be made with a good margin of safety factor.

The equipment shall be installed indoor.

The reference ambient temperature outside the equipment shall be taken as 50C and relative humidity as 100%.

25.0 JUNCTION BOXES

25.1 Construction

Bidder shall supply and install junction boxes complete with terminals as required.

Junction boxes shall be suitable for mounting on walls, columns, structures etc. The brackets, bolts, nuts, cable-glands, screws and all other accessories required for the erection shall be included in the Bidders scope.

Junction boxes shall be of square or rectangular type of 2.0 mm CRCA sheet steel and shall have bolted cover with good quality gasket lining.

Junction box and covers shall be hot dip galvanised.

All the terminals blocks of ESSEN make or equivalent shall be rated for 1100V and shall be of stud type. Each terminal shall be suitable for connecting two 2.5 mm^2 copper conductor.

All terminals shall be complete with insulated barriers, terminals studs, washers, nuts, locknuts, identification strips etc.

Junction boxes located inside shall have IP-54 protection as per IS 2147. Junction boxes located outside shall have IP-55 protection as per IS 2147.

Junction boxes shall be provided with one earthing terminal suitable for galvanised steel conductor.

The general arrangement, cross sectional details and other technical details are to be submitted in the form of drawing for Project Manager‟s approval.

25.2 Interconnecting cables

All cables between junction box and field devices shall be stranded copper conductor, PVC insulated, extruded PVC inner sheathed, single galvanised steel wire armoured and overall PVC sheathed 1.1 kV grade and shall conform to IS 1554. The minimum size of cable used shall be 2.5 mm^2 copper conductor. All cables shall be supplied by the Contractor.

26.0 CONDUIT AND CONDUIT ACCESSORIES

The bidder shall supply and install all rigid steel conduit, flexible conduits, Hume pipes etc. complete with accessories such as tees, bends, adaptors and couplings as required for cabling work between various field devices to junction boxes.

Contents

ANNEXURE-A: Compliance Certificate of Technical Specification

The bidder shall confirm compliance to the following by signing and stamping this compliance certificate and furnishing same with the offer.

1. The scope of supply, technical details, construction features, design parameters etc. shall be as per technical specification & there are no exclusion/ deviation with regard to same.

2. There are no deviation(s) with respect to specification other than those furnished in the schedule of deviations.

3. Only those technical submittals which are specifically asked for in Notice Inviting Tender (NIT) to be submitted at tender stage shall be considered as part of offer. Any other submission, even if made, shall not be considered as part of technical offer.

4. Any comments/ clarifications on technical/ inspection requirements furnished as part of bidder's covering letter shall not be considered by BHEL, and bidder's offer shall be construed to be in conformance with the specification.

5. Any changes made by the bidder in the price schedule with respect to the description/ quantities from those given in 'BOQ' of the specification shall not be considered (i.e., technical description & quantities as per the specification shall prevail).

Date: Bidder's Stamp & Signature

ANNEXURE-B: Deviation(s) of Technical Specification

Bidder shall list out all technical potential deviation/ change request (s) along with clause with respect to technical specifications.

Sl. No.	Page No.	Clause No.	Deviation	Reason/ Justification(s)

Any deviation not specifically brought out in this section shall not be admissible for any commercial implication at later stage. Except to the technical deviations listed in this schedule, bidder's offer shall be considered in full compliance to the tender specifications irrespective of any such deviation indicated / taken elsewhere in the submitted offer.

Date: Bidder's Stamp & Signature

ANNEXURE-C: Technical Checklist

Sl. No.	Particulars	Confirmation by Bidder	
1	**Technical Qualifying Requirement**		
1.1	The bidder to furnish relevant documents for meeting the qualifying requirement. Performance certificates shall be submitted in English. Translated pages should be attested by the ultimate customer, if attested only by the bidder it shall be notarized.	Confirmed	Yes/ No
1.2	The bidder's scope includes supply and services such as Supervision of installation, Testing and commissioning.	Confirmed	Yes/ No
2	**Un-priced BOQ**		
2.1	Confirm that all items have been quoted separately. (If any item has not been quoted, the same shall be specifically brought out with technical reasons thereof. Record the same in schedule of technical deviations.	Confirmed	Yes/ No
3	**Technical**		
3.1	Catalogues, indicative OGA of the offered equipment is attached.	Confirmed	Yes/ No
3.2	Minimum Number of auxiliary contacts on each isolator - besides requirement of this spec. The bidder shall wire up 12 NO +12 NC to Terminal Block (reversible) for purchaser 's use.	Confirmed	Yes/ No
3.3	Minimum Number of auxiliary contacts on each earthing switch - besides requirement of this spec. The bidder shall wire up 10 NO +10 NC to Terminal Block for purchaser 's use shall be provided.	Confirmed	Yes/ No
3.4	LED light is to be provided with each marshalling box/ drive unit of isolator & earth switch as per technical requirement (min. 7 watt)	Confirmed	Yes/ No
3.5	Bidder to provide flexible Copper Braid for Earthing System for Isolator and earth switch MOM Box (2 number per box), size equivalent to 75X10 mm GS flat	Confirmed	Yes/ No
3.6	TB's for (for incoming AC Power Cables) shall be suitable for size 4Cx16 Sqmm Al (minimum).	Confirmed	Yes/ No
4	**Technical Deviations**		
4.1	Confirm that the Complete systems have been offered as per the requirements of Technical Specification and Technical Deviation sheet has been submitted. Deviations mentioned	Confirmed	Yes/ No

	elsewhere in the bid shall not be considered.		
5	**Guaranteed Technical Particulars**		
5.1	All equipment being supplied shall conform to Guaranteed Technical Particulars as per technical specification and applicable IS/ IEC.	Confirmed	Yes/ No
6	**Type Tests Requirements**		
6.1	All equipment being supplied shall conform to type tests as per technical specification and shall be subject to routine tests in accordance with requirements stipulated under respective sections.	Confirmed	Yes/ No
6.2	The validity of type test reports shall be as per the latest CEA guidelines (amended time to time) as on the original scheduled date bid submission for BHEL tender. In case, where type test certificates are older than period as per latest CEA guidelines (amended time to time), bidder/ manufacturer shall carry out the type tests prior to dispatch of equipment without any commercial implication on BHEL/ OPTCL.	Confirmed	Yes/ No

Date: Bidder's Stamp & Signature

ANNEXURE-D: Guaranteed Technical Particulars
(400kV & 132kV Isolator with earth switch)

Sl. No.		Description	Particulars
1		Manufacturer's Name	
2	a)	Type & Designation	
	b)	Standard to which equipment conforms	
3		Rated voltage	
	i)	Rated	
	ii)	Maximum permissible	
4	a)	1.2/50 micro second lightning impulse	
		- Between line terminals and ground	
		- Between terminals with isolator in open position	
		- Between phases	
	b)	100% impulse flashover voltage of completely assembled isolator with arcing horns with 1.2/50 micro seconds impulse wave against ground	
5		250/2500 micro second switching impulse withstand voltage	
		- Between line terminals and ground	
		- Between terminals with disconnecting switch in open position	
6		Dry & Wet one minute power frequency withstand voltage	
	i)	Between line terminals and ground	
	ii)	Between terminals with isolator in open position	
	iii)	Between phases	
7		Rated frequency	
8		Rated normal current and maximum continuous rating of isolator	
9	a)	Rated peak short circuit current	
	b)	Fault current which can be withstood by an earth switch	
	c)	Maximum capacitive current which can be safely interrupted by the isolator	
	d)	Maximum Inductive current that can be safely interrupted from the line by the isolator	
10		Rated short time current for:	
	i)	1 second	
	ii)	3 seconds	
11	a)	Rated peak withstand current	
	b)	Rated peak short circuit current of earthing blade	
12		Rated inductive breaking current	
13		TRV caused by breaking/making inductive current	
14		Maximum capacitive breaking current	

15	TRV caused by breaking/making capacitive current	
16	Rated insulation level	
a)	1 minute power frequency withstand voltage	
i)	Between live terminal to ground	
ii)	Across open contacts	
b)	1.2/50 micro second lightning impulse withstand voltage	
c)	250/2500 micro second switching impulse withstand voltage	
17	Maximum temperature rise over ambient at rated current	
a)	Contacts	
b)	Hottest part	
18	Type of motor operating mechanism	
a)	Whether separate operating mechanism provided for operation of main blades and earthing blades	
b)	Current during closing	
c)	Current during opening	
d)	Closing time	
e)	Opening time	
f)	Operating voltage and range	
g)	HP of operating motor	
h)	Torque required to:	
i)	Open the isolator	
ii)	Close the isolator	
19	Design data of main contacts	
a)	Material	
b)	Type	
c)	Contact area	
d)	Contact pressure	
e)	Surface treatment and thickness of surface coating/silver electrolytic plating	
f)	Overall distance after making of contacts	
g)	Distance between the contacts in the fully open position	
h)	Current density at the minimum cross section of switch blade	
i)	Speed of break	
20	Partial discharge level	
21	Corona extinction voltage	
22	Radio interference level	

23		Auxiliary switches	
	a)	No. of NO and NC contacts	
	b)	Rated voltage	
	c)	Rated current	
	d)	Test Voltage	
24	a)	No. of operations the switch can withstand without any need for inspection	
	b)	No. of operations which the switch can withstand without deteriorating the contacts	
25	a)	Type of mounting	
	b)	Whether suitable for inverted mounting (Give details of modifications required, if any, to make isolator under hung)	
26	a)	No. of poles per phase	
	b)	No. of breaks per phase	
27		Safety factor taken into account while designing the isolator	
28		Type and material used for arcing contacts, if provided	
29		Weight of 3 pole isolating switch with grounding switch on both sides	
30	a)	Type of interlock between main isolator and grounding switch	
	b)	Power required by interlocking coil at 220V and its make	
31		Details of type test reports enclosed and the standards as per which these tests have been carried out	
32		Rated maximum time duration of short circuit	
33		Rated mechanical terminal load	
34		Rated supply voltage of operating devices and auxiliary circuits	
35		Location, type and number of bearings	
36		Clearance in air (minimum)	
	a)	Between phases	
	b)	Between live parts and earth	
	c)	Distance between centers of outer stacks of insulators	
	d)	Between fixed contacts and the blade in open position	
37		Test to be conducted by the manufacturer at works	
	a)	Type tests	

b)	Routine tests	
38	Tests to be conducted at site	
39	Details of insulators	
a)	Make	
b)	Type	
c)	Size	
d)	Weight	
e)	Cantilever Strength	
f)	No. of Units per stack	
g)	Diameter of Shed	
h)	Height of stack	
i)	Creepage distance	
j)	Dry arcing distance	
k)	One minute dry withstand voltage	
l)	One minute wet withstand voltage	
m)	Power frequency flashover voltage	
n)	Impulse withstand voltage	
o)	Impulse flashover voltage	
p)	Hissing voltage (at which audible discharge can be detected)	
q)	Puncture Voltage	
40	Details of type test reports enclosed	
41	Type and material of connectors	
42	Shipment dimensions of largest package (L x B x H)	
43	Weight of heaviest package	
44	Details of the drawings and other information enclosed	
45	Any other information not mentioned above	
46	Details and weight of supporting structure	

Date: Bidder's Stamp & Signature