

**ADMINISTRATION OF DAMAN & DIU  
ELECTRICITY DEPARTMENT  
DAMAN**

**TENDER SPECIFICATION  
FOR**

**INSTALLATION OF 2 X 15 MVA 66/11KV  
SUB-STATION  
AT BHIMPORE, DAMAN**

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Date : 27/05/2011

**Re – Tender Notice No. 03 of the year 2011-2012**

The Executive Engineer, Electricity Department, Daman invited sealed tenders in two part bid on behalf of the president of India, from reputed Electrical contractor/equipment manufacturer having adequate experience in construction of HT/EHT sub station and transmission line have valid HT/EHT license from competent licensing authority for execution of the work on turn-key basis & whose past performance of similar type works are found satisfactory so as to reach this office on or before 07/07/2011 up to 15 00 Hours.

The Tender will be opened on the same day if possible

T.S No.	Name of Work	E.M.D	Tender fee	Time Limit (in day)
TS-23	Design. supply. erection. testing & commissioning of 66 KV / 11 KV 2x15 MVA Sub Station at Bhimpore including civil work along with associated 66 KV transmission line on turn key basis.	Rs.25 Lakhs	Rs. 1500/-	360 Days

The intending agency should have the following **eligibility criteria** and submit the document along with their application from :

(I) Valid Electrical Contractor's License

(II) The **supporting documents from concerned authorities** for successful completion of the sub station & line, as well as the operational performance certificate of those Sub stations running successfully for last 2 years may be furnished.

(III) The agency have a minimum annual turn over of **Rs.8 Corers** for last 3 years and produce a solvency certificate from the schedule Bank of Rs.1 Corers.

Any agency who has been **banned for malpractices or poor performance** or for any other reason either by this department or any other department/organization. need not bid as such bids are liable to be rejected as and when it comes to light.

The Tender documents can be down loaded from web site [www.dded.gov.in](http://www.dded.gov.in) or obtained from the office of the Executive Engineer, Electricity Department, Daman on payment of tender fees from 10/06/11 to 25/06/11 during office hours in all working days.

The down loaded tender document are to be submitted along with non refundable/nontransferable tender fee in the form of DD from any scheduled bank in favor of the Executive Engineer, Electricity Department, Daman and proof of eligibility criteria as mentioned above in separate envelope.

Tender received without EMD in the prescribed form of FDR shall be rejected EMD in the form of FDR of scheduled Bank shall have validity for minimum period of 120 days from the date of receipt of the tender.

The prospective bidders viewing this notice are required to constantly monitor our web site for amendments/corrigendum that may be issued from to time. No separate amendment will be published in the newspaper

No tender papers will be supplied by post.

Right to issue and to accept or reject any or all tender without assigning any reasons there of is reserved by the undersigned.

The jurisdiction for any legal dispute will be Daman & Diu

Sd.  
Executive Engineer.  
Electricity Department,  
Daman.

## ELIGEIBELITY CERTERIA

### Qualifying Requirement

- 1) The Bidder should have successfully completed and commissioned at least 1 (One) nos. of substation work (including civil works) involving higher voltage category works of 66kV, class for any utility or any other organization along with supply and commissioning of data acquisition scheme, SCADA for remote controlled monitoring.
- 2) Such installations shall be in successful commercial operation for a period of at least 2 (two) years as on the day of opening. The value of such each contract shall not be less than Rs. 5crores (Rupees Five crores)
- 3) Bidder shall enclose documentary evidence along with the bid i.e. certificate issued by the client in this regard.
- 4) The certificate shall be from the officer of the utility/company not below the rank of Chief Engineer.
- 5) The bidder offering in this tender must have executed at least one no. of 66 KV or above voltage class sub station in India which is in successful operation for at least two years on the date of tender opening, or their collaborator should have completed at least 3 sub stations of 66 KV or above voltage class with in India or abroad and in successful operation for at least two years.
- 6) The financial turnover of the bidder (Financial Year) shall not be less than Rs. 8 (Eight) Crores during any one or more of the preceding 3 (three) financial years. The bidder shall enclose the audited balance sheet and cash flow statement for the last 3 (three) financial years with the bid documents.
- 7) Bidder shall provide solvency certificate of Rs. 1Crores being a value of Bank Solvency required for class A registered Contractor.
- 8) The bidding is open to manufacturer(s), Contractor(s), or an authorized representative of manufacturer(s) or joint venture company. Such bidders should meet with the qualification criterion stipulated herewith. Manufacturer opting to bid through their authorized representative are not permitted to bid on their own separately. The joint venture company should have executed similar works on the same joint names as per eligibility criterion.
- 9) The bidder shall be a manufacturer or an authorized representative of manufacturer(s) / Contractor (s) who regularly manufactures and/or erects equipment of the type specified and has adequate technical knowledge and manufacturing / erection experience for the works tendered including design of equipment, material and structures as well as erection work of electrical and civil nature.

10) The bidder shall certify or ensure that their ownership shall not change during the proposed period of finalization of the order and the period of execution of work. (If such change is anticipated, the scope and effect thereof shall be defined).

11) The bidder shall possess a valid Electrical Contractor License (class – I) EHT/HT class issued by the statutory authority to work in the State of Gujarat or Union Territory or another state in India and shall at least have a minimum experience of 3 (three) years in the execution of works of similar type and category specified in the enquiry. In case of entrusting the civil work to sub contractor, the sub contractor should possess Class A registration as per Govt./SemiGovt./PWD Organization criteria. The required documents shall be submitted along with tender without which the offer shall be liable to be rejected.

12) Interested Bidders preferably satisfying the pre qualifying requirements shall download the tender documents from web site and submit the duly filled in required schedules as per instructions in following pages before due date.

## **INSTRUCTIONS TO BIDDERS**

1. The bidders have to down load the tenders from website and pay the tender fees (Non-refundable) as per Tender Notice and EMD while submission of offer . No page from the tender documents shall be defaced or detached. In addition, the bidder shall make no correction in the tender documents. Any over writings or corrections or manuscript in the Bid will be ignored and will not be considered authentic unless the same are properly authenticated with the signature and seal of the Bidder. Any comments which the bidder desires to make, shall not be placed on the tender documents, but shall take the form of a separate statement, as brief as possible, and giving reference to pages and clauses of the tender documents.
2. Total work will be commenced within fifteen days from date of issue of work order and shall be completed within 360days of date of issue of commencement letter.
3. All and complete tender documents, as prescribed, are to be returned along with all rejoinders. Bidders are forbidden from furnishing their own printed / typed commercial & other terms and conditions.
4. (a) All the Bidders are requested to indicate the name of their Authorized Representative with Designation and full address, phone, mobile, E-Mail and fax number etc. in the Tender documents itself. In case the representative is changed during the course of execution of the contract, the contractor immediately shall notify the same, failing which electricity department Daman will not have any responsibility of contractual implication.
5. (a) The bidders shall specifically note that quantities in case of some items mentioned in Schedules in part –IV of the tender may vary as per actual requirement. As such, the successful bidder shall have to execute the work at the same rates of the order for the changed / increased quantities if any, without any extra compensation whatsoever.
6. Bidder shall have to submit 4(Four) copies of bidding schedules (as included in PART-IV) quoted, in a separate sealed envelope,
7. The Bidders will ensure submission of Tenders duly filled in before due date and time.

8. Tender documents shall be submitted consisting of : -
- a) Tender Notice
  - b) Eligibility criteria
  - c) Instructions to Bidders
  - d) Tender Document.
  - e) Schedule of quantities and Price.
- Bidder may take note of all the contents and fill in the Schedules, quarries etc. as Called for in the respective part of the documents.
9. Necessary drawings will be issued to the bidders along with the tender. The drawings however shall be returned along with "Envelope - A". The authorized representatives of the bidders shall put their stamps and signatures on the drawings inspected by them. It will be presumed that all the bidders have inspected the drawings prior to submitting their tenders
10. Tenders should be placed in sealed envelopes super-scribed with the name of the work as mentioned in the tender notice and also the name and address of the bidders and submitted as per time limit specified in tender notice. The **Part-I, II, and Part-III** of tender documents, along with the EMD, contractor's covering letter and other information shall be put in an envelope and shall be marked "**Envelope-A**" with details of EMD paid super scribed. The **Part – IV** containing all the Schedules **of quantities & prices and Bidding schedule** and **3 copies of only Bidding schedule** shall be enclosed in the envelope marked as "**Envelope – B – Price Bid**". On specified opening due date, only **Part-I, II, & Part-III** shall be opened on the opening date. Subsequently after scrutiny of **Part-I, II, & Part-III; the price bid Part – IV** shall be opened only of acceptable bidders, the date to be decided and intimated subsequently.
11. Submission of tender will be the conclusive evidence that the bidder has fully satisfied himself as to the nature and scope of the work to be done, site conditions and all other factors affecting the performance of the contract and the price and as to the terms and conditions of the contract agreement / tender documents. No idling / mobilizing / demobilizing / remobilizing or any type of claim shall be admitted and paid on any part of the work.
12. Electricity department will not be responsible for pay for the expenses or losses those may be incurred by any bidder in the preparation of his tender.
13. Access to the site during tender period may be arranged by an application to the Executive Engineer /Assistant Engineer (project)Elect. Dept. Daman.

14. Should the bidder find any discrepancy, omission, ambiguity or conflict in or among the documents published on website or be in doubt as to their meaning and interpretation, such matter should be brought to the attention of A.E. (projt) at the office of E.E. (O&M), Elect. Dept. Daman before 25/11/2010.
15. Bidders must disclose the names of their partners, if any, in the particular contract. Any bidder failing to do so will render himself liable to have his earnest money deposit forfeited and the contract, if entered into, will be cancelled at any time during its currency and the same shall be awarded to another agency at the sole discretion of the Board at the risk and cost of such defaulting Contractor.
16. If it is found that two or more persons who are connected with one another either financially or as principal and agent or master and servant have tendered under different names for the same contract without disclosing their connections, then such tenders will be rejected and the earnest money deposit will be forfeited. Any contract if entered into, under such conditions is also liable to be cancelled.
17. In case the bidder is a joint stock company, affix the seal of the company in the presence of witnesses and signed by two Directors or by persons duly authorized to sign the contract for the company under a power of attorney. The bidder shall produce a certified copy of such power of attorney at the time of making the agreement.
18. All the documents forwarded herewith are to be returned with the tender. The bidder must fill in all blank spaces in the form of tender and sign in full as and where shown. Only the person authorized to make the contract should sign the tender and execute the contract on behalf of the bidder.
19. The bidder must be very careful to deliver a bonafied tender, as per conditions laid down in this notice. Failure to furnish full and complete details or furnishing vague information will result into rejection of Tender. The Tender submitted shall be for complete scope of work as envisaged in this Specification.
20. Any tender which proposes alterations to any of the conditions laid down, or which Proposes any other conditions of any description whatsoever is liable to be rejected.
21. Tender(s) not accompanied by the following are liable to be summarily rejected:
  - a) Earnest money amount mentioned in tender notice in the form of "DEMAND DRAFT" drawn on scheduled Bank in favour of Executive Engineer Electricity department Daman payable at Daman. The earnest money deposit will not earn any interest. The draft for tender fees shall separated with EMD.



- b) Evidence showing their experience of identical or similar work with a list stating clearly the description of works, costs, location and the name of a firm / department for whom the work was carried out and the period of such jobs executed by the bidder from time to time.

All the tender drawings issued to the contractors along with the tender are to be returned with “Envelope – A” – Technical Bid.

22. The tender of any bidder that does not conform with the provision of specifications, such tender liable for rejection. No reasons shall be furnished for the acceptance or rejection of any tender.
23. The successful bidder will have to enter into a written contract agreement with acceptance of tender. With the Executive Engineer Electricity department Daman on the terms and conditions.
24. The earnest money deposited by the bidder(s) will be returned only to the unsuccessful bidders after the scrutiny of technical bid / price bid or on award of contract whichever is later. Department will forfeit the earnest money if the bidder refuses to accept the contract or fails to commence works within 30 days from the date of issue of work order without prejudice to his delay being liable for any further loss or damage incurred in consequence by the Electricity department Daman
25. The tender of any bidder, which does not conform to the above instructions, may not be Considered.
26. All and complete tender documents comprising the following are to be returned along with the tender. These documents along with any other documents as may be hereafter mutually Agreed to, by the parties, shall eventually form part of the contract agreement to be entered into between the parties.
- i) Tender Notice
  - ii) Eligibility criteria
  - ii) Instruction to Bidders
  - iii) Tender Document
  - v) Drawings.

## DETAILS REQUIRED TO BE FURNISHED BY THE BIDDERS

- |   |         |
|---|---------|
| a) Human Resources details.   | Yes/No  |
| b) Availability of tools, equipment etc.  | Yes/No  |
| c) Details of orders executed.  | Yes/No  |
| d) Financial capability.  | Yes/No  |
| e) Supply capability  | Yes/No  |
| f) Employee provident fund registration certificate   | Yes/No  |
| g) License certificate of Electrical Inspectorate Office of Gujarat State/Union Territory/ Other state. | Yes/No  |
| h) Latest Income-tax certificate.   | Yes/No  |
| i) Tender Fee/EMD, in favour of E E DAMAN   | Yes/No  |
| j) Company's Article of Association   | Yes/No  |
| k) Details of Partners / Directors  | Yes/No  |
| l) B.R./P.A. Authorizing Person to sign on behalf of firm.  | Yes/No  |
| m) Certificate of previous experience for similar work Enclosed (as laid down in the tender notice)     | Yes/No  |
| n) Class-A registration certificate enclosed for Civil work   | Yes/No  |
| o) Solvency Certificate as per NIT  | Yes/No. |

Signature:

Name:

Seal of the Tendering Firm

Status:

Name of Tendering Firm:

**ADMINISTRATION OF DAMAN & DIU  
ELECTRICITY DEPARTMENT  
DAMAN**

**TENDER SPECIFICATION  
FOR**

**INSTALLATION OF 2X15MVA, 66/11KV  
SUB-STATION  
AT BHIMPUR, DAMAN**

**SECTION – I**

**GENERAL TERMS & CONDITION**

## **SECTION - I**

### **1-A GENERAL TERMS AND CONDITIONS**

- 1.1 Electricity Department, UT of Daman & Diu is setting up 66/11 KV, 2 x 15 MVA, 66KV Sub along with 66 KV D/C line, as shown in single line diagram at Bhimpore Daman. The location at 15Kms away from Vapi Railway Station on Western Railway.
- 1.2 This tender covers the design, engineering, manufacture, inspection, supply, storage at site assembly, erection, testing and commissioning of 66/11kv, 2x15 MVA Sub-station at Bhimpore & 66 KV D/C line for feeding the S/S. The details of works & as given in Section IV of this document.
- 1.3 All the equipments designs should be confirm to relevant IS/IEC Specification ended up to date as per latest IS/IEC .The Equipments covered in this specification shall be complete in all respect & any device not included in specification but essential for proper design, operation & maintenance of the equipment and completion of this project as a whole shall be included in the offer by indicating the reason for same.
- 1.4 The Tenderer shall study the entire specification & satisfy himself thoroughly regarding the workability of the equipment as a whole & shall take full responsibility for the guaranteed operation of the equipment as regards output, performance, safe, smooth & reliable working.
- 1.5 Deviation form specification, if any, shall be brought out clearly in the offer separately. If the deviation are not brought out clearly & agreed prior to order placement, the purchaser will not consider the same at a later date.
- 1.6 The Tenderer if he so desires, may visit the site & ascertain local condition, traffic restriction, labour condition, accommodation etc. he may require for his staff, site condition & other observation in the area, if any, & allow for any extras likely to be incurred due to any or all the above in his quoted rates. No additional claim whatsoever will be admissible later, on these grounds.
- 1.7 All equipment as well as accessories & fitting shall be standardized so as to reduce inventory as well to facilitate maintenance.
- 1.8 The purchaser reserves the right to selecting a particular manufacturer of electrical equipment in the interest of standardization & the contractor shall supply equipment of the particular make if so required.

### **1.9 SYSTEM DATA**

System Voltage and System of Earthing	:	66 KV Solidly earthed 11 KV Solidly earthed 415 V Solidly earthed
Rated frequency	:	50 Hz
Voltage variation	:	66 KV $\pm$ 10 % 11 KV $\pm$ 10% 415 V $\pm$ 10 % - 15 %
Frequency variation	:	$\pm$ 5 %
Three phase symmetrical Short circuit level for Selection of equipment	:	66 KV: 3000 MVA 11 KV: 500 MVA 415 V: 40 MVA

Control voltage : 110 V DC with  $\pm 10\%$  Variation (from battery)  
1 phase 240 VAC + 10% -15% from ACDB Substation auxiliary panel.

\* Short time rating of equipment :  
For 66 KV and 11 KV : 25 KA for 3 Sec.  
Switchgear

#### 1.10 CLIMATIC & ISOCERAUNIC CONDITIONS

The climatic conditions, under which the equipment shall operate satisfactorily, are as follows:

- a) Maximum ambient temperature of air in Shade ( C ) ..... 50°C
- b) Maximum ambient temperature of air in Shade ( C ) ..... 14°C
- c) Maximum daily average ambient temperature ( C ) ..... 40°C
- d) Maximum Yearly average ambient temperature ( C ..... 30°C
- e) Maximum relative humidity (%) ..... 95%
- f) Average number of thunderstorm days/annum .....15
- g) Average annual rainfall .....150cm
- h) Maximum wind pressure .....150 kg/m<sup>2</sup>
- i) Height above mean sea level .....Not Exceeding 1000 mts

#### 1-B SCOPE OF WORK

The scope of work shall cover the items listed, but not be limited to the following:

2.1 Design, Engineering Supply, installation, testing & commissioning of 66/11 KV, 2x15 MVA Sub-Station with the following equipments -

	Equipments	Nos
1	15 MVA , 66/ 11 KV Power transformer	2
2	66 KV Lighting arrestor	12
3	66 KV isolator with E/S	5
4	66 KV isolator without E/S	12
5	66 KV SF6 Circuit Breaker	5
6	66 KV Current Transformer	15
7	66 KV Potential Transformer	6
8	66 KV Control & Relay Panel	5
9	Galvanized Steel Structure with Nuts & Bolts for 66 KV bays and equipments	As per requirement
10	a) 11 KV Switchgear I/C & Feeder Panels (SCADA competeble)	8
	b) Busc oupler & Adopter Panel	1
11	Battery and Battery Charger	1
12	AC and DC distribution boards	1
13	11 KV Cable (3x300 Sq. mm)	
14	11 KV Cable (3C x 240 Sq. mm)	As per requirments
15	Power cable termination kit	
16	Control cable of various sizes and other power cable	
17	Clamps, Connector, Conductor & earthing material etc.	
18	11 KV take off structure	

19	Yard illumination	
20	Station transformer (100 KVA) with all accessories	2
21	Fire extinguishers	As per requirements
22	Communication system	As per requirements
23	Cable trench material	As per requirements
24	SCADA system	
25	Miscellaneous items	

2.2 LILO of existing 66 KV kachigam-Dalwada Transmission line with panthe conductor at Bhimpore (0.5 km)

2.3 Civil works as under -

Sr. No.	Description
1	Land development & leveling etc.
2	Constructions of control room buldg. & Stores.
3	Providing Chain link fencing to 66 KV Switchyard
4	Construction of internal road for S/S.
5	Water supply arrangement for drinking water for earthing along with bore well & pipe line etc.
6	Oil Sock pit & fire wall
7	Spreading of gravel in switchyard

**Along with any other works as per requirement for successful operation of the sub-station.**

2.4 Over-head bus work complete with ACSR Zebra conductor, jumpers, rigid and expansion type connectors, supporting insulator assemblies, clamps etc.

2.5 Galvanised Structural steel work for supporting all outdoor equipment, over-head bus work, gantry tower including Lightning protection mast.

2.6 Lightning protection of outdoor switchyard complete with shielding mast, spikes and all necessary accessories as required.

2.7 110V, Plant Battery with dual Float, Float cum Boost Battery charger and DCDB.

2.8 Auxiliary ACDB 415 Volts for catering to SPN / TPN loads of 66kV outdoor switchyard equipment.

2.9 Lighting to outdoor Switchyard equipment.

2.10 All inter-connecting auxiliary power and control cables. Cabling materials, Conduits, conduit fittings, cable trays, supporting materials etc. as required for equipment covered in this package.

2.11 System earthing as well as earthing of all outdoor / indoor equipment, outdoor steel structures, shielding, substation fence and gate, cable trays etc. complete with earthing stations, earthing conductors and accessories as required.

2.12 Indoor equipment namely 11kV MRSS Switchboard, Battery, Battery Charger cum DCDB, AC Distribution Board etc., will be housed in MRSS as shown in Drawing.

2.13 Civil work like R.C.C. foundation for Gantry Structures, Lightening Arrestors, Isolators, Breaker, CTs, PTs and control cable trenches from Switchyard to control room as per R.E.C. standard.

2.14 The work may include any other items as may be required to complete the overall commissioning of the switch yard and transformer though not specifically indicated in the specification.

## **2.0 STANDARDS**

2.1 The equipment and accessories covered by this specification shall be designed, manufactured and tested in accordance with the latest relevant standards and codes of practice published by the Bureau of Indian Standards (BIS) as applicable.

2.2 All electrical equipment and installation shall conform to the latest Indian Electricity Rules as regards safety, earthing and other essential provisions specified for installation and operation of electrical plants.

2.3 All equipment and installation shall comply with the statutory requirements of the I.E. rules.

2.4 Unless otherwise specified all the material/equipments and the work shall comply in all respects with the requirement of the specification under section-II and attached with this tender documents.

2.5 The successful tendered will have to submit wherever necessary the design/drawing/test report in respect of Electrical and civil works to department for approval before taking up the work execution.

2.6 The different items and their rates, which the department will supply, are given in page 29 of C.P.W.D form-8 page of the tender document. The to and fro transport arrangement for the delivery of items supplied by the department will have to be arranged by the contractor.

## **3.0 DESIGN**

3.1 All equipment shall be designed for operation in tropical humid climate at the required capacity in an ambient air temperature of 50°C. equipment shall be suitable for an ambient temperature of 50°C. Maximum relative humidity of 100% shall also be taken into consideration for design of equipment however, the maximum relative humidity may not occur simultaneously.

3.2 All electrical equipment and accessories shall be suitable for satisfactory operation with the following system parameters and nominal system frequency of 50Hz  $\pm$  5% and voltage variation of  $\pm$ 10%

System Parameters	..66kV
Nominal system voltage	..66kV
Highest system voltage	..72kV
No. of phases	..3
System neutral earthing	..Solidly earthed
Rated short circuit interrupting capacity	..25 KA
Rated short time withstand capacity	..25KA for 3 second
Power frequency dry withstand voltage	..140 Kv
Impulse withstand	..325 kV peak

3.3 Control circuit voltage adopted for electrically operated closing and tripping mechanism of high voltage circuit breakers, auxiliary relays, indicating lamps etc shall be 110V DC.

3.4 Unless otherwise specified auxiliary supply to space heaters, cubicle lamps, sockets etc. shall be 240V, AC single phase fed from auxiliary ACDB located in Control room.

#### **4.0 GUARANTEE**

The contractor shall warrant that the plant will be new and in accordance with the specification and that the equipment structures ect. will be free from defects on materials and workmanship. The contractor shall furnish performance guarantee for a period of 24 calendar month (guarantee period) from the date of commissioning for smooth operation of sub station.

#### **5.0 OTHER REQUIREMENTS**

##### **5.1 Accessibility and interchangeability**

All working parts, insofar as possible, are to be arranged for convenience of operation, inspection, lubrication and ease of replacement with minimum downtime. All like parts of equipment or of duplicate equipment offered shall be interchangeable.

##### **5.2 Quality and Workmanship**

The quality of materials of construction and the workmanship of the finished products / components shall be in accordance with the highest standard and practices adopted for the equipment covered by the specification.

##### **5.3 Painting**

All items of equipment and materials shall be thoroughly cleaned and painted in accordance with relevant Indian Standards. The finish paint shall be done with two coats of epoxy based final paint of colour Shade RAL 7032 of IS:5 for indoor equipment

#### **6.0 Approved make of Equipments Make:**

- a) 66 KV SF-6 circuit Breaker.....ABB/CG/Siemens/Alstom
- b) 66 KV CT.....Hi-voltage/Test field/Mehru/  
ABB/BHEL/CGL
- c) 66 KV PT.....Hi-voltage/Test field/Mehru  
ABB/BHEL/CGL



- d) Insulator 120/90 KN.....BHEL / JSI
- e) Lighting arrester.....ELPRO
- f) Isolator.....Danke / Kiron
- g) Battery Charger Unit.....Amar Raja/ sterlite/ Exide
- h) Battery Cell.....Amar Raja/ Amco/
- i) 66 KV control panel.....Maktel / ABB / CGL
  
- j) 11 KV Incomer/Feeder control panel.  
with V.C.B.....ABB / Jyoti Make
- k) Control / Power cable.....CCI/Poly Cabs / Havels
- l) 11 KV XLPE cable.....Poly Cab/Nicco/Torrent/CCI
- m) Transformer.....Voltamp / Danke / Ashoka / IMP
- n) Communication/ SCADA system.....Reputed make

## **7.0 COMPARISION OF THE BIDDINGS**

### **7.1.1 Technical bid**

The technical bid of all eligible participant are scrutinized in the priority based.

- (1) Experience in similar type jobs carried out and volume of work executed till last 3 years.
- (2) The financial performance as well as the time taken for each job executed.
- (3) Present performance of the executed jobs by the agency

### **7.1.2 Financial bid**

The financial bid of those eligible participants who qualify the technical requirement will be scrutinized on the priority busies.

- (1) The Fund mobilization capacity of the fir an i.e. the volume of work executed till date
- (2) The set up of the establishment and capacity of staff

7.1.3 While finalizing the bid weigh tag of both bid will be consider. The tender would be awarded on the total cost of the project not on part basis.

## **8.0 QUANTITIES**

The quantities given under bidding schedule of this tender are tentative. The department reserve the right to finalize the quantities for which the unit rates quoted in the tender by the tendered shall be valid and binding irrespective of the quantities finalized by the department.

## **9.0 COMPLETENESS OF THE CONTRACT.**

Any fitting or accessories which may not have been specifically mentioned in the specification but which are usual or necessary in the equipment of similar plant or for efficient working of the plant shall be deemed to be included in the contract and shall be provided by the contractor without extra charges. All plant and apparatus shall be complete in all details whether such details are mentioned in ht specifications or not.

## **10.0 BIDDING**

- 10.1 The tenderer must quote his firm rates in the bidding schedule forms in quadruplicate. Rates must be quoted separately for each activity or items or work.
- 10.2 The rate for supply if material, if indicated separately shall include:
- a) Cost of materials.
  - b) All duties such as customs, excise etc.
  - c) All taxes such as CST / LST / VAT etc.
  - d) Packing, forwarding, freight, clearing charges etc.
  - e) Cost of packets, containers, drums, cases etc.
  - f) Insurance and other similar charges.
  - g) Octroi and any other such charges (no octroi in Daman at present)
  - h) Freight charges up to destination and transportation charges up to the site of work and noting extra / except than the quoted rate shall be liable for payment for statutory variation effected by Govt.
- 10.3 The charges for erection, testing and commissioning shall be quoted separately for each item and many include necessary services, civil foundation works, T & P etc. & S Tax rate.
- 10.4 No variation in the prices shall be permissible over and above the prices quoted. They shall remain firm and final till the completion of entire work in all aspects, once the tendered accepts the work order and / or contract, except for variation in prices due to statutory variation effected by the Govt
- 10.5 The rates quoted shall be valid for 120 days from the date of opening of the tenders. The order shall be placed within the validity period, otherwise after obtaining extension of the validity of the rates. The tenderers having once accepted the order / contract, shall not be entitled to vary the rates quoted on what over account and the rates quoted shall be firm and final till completion of the works.

## **11.0 COMPLIANCE WITH THE REGULATIONS.**

- 11.1 All the works shall be carried out in accordance with I.E.Act. 2003 and I.E. Rules, 1956 as amended up to date and any revisions thereof that may be issued during the currency of the contract.

## **12.0 INTERCHANGEABILITY.**

All the parts shall be made accurately to standard gauge whatever possible as to facilitate replacement and requirement. All corresponding parts of similar equipment including the spare parts are interchangeable.

### **13.0 PLACE OF MANUFACTURE AND INSPECTION**

13.1 The tenderer shall state in his tender the places of manufacture, testing and inspection of the various materials, apparatus and equipment included in the contract. Authorized representatives of the Electricity Deptt if necessary entitled to be present at the time of all tests of materials, apparatus equipment and the contractors shall provide all necessary facilities for the same. Representative of the purchaser shall be entitled to access the contractor of sub-contractor work at any time during the working hours for the purpose of inspection and testing the manufacture of materials equipment and building plant.

### **14.0 FAILURE TO MEET GUARANTEE & REOUIREMENT OF THE SPECIFICATIONS**

14.1 Should the factory tests of the operation or any piece of the apparatus under service condition show that it does not meet the guarantees and / or the requirement of these specification it shall be optional with the purchase to accept or reject the apparatus and direct the contractor to at once proceed to furnish such new parts as may be necessary to make it meet the guarantee and requirement. All expenses of furnishing and of installing new part or alternation to existing parts and all test made necessary be failure of the apparatus to the guarantees and other requirement of the specification shall be borne by the contractor.

### **15.0 CO-ORDINATION**

15.1 In the event of the tendered offering items manufactured by different manufacture it will be his responsibility to fully co-ordinate the activities of each manufacture in such a way that the complete equipment contracted is supplied in accordance with the contract. No extra charges shall be payable for these services.

### **16.0 FINANCIAL RESOURCES & EXPERIENCES**

16.1 The tenderer is requested to submit a statement of facts in details as to his previous experiences in performing similar comparable work and of the business and technical organization financial resources and manufacturing facilities available. The tenderer is also further requested to furnish the list of important electrical Sub Station laying or underground distribution system for which materials were supplied and / or erected in India or elsewhere and also testing facilities available at contractor's work. The details of list of similar work in hand should also be furnished in clause 28 and N.I.T. Form No.6.

## **16.2 GODOWN/STOREYARD**

This is a work contract hence no material/apparatus/equipment supplied by the contractor shall be taken delivery by the department. The store security safety materials/apparatus/equipment, plants and tools etc.. necessary in-connection with the work of the contract shall be the responsibility to the contractor till they are erected, tested, commissioned and properly handed over to/taken over by the department. The contractor must therefore, have a proper go-down/store-yard for storing, safeguarding the materials till they are brought to worksite for erection (and further testing and commissioning). The representative of the department shall have the right to have access to inspect the go-down/store-yard at any time during the currency of this contract.

## **17.0 DEVIATION**

17.1 Any deviation to this specification. if found necessary by the tenderer shall clearly be set-forth in the separate schedule annexed to this tender giving valid basis for such deviation. The advantages claimed if any due to such deviation should be clearly indicated.

## **18.0 PAYMENTS**

18.1 The terms of the payment shall be in according with the provision contained under CPWD Form-8 for the item rate tender and contract for works.

18.2 No advance payment shall be made along with the order. Running account bills / payment will be made for the activities complete in all respect payment will be made activity-wise. No payment will be made unless all the items of particular activity of storing completed. No payment will be made for the purpose of storing of materials, during the course of the contract, at the contractor's go-down worksite etc.. no transportation freight and insurance charges taxes and duty etc.. shall be paid separately all of which are deemed to have been included in the quoted rates whether expressly specified or not.

## **19.0 INSURANCE AND CONSIGNED**

19.1 This is a work contract. All materials/equipment shall be insured by the contractor against any damages and losses during transit to and storage at go-down works site. No insurance charges shall be payable by this department under any circumstances. The contractor shall make his own arrangement to received & store the materials at go-down site. The purchaser has right to inspect the materials/equipment receive at go-down site for any damage/loss etc.. and divert the contractor to make good any losses, damages etc. communicated to him within 30 days from the date of intimation irrespective of the settlement of claims with insurance, railway authorities etc.

## **20.0 COMPLETION PERIOD**

The time allowed for completion of all the activities covered under this contract shall be 360 days from the fifteen days after the date of written orders to commence work.

## **21.0 COMPENSATION**

Compensation for any / all delay in completion of work shall be laid as per clause 2 of CPWD-8.

## **22.0 EARNEST MONEY DEPOSIT**

Earnest Money Deposit should be deposited in the State Bank of India or Treasury and receipt challans thereof should be furnished. Demand Draft or Call Deposit Receipt on any scheduled Bank. Guaranteed by Reserve Bank of India can also pay the Earnest Money Deposit in favour of the Executive Engineer Electricity department Daman, E.M.D payment by cheque fixed and short-term deposit shall not be entertained. Tenders unaccompanied with E.M.D. are liable for rejection.

## **23.0 SECURITY DEPOSIT**

The successful tender will have to pay towards security deposit amount as per clause 1 of CPWD-8 Agreement form.

## **24.0 PAST WORK ORDERS EXECUTED**

The tendered should furnish a list of past similar works executed by them with full details. Attested copies of certificates in proof thereof issued by the concerned authorities may be enclosed.

## **25.0 INCOME TAX CLEARANCE**

The tender must attach Income Tax Clearance certificate along with the tender, failing which the tender is liable to be rejected. The I.T.C.C. should be valid as on the day of opening the tender.

## **26.0 AGREEMENT AND GOVERNING CONDITIONS**

The tender whose offer is accepted will have to enter into agreement in the CPWD-8 form. The same should be signed duly on all pages under office seal. The contract shall be governed by this agreement in CPWD-8 and also by the general terms and conditions, listed in these tender documents.

## 27.0 SUBMISSION OF BID

Tenders should be placed in sealed envelopes super-scribed with the name of the work as mentioned in the tender notice and also the name and address of the bidders and submitted as per time limit specified in tender notice. The **section-I, II and III** of tender documents in triplicate along with EMD, contractor's covering letter and other information shall be put in an envelope and shall be marked "**Envelope-A**" **Technical Bid** With details of EMD paid super scribed. **Tender Fee and eligibility criteria for the tenderer who down load ed the document from website in separate envelope.**

The **section – IV** containing all the **schedule of quantities and bidding schedule** and **4 copies of only bidding schedule** shall be enclosed in the envelope marked as "**Envelope – B - price Bid**". On specified opening due date, only **Section – I, II & Section – III (Technical Bid)** shall be opened. Subsequently after scrutiny of **Section – I, II & Section III, the price bid Section – IV** shall be opened only of acceptable bidders on date to be decided and intimated subsequently.

Executive Engineer (Elect.)  
Daman.

**ADMINISTRATION OF DAMAN & DIU  
ELECTRICITY DEPARTMENT  
DAMAN**

**TENDER SPECIFICATION  
FOR**

**INSTALLATION OF 2X15MVA, 66/11KV  
SUB-STATION  
AT BHIMPORE, DAMAN**

**SECTION – II**

**TECHINICAL SPECIFICATION**

## SECTION – II

### TECHNICAL SPECIFICATION

#### 01 SECTION – II GENERAL TECHNICAL REQUIREMENTS FOR 66 KV C.B.

##### 1.1 SCOPE :

- 1.1.1 This section covers the design, manufacture, testing, inspection. Supply and delivery of 66KV Circuit Breakers with associated accessories and complete in all specified in the schedule of requirements.

##### 1.2 APPLICABLE STANDARDS :

- 1.2.1 Except where specified otherwise in this specification, the circuit breakers shall conform to the latest edition of IS 62271-100 with latest amendment.

##### 1.3 DRAWINGS :

- 1.3.1 The bidder shall furnish the drawings in triplicate incorporating the following particulars.
- a) Drawing showing the general outline dimensions of circuit breakers. With clear identification of parts / items.
  - b) Drawing showing control cabinets and circuit diagrams for operating mechanism of circuit breakers.
  - c) Drawing showing the complete operation cycle of the circuit breaker with description.
  - d) Compression type terminal connector for the breakers.
- 1.3.2 The Bidder shall submit the following drawing within 15 days from the date of receipt of clear order:-
- a) Outline dimensional drawings showing all parts items, transport weight etc. of circuit breaker & its support structure.
  - b) Detailed drawings of operating mechanism of circuit breakers.
  - c) Wiring and control diagram.
  - d) Drawings of foundation details, mounting structures, spacing of bolts etc.
  - e) Compression type terminal connectors suitable for (ACSR) panther conductor, with STC rating & bill material & complete dimensions.
- 1.3.3 The tenderer may also, submit any other drawings found necessary in addition to the drawings stated above.



#### 1.4.1 **GENERAL DESIGN FEATURES OF CIRCUIT BREAKERS :**

1.4.1 The circuit breakers shall be capable of rapid and smooth interruption of currents under all conditions completely suppressing all undesirable phenomena even under the most severe and persistent short circuit conditions or when interrupting small currents or leading or lagging reactive currents. The circuit breakers shall be 'Restrike-Free' under all operating conditions. The details of any device incorporated to limit or control the rate of rise of restriking voltage across, the circuit breaker contacts shall be stated. The over voltage across, the circuit breaker contacts shall be stated. The over voltage caused by circuit breaker while switching inductive or capacitive loads shall not exceed 2.5 times the highest phase to neutral voltage. The actual make and break times for the circuit breakers throughout the ranges of their operating duties shall be stated in the offer and guaranteed.

1.4.1.2 The arc quenching chambers shall have devices to ensure almost uniform distribution of voltage across the interrupters.

##### 1.4.1.3 **Breaking Capacity: -**

The interrupting capacity of the breakers for kilometric faults (short line faults) shall be equal to its interrupting capacity [as per Clause 4-106 of IS: 13118 (IEC-56) and shall be stated in the tender. The details of tests conducted for confirming the capability of the breakers under kilometric fault conditions shall be furnished in the offer.

1.4.1.4 The circuit breakers shall be designed for interrupting line charging currents without undue rise in the voltage on supply side and without any restrike and without showing signs of undue strain. The guaranteed over voltage which shall not be exceeded while interrupting the line charging currents as specified under the Clause 2.4.10 Section-II of this specification shall be stated in the offer.

1.4.1.5 The circuit breakers shall be capable of interrupting small inductive currents (occurring while switching off unloaded transformer) without giving rise to undue over voltage and without restrikes. The maximum over voltage value which will not be exceeded under such conditions shall be stated in the offer, and in conformity to this, test reports alongwith oscillograph shall be furnished in the offer.

##### 1.4.1.6 **Restriking Voltage :-**

The circuit breakers shall be capable of interrupting the rated power when the restriking voltage has a frequency of not less than 400 Hz and with a restriking voltage having frequency of 2000 Hz. The circuit breakers shall be capable of interrupting atleast 50% of nominal breaking capacity.

1.4.1.7 The measures adopted for ensuring proper operation at high rate of rise of restriking voltage and for limiting the actual voltage values across the breaks shall be described in the tender. The type breaker contacts and of the auxiliary switching devices used for interrupting the resistor current shall be clearly stated.

##### 1.4.1.8 **Recovery voltage and power Factor:**

The circuit breaker shall be capable of interrupting the rated power with recovery voltage equal to the rated maximum line to line service voltage at rated frequency and at a power factor not exceeding 0.15.

1.4.1.9 The circuit breakers shall also be capable of satisfactory operation even under conditions of phase opposition that may arise due to faulty synchronizing. The maximum power which the breaker can satisfactorily interrupt under phase opposition shall be stated in the offer.

1.4.1.10 The operating duty of the circuit breaker shall be as specified under Clause-2.4.12 of specific technical requirement for breakers.

## **1.4.2 Temperature Rise :-**

- 1.4.2.1 The temperature rise and the maximum temperature on any part of the breaker when in service under continuous full load conditions and exposed continuously to the direct sun-rays shall not exceed the permissible limits as per relevant ISS. When the standard specifies the limits of temperature rise. This shall not be exceeded when corrected for the difference between ambient temperature at site and the ambient temperature specified in the relevant specification. The correction proposed shall be stated in offer and shall be subject to the approval of the purchaser.

## **1.4.3 General Features of Circuit Breakers :-**

- 1.4.3.1 The circuit breakers shall be suitable for outdoor operations under the climatic conditions specified in section-II of this specification.
- 1.4.3.2 The circuit breakers operating mechanism shall have two nos. of tripping coils and one no. of closing coil for better reliability.
- 1.4.3.3 Exposed live parts shall be placed high enough above ground to meet the requirements of local safety codes.
- 1.4.3.4 All similar parts, particularly removable one and shall be interchangeable with one another.

## **1.4.4 Insulation of the Circuit Breaker :-**

The insulation to ground, the insulation between open contacts and the insulation between phases of the completely assembled circuit breaker shall be capable of withstanding satisfactorily dielectric test voltage corresponding to BIL specified in Clause –2.4.2 of his specification.

- 1.4.5(a) The minimum clearances in open air shall be as under,

Minimum clearance between phase : As per relevant IS.

Minimum clearance between live parts : As per relevant IS.  
And grounded objects.

- 1.4.5(b)

Adequate clearance in air shall be provided between phase and from phase to ground. The clearance shall be such that the breaker shall withstand the BIL specified in the specification. The minimum clearance from live parts to ground level shall not be less than 3000mm – including plinth height as 150mm.

## **1.4.5 Contacts of Circuit Breaker :-**

- 1.4.6.1 The main contacts shall have adequate area and contact pressure for carrying the rated currents and the short time rated breaking currents of the breaker without excessive temperature rise. Contacts shall be easily replaceable and shall be first to open and last to close so that burning of the contact may be negligible.

## **1.4.7 Operating Mechanism of Circuit Breakers :-**

- 1.4.7.1 Circuit breakers shall be power operated by a motor compressed spring charging mechanism, the mechanism will be trip-free electrically and mechanically. The mechanism shall be strong, quick in action and shall be removable without disturbing other parts of the circuit breakers. All the working parts in the mechanism shall be of corrosion resistant materials and all bearings which require greasing, shall be equipped with pressure grease fittings. The mechanism and breaker shall be such that the failure of any spring will not prevent tripping and will not cause tripping or closing.

1.4.7.2 The circuit breakers shall be designed for remote control from the control room for local tripping and closing by normal means.

1.4.7.3 The circuit breaker shall have a mechanical 'ON-OFF' indicator in addition to facilities for remote electrical indicator.

1.4.7.4 The operating mechanism along with its accessories shall be suitable for electrical operation from ground and shall be mounted in a weather proof-cabinet with hinged doors located near the breakers. The cabinet shall be suitable for IP 55 degree of protection. The local control switch and the breaker position indicator shall be provided in this cabinet which shall be free standing and supported by suitable arrangements. The control circuit shall be designed to operate on D.C. as specified in section-II of this specification. The closing and opening coils shall be designed to operate satisfactorily at any control voltage from 80% to 115% of the normal voltage. A heater of adequate capacity with thermostat shall be provided in the cabinet to avoid moisture condensation.-

1.4.8 **Auxiliary switches :-**

1.4.8.1 A minimum number of 6NC + 6 NO Auxiliary switches contacts shall be provided on each circuit breaker for use in remote indication control scheme of the circular breakers and for safety interlocking. Provision shall be made for adding more auxiliary switches, if required. Auxiliary switches shall be placed in weatherproof galvanized casing and current rating of switches shall be mentioned in the offer.

1.5 **BUSHING & INSULATORS :**

1.5.1 The porcelain insulator used in manufacturing the bushings shall be homogeneous, free from laminations, cavities and other flaws or imperfection that might affect the mechanical or dielectric qualities. All bushings of identical rating shall be interchangeable. The insulators shall conform to the latest edition of IS : 3447. Any other equivalent standard (Latest). The puncture strengths of the bushings shall be greater than their flashover values. The bushings shall be entirely free from external and internal corona. The protected and total creepage distance of the bushings shall be suitable for heavily polluted atmosphere. The creep age distance of the insulator shall be 1810mm suitable for heaving polluted atmosphere.

1.6 **TERMINAL CONNECTORS AND EARTHING TERMINALS :**

1.6.1 Compression joint type terminal connectors suitable for ACSR "PARTHER" Conductor shall be supplied and they shall be suitable for both vertical and horizontal connections of the Transmission line conductor or station bus bar. Suitable terminal earth connectors (two Nos.) for earthing connections shall also be supplied. The drawing of this connector shall be submitted. SS bolt for connector shall be provided with two. Nos. of SS nuts (including lock nut & one SS washer.

1.7 **TROPICALISATION :**

1.7.1 All control wiring, electric motors and accessories shall be protected against fungus growth and other harmful effects due to tropical environments.

1.8 **GALVANISING :**

1.8.1 All ferrous parts of breakers and compressed air plant including bolts, nuts etc. shall be hot-dip galvanized as per latest edition of IS: 2629. Support structure's galvanizing shall be done as per IS 4843 (latest edition). Electro galvanized bolts nuts, & washers are also acceptable.

1.9 SF6 GAS:  
SF6 Gas Complies with IEC – 376 & suitable in all respect for use in the CB under all operating conditions.

1.10 **INSPECTION**

1.10.1 Each Circuit Breakers shall be inspected and checked by the representative of ED Daman / consultant, prior to dispatch and routine test shall be carried out on each Circuit Breakers as per (IS)/IEC.

1.11 Test & Test Reports: -

1. Reports of all type tests as stipulated in IS 13118 shall be submitted. It should not be Be more than 3 years old.
2. Routine test as per IS shall be carried out in presence of purchaser representative.

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**02 SECTION II – SPECIFIC TECHNICAL REQUIREMENTS OF 66KV CIRCUIT BREAKERS**

2.1 **SCOPE:**

This section covers the specific technical requirements. Climatic and isocerunic conditions and systems particulars for which the circuit breakers shall be offered as per the General Technical Requirements given in Section-I of this specification and the schedule of requirements specified herein.

2.2 **CLIMATE & ISOCERAUNIC CONDITIONS:**

2.2.1 The climatic conditions under which the breaker shall operate satisfactorily are as follows:

- a) Maximum ambient temperature of air in shade (°C). : 50°C
- b) Minimum ambient temperature of air in shade (°C). : 4°C
- c) Maximum daily average ambient temperature (°C). : 40°C
- d) Maximum yearly average ambient temperature (°C). : 3°C
- e) Maximum relative humidity (%). : 95%
- f) Average number of thunderstomn days annum. : 15
- g) Average annual rainfall (Cm.) : 150cm.
- h) Maximum wind pressure (Kg/m2) : 150kg/M2.
- i) Height above mean see level (m). : Not exceeding 1000 meter

2.2.2 All breakers offered shall be suitable for continuous satisfactory operation at the full rated capacity under the above climatic conditions.

2.2.3 Since the sub-station may be near seashore or Industrial area, the breaker offered shall be suitable for heavily polluted atmosphere.

2.3 **SYSTEM DETAILS:**

- i) Nominal system voltage : 66KV
- ii) Maximum rated voltage : 72.5 KV
- iii) Frequency : 50 Cycle Second.
- iv) Number of Phases : 3
- v) Neutral Earthing : Solidly earthed.

2.4 **The circuit breakers shall be complete with following requirements. :**

- 1) Number of Poles : 3
- 2) Basic Insulation level
  - a) 1.2 50 Microsecond impulse withstand voltage (KVP) : 350
  - b) On Minute Power Frequency withstand volt g(KV rms). : 140
- 3) Rated normal current : 2000 Amps.
- 4) Rated symmetrical breaking capacity at highest system voltage. : 3000 MVA
- 5) Rated short circuit breaking capacity : 31.5 KA (rms.)
- 6) Rated duration of short circuit : 3 second.
  
- 7) Total break time for any current upto the rated breaking current. : 3 cycles
- 8) Closing time. : Not more than 10 cycles.
- 9) Rated characteristics for short line faults As per Clause 4 of IS 13118 TEC-56.
- 10) Rated transient recovery voltage for terminal faults: As per Clause-4. 102 of IS: 13118 IEC56.
- 11) Rated line charging current breaking current :10 Amps.
- 12) Rated short circuit making current. : 50 KAp
- 13) Rated operating duty 0-0.3 Sec-Co-3 Min.- Co.
- 14) Total creepage distance : 1810mm
- 15) SF6 gas density monitor to be provided.
- 16) Gas filling device to be supplied with breaker with first filling of SF6 gas and gas leakage detector.
- 17) Rated voltage of trip coil, 110 v DC operating mechanism electro Dynamic.

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**SCHEDULE -A**

**GUARANTEED TECHNICAL PARTICULARS FOR CIRCUIT BREAKER SF6 (66KV)**

1. Name of manufacture :
2. Type :
3. Governing standard :
4. Rated voltage (KV) :
5. Maximum continuous rated service voltage (KV) :
6. Frequency (HZ) :
7. Whether Outdoor breaker offered :
8. Normal current rating (amps) :
  - i) Under standard conditions :
  - ii) Under site conditions :
9. Short time current rating (KA) :
  - a) For 3 second :
  - b) Rated operating duty :
10. Maximum temperature rise over ambient temperature. due to rated current in main contacts, measured after breaking test. :
11. Rated short circuit breaking current. :
  - a) Rated short circuit current (A.C component)-KA (Rms)-at KV :
  - b) Percentage D.C component :
  - c) Assymetrical breaking current (including D.C. component ) at KVrms. :
  - d) Rated symmetrical breaking capacity not relevant in MVA for SF6 CB :

12. Making capacity (KA peak) :
13. Total breaking time (milli second)
- a) For interruption of 10% of the rated capacity. )  
 )  
 )
- b) For interruption of 30% of the rated capacity )  
 )  
 )
- c) For interruption of 60% of the rated capacity )  
 )  
 )
- d) For interruption of the full rated capacity )  
 )
14. Arcing time (milli seconds) :
15. Making time (milli seconds) :
16. Minimum reclosing time at rated interrupting capacity from the in fault of the trip coil energisation (milli seconds) :
17. A) Minimum dead time
- a) 3 phase re-closing (milli seconds) :
- b) Limit of adjustment of dead time for 3 phase re-closing. :
- B) Whether re-strike free and trip free (IS/IEC applicable may be stated) :
18. Data on restriking voltage for 100%, 50% or 30% rated capacity : 100% 60% 30%  
 ----- ----- -----
- a) Amplitude factor :
- b) Phase factor :
- c) Natural frequency (Hz) :
- d) Rate of rise of restriking voltage (V/micro second) :
19. Maximum interrupting capacity under phase opposition condition :
20. Maximum line charging current breaking capacity without over voltage exceeding 2.5 times the rated phase to neutral voltage(Amps) :



21. Maximum line charging current :  
breaking capacity and corresponding  
over voltage recorded in test.
- a) On supply side : )  
) )  
b) On line side : )
22. Maximum cable charging current :  
breaking capacity and corresponding  
over voltage recorded in test.
- a) On supply side : )  
) )  
b) On line side : )
23. Maximum shunt capacitor Bank :  
switching capacity
24. Maximum breaking capacity on :  
kilometric faults.
25. Maximum over-voltage on :  
switching transformers on no load  
and the charging current.
26. Dry 1 minute power frequency :  
test withstand voltage, for complete  
circuit breaker.
- a) Between line terminals & :  
grounded parts (KV rms)
- b) Between line with :  
breaker contacts open (KV rms)
27. Wet 1 minute power frequency :  
test withstand voltage for complete  
circuit breaker.
- a) Between line terminals and :  
grounded parts (KV rms)
- b) Between terminals with breaker :  
contacts open (KV rms)
28. 1.2/50 micro second wave impulse  
withstand voltage for complete  
circuit breaker.
- a) Between line terminals and :  
ground (KV rms)
- b) Between terminals with circuit :  
breaker contacts open (KV peak)

**SUPPORT INSULATORS**

- 29. Make & Type :
- 30 Insulation Class :
- 31 Visible corona discharge voltage :
- 32. Wet 1-Minute power frequency flashover voltage (KV rms) :
- 33. Dry 1-Minute power frequency flashover voltage (KV rms) :
- 34. 1.2/50 Micro-second impulse flashover voltage (in KV peak) :
- 35. Creepage distance to ground heavily polluted atmosphere :
- 36. Minimum clearance in air :
  - a) Between phases (mm) :
  - b) Live parts and earth (mm) :
  - c) Live parts to ground level (mm) :

**CONSTRUCTION FEATURES**

- 37. No. of poles per Circuit Breaker :
- 38. No. of breaks per pole :
- 39. Total length of breaks per phase (mm) :
- 40. Type of main contacts ;
- 41. Material of main contacts :
- 42. Whether main contacts silver plated (Yes/No). :
- 43. Thickness of silver coating on main contacts(mm). :
- 44. Contact pressure on main contacts (Kg/m.sq.) :
- 45. Type of arcing contacts :
- 46. Contact pressure on arcing contacts (Kg/m.sq) :
- 47. Type of auxiliary switches :
- 48. Material of switch contacts :
- 49 Whether contacts silver plated (Yes/No) :

50. No. of auxiliary switch contacts operating with all three poles of a breaker. :
- a) Which are closed when Breaker is closed. :
  - b) Which are open when breaker is open. :
  - c) Those adjustable with respect to the position of main contacts. :
51. A) No. of spare auxiliary switch contact operating. :
- a) Which are closed when Breaker is closed. :
  - b) Which are open when breaker is open. :
- B) Details of pressure switch & its setting for low pressure alarm and low pressure cut-out. :
52. No. of operations possible without maintenance.
- a) At full rated interrupting capacity. :
  - b) At 50% of rated interrupted capacity. :
  - c) At 100% of rated current. :
  - d) At 50% of rated current. :
53. Mounting flange details. :
54. Type of operating mechanism (Pneumatic/mechanism/Motor operated spring charged). )
- a) Opening )
  - b) Closing )
  - c) Control voltage aux. :
55. Tripping and closing circuit voltage (V) :
56. Power required for trip coil (in watts) :
57. Power required for closing coil (in watts) :

**WEIGHT & SPACE REQUIREMENT.**

- 58. Weight of 3-phase breaker complete :  
with operating mechanism, support-  
ing insulators, frame work etc.
  
- 59. Impact loading for foundation :  
design to include dead load plus  
impact value on opening at  
maximum interrupting ratings  
in terms of equivalent static load.
  
- 60. Weight of heaviest package (Kgs). :  
space requirements. (Length,  
width, height).
  
- 61. SF6 gas/air pressure details
  - a) Rated SF6 gas : 7 bar absolute
  
  - b) IS/equivalent standard applicable : IEC-376  
for SF6 gas.
  
  - c) Qty of SF 6 supplied for :  
Actual use (kg)  
Spare Qty (kg)
  
  - d) chemical composition of gas :
  
  - e) Action on compensated gas pressure :  
give alarm cutoff .

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1.1 GENERAL DESIGN FEATURES OF CURRENT TRANSFORMERS :

- 1.1.1 The current transformers shall be of outdoor type single phase, 50 Hz, oil immersed self cooled suitable for operation in the climate conditions specified. The current transformers shall be complete in all respects. The 66 KV CT shall be of dead tank design for all ratio CTs.
- 1.1.2 The core shall be high grade, non-ageing, silicon laminated steel of low hysteresis loss and high permeability. The core material used in case of metering core shall be stated in the tender.
- 1.1.3 The current transformers shall be hermitically sealed to eliminate breathing and entering of air and moisture in the tank. Provision of pressure releasing device is not permitted. For compensation for variation in volume of oil due to temperature variation, **stainless steel bellows shall be provided**. The successful bidder shall have to submit calculations of volumetric expansion and contraction. These calculations shall be submitted alongwith the basic parameters of SS bellow used in CT.

**Rubber bellow or Nitrogen gas cushioning for above purpose will not be accepted.**

The current Transformers provided with stainless steel bellows for compensation of oil volume variation shall be provided with a suitable oil level indicator at suitable location to enable an observer to see the oil level of the C.T. from the ground level. Oil level indicator shall be provided with fluorescent green coloured floating ball.

- 1.1.4 The score of current transformers to be used for metering and instrumentations shall have saturation factor, low enough to avoid damage to the instruments, in the event of maximum short circuit current.
- 1.1.5 a) The C.T. core, to be used for protective relays shall be of accuracy class, specified or appropriate class suitable for back up, over current and earth fault, differential and busbar protection.
- 1.1.5 b) Nuts and bolts (or screws used for fixation of interfacing porcelain bushings for taking out terminals) shall be provided on flanges, cemented to the bushing and not on the porcelain i.e. Flange type 66 KV bushing for CT, shall be provided.
- 1.1.5 c) For gasket joints, wherever used, Nitrile Butyl rubber gaskets shall be used. The gasket shall be fitted properly with adequate space for accommodating the gasket under compression.
- 1.1.5 d) The bolts required for fitting the dome shall be of stainless steel of minimum 6mm dia.
- 1.1.5 e) The outer surface of **metal tank shall be Hot Dip Galvanised**, whereas, the inner portion shall be painted with oil resistive, insoluble paint. The purchaser reserves right for stage inspection during manufacturing process of tank / CT.
- 1.1.5 f) The tank of CT shall be provided with pressboard of 2 mm thickness inside and at bottom.
- 1.1.5 g) Provision of drain valve for sampling / draining of oil purpose at the bottom of tank is to be provided.
- 1.1.5 h) The minimum thickness of flange & gasket provided on tank shall be as follow:
- |    |                          |   |      |
|----|--------------------------|---|------|
| a) | Flange thickness of tank | - | 8 mm |
| b) | Top plate thickness      | - | 5 mm |
| c) | Gasket thickness         | - | 6 mm |
- 1.1.5 D) The current transformers shall be suitable for mounting on steel structures or concrete pedestals.

## **1.1.6 WINDING AND TERMINALS:**

1.1.6.1 The rating of the secondary winding shall be as specified under Section II of this specification. Ratio changing arrangement shall be provided on secondary winding for multi – ratio design, either a number of identical secondary winding may be provided to achieve desired ratios by series / parallel connection for the secondary winding or the secondary winding may be tapped. However, identical secondaries for tapped secondary winding shall meet requirement as specified.

1.1.6.2 Primary and secondary windings shall be of electrolytic grade copper and shall have continuous thermal rating as specified for all ratios. The primary winding is to be designed for continuous extended primary current at 120% of rated primary current. The secondary winding wherever tapped, shall be adequately reinforced to withstand normal handling without damage.

1.1.6.3 The primary terminals shall be of standard size of 30 mm dia x 80 mm length for all CTs rated upto 1200 Amps. For higher values of primary current, each primary terminal shall be made out of two such rods of 30mm dia x 80 mm length in parallel. The primary terminals shall be heavily tinned electrolytic copper. The minimum thickness of tinning shall be 15 microns.

1.1.6.4 The secondary terminals shall be brought out in a compartment for easy access. Secondary terminal studs shall be provided with at least three nuts and adequate of brass, duly nickel plated. The minimum outside diameter of the studs shall be 6mm. The length of at least 15mm shall be available on the studs for inserting the

leads. The horizontal spacing between centers of the adjacent studs shall be at least 1.5 time the outside circum dia. Of the units.

1.1.6.5 The current transformer shall be provided with suitable test tap for measurement of capacitance, tan delta as well as partial discharges, in factory as well as at site. Provision shall be made of a screw on cap for solid and secured earthing of the test tap connection, when not in use. A suitable caution plate shall be provided duly fixed on the cover of the secondary terminal box, indicating the purpose of the test tap and necessity of its solid earthing as per prescribed method, before energizing the CT.

### **1.1.7 TERMINAL BOX OF CURRENT TRANSFORMERS :**

1.1.7.1 The exterior of the secondary terminal box shall be hot dip galvanized. A cable box along with necessary glands for receiving control cables suitable for mounting on bottom plate of the terminal box shall be included in the scope of supply. A door with locking arrangement shall be provided on the front of the terminal box. The secondary terminal shall be taken out through composite epoxy or FRP mould having single gasket packing & shall be provided by suitable link with connector block to be provided. Secondary jumpers shall be terminated at one side of this terminal connector block.

### **1.1.8 TEMPERATURE RISE :**

1.1.8.1 The maximum temperature rise of the current transformer and its oil, winding and external surface of the core and other parts shall be as specified in Table I of IS:2705 (Part I) 1981.

## 1.2 BUSHING AND INSULATORS:

1.2.1 The porcelain insulator used in manufacturing the bushings shall be homogenous, free from lamination cavities and other flaws or imperfection that might affect the mechanical or dielectric qualities. All bushings of identical ratings shall be interchangeable. The bushing shall conform to the latest edition of IS: 2909. The puncture strengths of the bushings shall be entirely free from external and internal corona. The protected and total creepage distance of the bushings shall be 1810mm (minimum).

1.2.2 Suitable means shall be provided to accommodate conductor expansion and there should not be any undue stress on any part of the equipment due to temperature changes.

The bidder may provide packing between insulator and tank. This packing shall be preferably Nylon Bush of minimum 3 mm thickness.

1.2.3 The hollow porcelain bushings conforming to the latest edition of IS: 2099, shall be used for current transformers. The insulation of bushings shall be co-ordinated, with that of the instrument transformer such that the flashover, if any, will occur only external to the current transformers. The bushings should not cause radio interference, when operating at rated voltage.

1.2.4 The quantity of insulating oil for the first filling of oil in each CT and the complete specifications of the oil shall be stated in the tender. The oil shall conform to the requirements of latest edition of IS: 335. The actual oil to be used shall be of the following approved make.

- |                              |                                |
|------------------------------|--------------------------------|
| a) Apar, Mumbai              | f) Rinki Petrochemical, Baroda |
| b) Madras petroleum, Chennai | g) Amod Petrochem, Samiyala;   |
| c) Savita Chemicals,         | Dist. Baroda                   |
| d) Sarabhai Petrochemical,   | h) Raj Petroleum, Panoli       |
| e) Raj Lubricants, Chennai   | I) Tashkent Oil Co. Ltd.       |

The manufacturer of CT shall measure the PPM value of oil before filling inside the CT and shall keep record of the same.

## 1.3 TERMINAL CONNECTORS AND EARTHING TERMINALS :

1.3.1 Compression joint type bimetallic terminal connectors suitable for ACSR 'PANTHER' conductors (with 510 amps.) shall be supplied for CTs with having primary current up to 600 amps. The terminal connectors shall be suitable for 31.5 KA for 3 secs. They shall be suitable for vertical & horizontal connections.

## 1.4 GALVANISING:

1.4.1 All ferrous parts of current transformers including bolts, nuts etc. shall be **hot dip galvanized** as per IS: 2629-1966 with (latest edition).

### 1.5 TESTS AND TEST REPORTS:

1.5.1 Reports of all type tests as stipulated in the latest edition of IS:2705 for current transformers shall be submitted along with the tender.

1.5.2 The type test reports for the type tests carried out as per IS: 2705 (latest edition) for specified CTs and those for offered insulators shall be submitted. The type test reports shall not be older than five years, prior to the date of opening of bid.

1.5.3 Routine tests as per the latest edition of IS: 2705 for current transformers shall be carried out on each current transformer in presence of purchaser's representative.

### 1.5.4 General points:

- The manufacturer shall use 5 KV Meager for measuring IR values of CTs.
- The manufacturer shall carry out Partial Discharge test and tan delta test as per relevant ISS at their factory and shall keep record of the same.

- c) The manufacturer shall offer CTs for routine tests / inspection in line with the requirement.
- d) Record of each manufacturing process shall be maintained by the manufacturer, and shall be shown to the inspector, on demand at the time of inspection.

**1.6** Guaranteed Technical particulars shall be furnished along with the tender.

**1.7 COMPLETENESS OF EQUIPMENTS:**

Any fittings, accessories or apparatus which may not have been specifically mentioned in these specifications, but which are usual or necessary for the equipment of similar plant shall be deemed to be included in the contract and shall be supplied by the contractor without extra charges. All plant and equipment shall be complete in all details whatever such details are mentioned in the specification or not.

**1.8** Each CTS & PTS shall be inspected and checked by the representative of ED daman / consultant, prior to dispatch and routine test shall be carried out on each CTS & PTS as per IS/IEC.

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## **05 SECTION II-A: SPECIFIC TECHNICAL REQUIREMENT OF 66KV CTS**

### **2.1 SCOPE:**

2.2.1 This section covers the specific technical requirements, climatic and isoceraunic conditions and systems particulars for which current transformers shall be offered as per the general technical requirements given under section-I of this specification and the schedule of requirements specified herein for various substations.

### **2.2 CLIMATIC & ISOCERAUNIC CONDITIONS:**

2.2.1 The climatic conditions, under which the equipment shall operate satisfactorily are as follows:

a) Maximum ambient temperature of air in Shade (C)	50°C
b) Minimum ambient temperature of air in shade (C)	4°C
c) Maximum daily average ambient temperature (C)	40°C
d) Maximum yearly average ambient temperature (C)	30°C
e) Maximum relative humidity (%)	95%
f) Average number of thunderstorm days / annum.	15
g) Average annual rainfall	150 cms.
h) Maximum wind pressure	150 Kg/m <sup>2</sup>
i) Height above mean seal level	Not exceeding 1000mtrs.

2.2.2 All equipments offered shall be suitable for continuous satisfactory operation at the extended primary current of 120 % of full rated capacity, under the above climatic conditions.

2.2.3 Since the substations may be near seashore, the equipment offered shall be suitable for heavily polluted atmosphere.

### **2.3 SYSTEM DETAILS:**

i) Nominal system voltage	66 KV
ii) Maximum rated voltage	72.5 KV
iii) Frequency	50Hz.
iv) Number of phases	3
v) Neutral earthing	Solidly Earthed

### **2.4 TYPE & RATING OF CURRENT TRANSFORMER:**

2.4.1 The 66 KV Current transformer shall have the rating as given below:

1) CT Ratio : 600-300-150/1-1-1 Amp			
2) No of Cores	: Three		
	<u>Core – I</u>	<u>Core – II</u>	<u>Core - III</u>
3) Application	metering	protection	Differential
3) Rated burden (VA)	15	20	-
4) Class of accuracy	0.5	5 P15	P S
5) I S F	< 5	-	-
6) Minimum knee point voltage	-	-	600 V
7) Exciting current	-	-	<30 mA at Vk/2
8) Rct	-	-	< 5 Ohm
9) 1.2 / 50 microsecond lightning impulse withstand voltage (kV peak)		: 350	
10) Power frequency withstand voltage for one minute (kV rms) Dry & Wet		: 140	
11) Short time with stand current (KA) (corresponding to fault level in MVA for 3.0 secs.)		: 25	

- 12) Minimum total for creepage distance for heavily polluted atmosphere: (mm) :1810
- 13) Reference standard for PTS : I.S 2705, 1992
- 14) Reference standard for oil : I.S 335, 1993
- 15) Max. temp. Rise over design Ambient Temp. at rated current & frequency : Max 50 over 50 Deg. Cent.
- 16) The 66kv PTS shall be outdoor type, single phase, 50 HZ, oil filled, Hermetically sealed with SS bellow, dead tank suitable for Hot line washing.
- 2.4.2 The ratings specified shall be guaranteed at all primary connections. Any changes in the particulars of the CTs that may be required for the protective relays (protective relays being procured separately) actually shall have to be met by the supplier of CTs without any extra cost.
- 2.4.3 All current transformers shall meet the requirements of this specification for  $\pm 3\%$  variation in rated system frequency of 50 Hz.

**2.4.4 EARTH QUAKE & WIND DESIGN LOADS:**

Each CT, including its supporting structure shall be designed to withstand repeated earthquake acceleration of 0.08 x 2g with wind loads of 150 kg/m<sup>2</sup> on the projected area (non-simultaneous) without damage to component parts and without impairment of operation.

- 2.4.5 The class insulation will be A or better.

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**G.T.P. FOR 66KV CTs.**

No.	Description	Unit	
1	MAKE		
2	TYPE		
3	Reference Standard for CTs		
4	Reference Standard for Oil		
5	a) Rated system Voltage b) Highest system Voltage	KV KV	
6	Rated primary current	A	
7	Rated Secondary current	A	
8	NO OF CORES		
9	Details of Cores a. Current Ratio b. No. of cores c. Rated Output Burden and Accuracy class Core – I. Core – II. Core – III.	A/A No. VA	
10	Short time thermal rating of Primary current for 3.0	KA	
11	Rated insulation level. a. 1.2/50 microsecond impulse withstand Voltage on primary winding. b. One minute power frequency withstands Voltage (Dry) on primary winding. c. One minute power frequency withstand Voltage (wet) on primary winding. d. One minute power frequency with stand test Voltage in secondary winding.	KV Peak  KV Rms  KV Rms  KV Rms	
12	Min. total Creepage Distance	mm	
13	Class of insulation		
14	No. of secondary turns		
15	Variation in ratio & phase angle error due to Variation in voltage by 1% Frequency by 1%		
16	Temperature rise	°C	
17	Knee point voltage		
18	Accuracy limit factor		

**06 SECTION II:- SPECIFIC TECHNICAL REQUIREMENT OF  
66KV PTS**

**2.5 SCOPE:**

2.2.2 This section covers the specific technical requirements, climatic and isocraunic conditions and systems particulars for which POTENTIAL transformers shall be offered as per the general technical requirements given under section-I of this specification and the schedule of requirements specified herein for various substations.

**2.6 CLIMATIC & ISOCERAUNIC CONDITIONS:**

2.6.1 The climatic conditions, under which the equipment shall operate satisfactorily are as follows:

a) Maximum ambient temperature of air in Shade (C)	50°C
b) Minimum ambient temperature of air in shade (C)	4°C
c) Maximum daily average ambient temperature (C)	40°C
d) Maximum yearly average ambient temperature (C)	30°C
e) Maximum relative humidity (%)	95%
f) Average number of thunderstorm days / annum.	15
g) Average annual rainfall	150 cms.
h) Maximum wind pressure	150 Kg/m <sup>2</sup>
i) Height above mean seal level	Not exceeding 1000mtrs.

2.6.2 Since the substations may be near seashore, the equipment offered shall be suitable for heavily polluted atmosphere.

**2.7 SYSTEM DETAILS:**

i) Nominal system voltage	66 KV
ii) Maximum rated voltage	72.5 KV
iii) Frequency	50Hz.
iv) Number of phases	3
v) Neutral earthing	Solidly Earthed

**2.8 TYPE & RATING OF POTENTIAL RANSFORMER:**

2.8.1 The 66 KV Potential transformer shall have the rating as given below:

1) PT Ratio : 66 kV / RT3 // 110V / RT 3 // 110V / RT3		
2) No of Cores	: Two	
	<u>Core – I</u>	<u>Core – II</u>
3) Application	Metering	protection
3) Rated burden (VA)	100	50
4) Class of accuracy	CL 0.5	CL 0.5
5) Voltage Factor	: .2 continuous, 1.5 for 8 hours	
6) Max. temp. Rise over design Ambient Temp. at rated voltage & frequency	: Max 50 over 50 Deg. Cent.	
7) 1.2 / 50 microsecond lightning impulse withstand voltage (kV peak)	: 350	
8) Power frequency withstand voltage for one minute (kV rms) dry & wet	: 140	
9) Minimum total for creepage distance for heavily polluted atmosphere	: 1810 mm	
10) Reference standard for PTS	: I.S 3156, 1992	
11) Reference standard for oil	: I.S 335, 1993	
12) Max. temp. Rise over design Ambient Temp. at rated voltage & frequency	: Max 50 over 50 Deg. Cent.	
13) The 66kv PTS shall be outdoor type, single phase, 50 HZ, oil filled, Hermetically		

sealed with SS bellow, dead tank suitable for Hot line washing.

**2.8.2 EARTH QUAKE & WIND DESIGN LOADS:**

Each CT, including its supporting structure shall be designed to withstand repeated earthquake acceleration of 0.08 x 2g with wind loads of 150 kg/m<sup>2</sup> on the projected area (non-simultaneous) without damage to component parts and without impairment of operation.

**2.9 INSPECTION:**

2.9.1 Each CT shall be inspected and checked by the representative of ED daman / consultant, prior to dispatch and routine test shall be carried out on each CT as per /IS/IEC.

\* \* \* \* \*

**GUARANTEED TECHNICAL PARTICULARS FOR 66 KV PTs.**

<b>No.</b>	<b>Description</b>	<b>Particulars</b>
1.	MAKE	
2.	TYPE	
3.	Rated primary voltage (KV)	
4.	No. of Secondary winding	
5.	Rated Secondary voltage (V) Winding-I Winding-II	
6.	Class of accuracy & Rated burden (VA) Winding-I Winding-II	
7.	Reference Standard	
8.	Oil conform to	
9.	Rated voltage factor and time	
10.	One minute power frequency withstand test (dry) voltage (KV)	
11.	One minute power frequency withstand test (wet) voltage (KV)	
12.	1.2/50 micro second impulse wave withstand test voltage (KVp)	
13.	One minute power frequency withstand voltage on secondaries (KV)	
14.	Reference Drawing	
15.	Min Total Creep age Distance (mm)	
16.	Surface treatment	
17.	Class of insulation	
18.	Temperature rise at 1.1 times rated voltage with rated burden.	
19.	Max, ratio error with rated burden & 5% normal primary voltage.	
20.	Max phase angle error with rated burden & 5% normal primary voltage	
21.	Variation in ratio & phase angle for variation in.. a) Voltage by 1% b) Frequency by 1Hz.	

**1.1 SCOPE :**

1.1.1 This Section covers the scope of design, manufacture, testing, installation etc. for the outdoor Isolators and Isolator-cum-Earthing Switches.

**1.2 STANDARDS :**

1.2.1 The Isolators and Isolator-cum-Earthing Switched shall comply with the requirements of the IS : 9921 and IEC : 129 (latest edition) except specified herein. The Insulators shall comply with the requirements of IS : 2544 and IEC : 168-1988 (lates: edition)

**1.3 DRAWING :**

1.3.1 Tender shall submit the following drawings (in duplicate) alongwith the offer for security.

- (a) General outline dimensional drawings.
- (b) Sectional view showing the general constructional features of the Isolators with / without Earthing Switches.
- (c) Details of fixed & moving contacts & Auxiliary Switch Box.

1.3.2 The successful tenderer shall submit the following drawings for the approval of the Purchaser within 15 days of receipt of purchaser order.

- (a) General outline drawing of plan, elevation and side view of Isolators and Isolator-cum-Earthing Switches with all accessories, showing dimensions, details, transport details etc.
- (b) Detailed assembly drawings with parts properly identified for assembly of the equipment Mechanical Interlock for Isolator with E.B. be stated in the drawing.
- (c) Drawings showing complete particulars of foundation and structural details.
- (d) Complete bill of materials for the Isolators, with the description of make, type designation and rating of various parts / items of isolators.
- (e) Literature / leaflet of auxiliary switch for isolators.

**4 GENEARL DESIGN FEATURES OF ISOLATORS & ISOLATOR-CUM-EARTHING SWITCHES :**

4.1.1. The Isolators shall be double break, outdoor, gange operated type, with blades rotating in horizontal plane. The design shall be for upright mounting. If required, and the Isolators shall be convertible for right or left hand control with minimum labour and replacement of part. The live parts shall be so designed that as far as possible, sharp points, edges and other corona producing surface are eliminated. Except the Insulator caps and bases, all other live parts shall be non-ferroous. Bolts, Screws and Pins shall be provided with locking arrangement and shall be of the best materials.

1.4.2 Each pole shall have three Pedestal type of Insulator's stacks. Necessary arrangements shall be provided for proper alignment of the contacts. Gange operated links shall be so designed that all phases shall make and break simultaneously.

1.4.3 The design of Isolators and Isolator-cum-Earthing Switches shall be provided for positive control of blades in all positions with minimum mechanical stress on the Insulators. Fixed guides shall be so provided that proper setting of contacts shall be obtained, when a blade is out of alignment even by 25mm in either direction. All movable parts which may be in current path shall be shunted by flexible copper conductor of adequate cross-section and capacity, which shall be furnished under bill of material.

1.4.4 The length of the handle for manual operation shall not be more than one metre and shall be stated on the drawing. The rotating parts shall have a smooth movement.

1.4.5 The clearance of 4000 mm from live parts to ground as per provision of I.E. Rules shall be considered while manufacturing of isolators & to decide location of operating mechanism box. Hight of structure of isolator from ground is to be considered as 2900 mm including 150mm for muffing.

## 5 TEMPERATURE RISE :

5.1 The maximum temperature rise of any part of the Isolator and Isolator-cum-Earthing Switch; while in service under continuous full load conditions, continuous direct sunrays and air, having maximum temperature (as specified in Clause 2.2.1 Section-II of this Specification) shall not exceed the values given below :

No	Parts	Max. Value of Temp. (°C)
1)	Copper contacts in air a) Silver faced b) Bare	105 75
2)	Terminals of disconnectors or Earthing Switches to be connected to external conductors b screws or bolts: a) Silver faced b) Bare	105 90
3)	Metal parts acting as springs.	The temperature shall not reach a value when the clasticity of the material is impaired. For pure copper, the temperature limit of 75° C is specified.

4)	Woven wire braids	75
5)	Metal Parts in contacts with Insulations of the following classes : a) Class 'A' (for impregnated material) b) Class 'b) Class 'Y' (for non-impregnated") c) Class 'E' (in air) d) Class 'B' (in air) e) Class 'F' (in air)	100 90 120 130 155
6)	ENAMEL : a) Oil base b) Synthetic in air	100 120

## 1.6 CONTACTS :

1.6.1 The moving & n fixed contacts shall be made of hard drawn electrolytic grade copper strips and shall be heavy duty self- aligning & high pressure type preferably which applies pressure to the contact surfaces after the blades are fully closed and release the pressure before they start to open. High pressure type contacts shall wipe the contact surfaces, while opening and closing. The contacts shall be so designed that wiping, action shall not cause securing or abrasion on the contact surfaces. The wiping action shall be sufficient to remove oxidefilm, formed during the operation of the switches. The pressure shall be developed by rotation of the entire blade.

1.6.2 The temperature rise of contacts due to the flow of rated short circuit current for a period of 3 seconds shall not cause any annealing or welding of contacts.

1.6.3 The moving contacts, if provided, shall close first and open last so that no damage is caused due to arcing whatever to the main contacts. The tenderer shall give full details of such contacts with necessary drawings.

1.6.4 The areing contacts, if provided. shall close first and open last so that no damage is caused due to areing whatever to the main contacts. The tender shall give full details of such contacts with necessary drawings.



1.6.5 The female contact and its tensioning by spring shall be such that there will, always, be a positive contact with adequate pressure to give enough contact surface for the passing of current. The springs provided should not go out of alignment or get entangled with the male contact during operation. The details of springs shall be furnished on the G.A. drawing.

## **1.7 OPEARTING MECHANISM :**

1.7.1 The Isolators and Isolator-cum-Earthing Switches shall be suitable for manual operation and the mechanism shall be such that it should be easy to operate by a single person. The height of the handle above the foundation shall be such as to ensure easy operation. This will be stated on the drawing. The operating mechanism shall have smooth movement and shall be so designed that all the three blades are in positive control throughout the entire cycle of operation.

1.7.2 The rotating Insulator stacks shall be provided with double roller or double ball-bearings of reputed make and shall be adjustable and easily accessible for dismantling requisite length shall be supported on ball or roller thrust bearings. The details of type designation, No & make of bearings shall be stated on the drawing.

1.7.3 Position indicators indicating 'Open' & 'Closed' position shall be provided near the operating mechanism.

1.7.4 Provision shall be made for pad locking the mechanism of Isolators and Earthing Switches in both. 'Close' and 'Open' positions.

1.7.5 The Isolator and Isolator-cum-Earthing Switch shall be such that its set-position will not be affected by wind pressure, vibrations, reasonable shocks etc.

1.7.6 The operating pipe shall be fitted such that, operation of blades of isolators shall be easy & the operating pipe shall not get stuck up during operation of isolators.

1.8 Connectors for phase Terminals & clamps for Earthing terminals.

1.8.1 630 Amp. Rated Isolator & Isolator-cum-Earthing Switches shall be with compression type bimetallic terminal connectors suitable for ACSR PANTHER" Conductor and 1250 Amps. Rated Isolater without Earth Switch shall be with the compression type bimetallic terminal connectors suitable for ACR\SR "TWIN MOOSE" Conductor for taking line and bus connections.

1.8.2 Each Isolator and Isolator-cum-Earthing Switch shall be with atleast tow numbers of grounding terminals and clamps for receiving ground connections.

1.8.3 S.S. bolts each shall be supplied with one no. S.S. washer & two nos. of S.S. nuts.

1.8.4 Terminal connector bimetallic coper plate shall be of 2mm thickness.

## **1.9 EARTHING BLADES :**

1.9.1 The Isolators controlling the transmission line shall be equipped with earthing blades. The Earthing blades shall be counter balanced to ensure easy operation.

1.9.2 Line earth switch shall consist of three Earthing links per Isolator which will normally rest against the frames, when the connected Isolator is in closed position. The Earthing links of all three phases shall be suitable for fitting on either side of the Isolator.

1.9.3 Short time current withstand capacity of earthing blades of Isolator Earthing Switch shall be same as that of the main blades of Isolator. The material of the earthing Isolator. Each earthing blade shall be provide with flexible copper connections of adequate length of not less than 60mm<sup>2</sup> are for connection between the operating shall and the base frame.

1.9.4 The rated making capacity of Earthing switches shall be as specified in the applicable standard of isolators.

### **1.10 SUPPORT INSULATORS:**

1.10.1 The support Insulators used for the isolators and Isolator-cum-Earthing Switches shall be of reputed make and made of best electrical porcelain and shall comply with requirements of IS : 2544 and IEC : 168-1988 (latest edition) and relevant standards. The Insulators shall be manufactured by the wet process. The porcelain and metal parts shall be assembled together with such material and in such a manner that any terminal expansion of the metal and the porcelain throughout the range of operating temperature shall not loosen the parts or create undue stress, affecting adversely the mechanical and electrical strength.

1.10.2 The Tenderer shall offer 66kv solid core Post Insulators only.

### **1.10.3 INTERLOCKING :**

All Isolators and Isolator-cum-Earthing Switches shall be suitable for electrical interlocking and the earthing switch shall, also, be mechanically interlocked with the inter-locking. This arrangement shall be clearly indicated in the drawing of Isolator cum earthing switch. Failure of power supply or connection to electrical interlock shall not produce on permit faulty operation.

1.11.2 Following Interlocks are required for:

- (i) Prevention of opening of line Isolators on load.
- (ii) Prevention of closing of earth switch. When line Isolator is closed.
- (iii) Prevention of closing of line isolator, when earth-switch is closed.

1.11.3 Provision shall be made for interlocking Isolators with circuit breakers so that these are closed, before the circuit breaker is closed and opened, after the circuit breakers is opened.

1.11.4 The details of interlocking system shall be furnished by the tenderer and shall be subject to the Purchaser's approval.

### **1.12 AUXILIARY SWITCHES:**

1.12.1 Auxiliary switches are to be provided both for main and earth switches and shall be mechanically actuated by the corresponding, operating mechanism, Six (6) number of each normally 'Open' and normally 'Closed' contacts to normally open contact or vice versa with minimum modification would be preferred. Switches shall be provided with provision for indication of switch position, electrical interlocking, remote semaphores etc.

1.12.2 Each auxiliary switches shall be equipped with four (4) numbers of normally 'Open' & normally 'Closed' spare auxiliary contacts in addition to those mentioned above.

1.12.3 Auxiliary switches shall be mounted in a weatherproof housing, suitable for I.P. 55 degree of protection which shall have provision for entry of cables of proper size and for fixing of cable glands.

### **1.13 BEARING :**

1.13.1 The design and construction of the various bearing shall ensure satisfactory operation for long period under all specified climate conditions. Bearing housing shall be weather-proof. Facilities shall be provided for lubrication of the bearings. All bearings shall be with first filling of grease.

All bearings installed in the path of current except those specifically designer on higher pressure contacts shall be shunted by flexible copper conductors of adequate cross-section.

**1.14 GALVANISING :**

1.14.1 All ferrous parts of the Isolators including mechanism housing shall be hot-dip galvanized as per IS:2629 (latest edition) and structural parts of Isolators shall be hoot-dip galvanized as per IS:4759 (latest edition)

**1.15 PAD LOCKING APRANGEMENT**

1.15.1 Padlocks or any other locking arrangement shall be provided for locking the operating handle of each isolator and earthing switch in the ‘ON’ & ‘OFF’ position. The locking arrangements shall be of approved design.

**1.16 TESTS :**

1.16.1 The Isolators and Isolator-cum-Earthing Switches shall be suitable for withstandin various type and routine tests as per IS : 9921 and IEC : 129 (latest edition)

The routine tests shall be conducted at the works of the Manufacturer of Isolators and Isolators-cum-earthing Switches alongwith Insulators offered as stipulated in IS : 9921 (Part-4) and IEC : 129 (latest editions), including power frequency voltage (dry) with stand test of the main circuit as per Clause 4.0.1 on the offered lot. The test certificates shall be submitted for approval before dispatch of isolators.

**1.16.2 TYPE TESTS :**

Certified copies of complete Test reports of the type tests. Carried out on the Isolators and Isolator-cum-Earthing Switches and on Insulators as per the specified standard shall be submitted by the Tenderer alongwith offer.

- (1) 1.2/50 microsecond tightning impulse voltage withstand test & one minute power frequency voltage (Dry & wet) withstand test.
- (2) Temperature Rise Test.
- (3) Rated peak short time withstand current and rated short time withstand current test.
- (4) Mechanical endurance test.

1.16.3 All test reports shall be submitted and got approved from the purchaser before dispatching the isolators and insulators.

**1.17 TROPICALISATION :**

1.17.1 The equipment and its accessories shall, by means of any of dip coating, shall be protected against fungus growth and other harmful effects due to tropical environments.

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**2.1 SCOPE :**

2.1.1 This section covers the specified technical requirements. Climatic and isoceraunic conditions, system particulars etc. for which the isolators and Isolator-cum-Earthing Switches shall be offered.

**2.2 CLIMATE AND ISOCERAUNIC CONDITIONS :**

2.2.1 The climatic and Isoceraunic conditions of site are as under :

- (a) Maximum ambient temperature in shade (°C) : 50
- (b) Minimum ambient temperature in shade (°C) : 4
- (C) Maximum daily average ambient temp. (°C) : 40
- (d) Maximum yearly average ambient temp. (°C) : 30
- (e) Maximum relative humidity (%) : 95
- (f) Average rainfall per annum (Cm) : 115
- (g) Average No. of thunder storm day per annum : 15
- (h) Maximum wind pressure (Kg/m<sup>2</sup>) : 150
- (i) Height above sea level. Not exceeding 1000 Mtrs.

2.2.2 The isolators offered shall be suitable for continuous operation at their full rated capacity under above conditions.

2.2.3 The isolators offered shall be suitable for heavily polluted atmosphere.

**2.3 SYSTEM DETAILS :**

- (a) Nominal voltage : 66 K
- (b) Maximum voltage : 72.5 KV
- (c) Frequency : 50 Hz ± 3 %
- (d) Number of phases : 3
- (e) Neutral Earthing : Solidly earthed.

**2.4 TYPE AND RATING :**

2.4.1 The Isolators an Isolator-cum-Earthing Switches shall comply with the following technical requirements :

## 66 KV Isolators

1)	Nominal system voltage (KV)	66
2)	Highest system voltage (KV)	72.5
3)	Rated frequency (Hz)	50
4)	Number of phases	3
5)	Rated current (Amps.)	1250 amp
6)	Rate short time current (KA rms)	31.5 kA
7)	Rated duration of short circuit current (Sec)	3
8)	Basis Insulation level (KV)	
	(i) Standard lightning impulse withstand voltage positive and negative polarity :	
	(a) Across the Isolating distance (KV peak)	375
	(b) To earth and between poles (KV peak)	350
	(ii) One minute power frequency withstand voltage : (Dry & Wet )	
	(a) Across the Isolating distance (KV rms)	160
	(b) To earth and between poles (KV rms).	140
9)	Minimum total creepage distance (mm)	1810
	(suitable for Heavily polluted atmosphere):	
10)	Type of Isolators and Isolator-cum-Earthing Switches -Double Break triple pole, gange operated type.	outdoor,
11)	1 min. power freq flash over volt (dry & wet),Kv rms	180/155 Kv rms
12)	1.2/50 $\mu$ sec. lighting impels withstands voltage.	350 Kv peak
13)	Standard dry impulse flashover voltage (Kvp)	355 Kv peak
14)	Minimum visible corona discharge volt. (Kv rms)	53 Kv rms
15)	Puncture voltage(Kv rms)	Non puncturable
16)	Tensile strength (KN)	70 KN
	Compressive strength (KN)	265KN
17)	Torsional strength	4.5KNm
	Cantilever strength (KNm)	4KN
18)	Galvanizing:	
i)	Applicable standard	IS:2629-1966
ii)	Method of Galvanizing	Hot dip galvanizing
iii)	Weight of zinc coating (gm/cm <sup>2</sup> )	As per IS.

## 2.5 PROTECTION AGAINST EARTHQUAKE AND WIND DESIGN LOAD :

2.5.1 Each Isolator and Isolator-cum-Earthing Switch shall be designed to withstand repeated earthquake acceleration or 0.08 x 29 and wind loads of 150kg m<sup>2</sup> of the projected area (non-simultaneous) without damage and without impairment of operation.

2.6 General :

- (1) Type test reports shall be submitted for the specified ratings of isolators & insulators. In case of submission of the same for higher rating of isolators. Its acceptability

against specified rating of isolator shall be justified by giving reference of clause of applicable. IS or other applicable standard.

- (2) List of orders executed shall be submitted for the specified ratings of isolators & insulators. In case of submission of the same for higher rating of isolators. Its acceptability against specified rating of isolator shall be justified by giving reference of clause of applicable. IS or other applicable standard.
- (3) Performance reports for specified isolators shall be submitted with the offer. In absence of these details, the offer will be evaluated accordingly.

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**10 Sec - II : GUARANTEED TECHNICAL PARTICULARS of  
66KV ISOLATOR**

1	Name of manufacturer	
2	Type of isolators	
3	Reference of applicable Standard IS or IEC	
4	Class (Outdoor/Indoor)	
5 a)	Rated normal voltage (Kv)	
b)	Rated highest system voltage (Kv)	
6	Frequency (Hz)	
7	Rated current of isolator (A) under site condition	
8	No of poles.	
9 a)	Max. current capacity for interrupting magnetizing current of transformers or charging current of line when equipped with arcing contacts.	
b)	-do- but when not equipped with arcing contacts.	
10	No. of operations possible without deterioration of contacts.	
11	Rated short time current (KA rms) for 3 seconds	
12	Rated peak current (KA peak)	
13	Rated current of earthing switches (amps)	
14	Type of mounting	
15	Phase centers phase clearance (mm)	
16	Minimum phase to phase clearance (mm)	
17 a)	Minimum phase to ground clearance (mm)	
b)	Min. clearance from base channel to ground (mm)	
18	No. of solid core post insulators	
19	No. of breaks per pole	
20	Type of interlock bet. isolating switch & earth switch	
21	Total minimum creepage distance suitable for heavily polluted atmosphere (mm)	
22		
a)	Type	
b)	Material	
c)	Whether arcing contacts silver plated(Yes/No)	
d)	Minimum thickness of silver coating	
e)	Current carrying capacity	

23	Main contacts (fixed and moving)		
a)	Type		
b)	Material		
c)	Whether contacts silver plated (Yes/No)		
d)	Minimum thickness of silver coating (mm)		
e)	Contact area in sq. mm		
f)	Contact pressure in Kg.		
g)	Current carrying capacity (Amp.)		
h)	Size of material used		
	(1) Moving contact (A/mm <sup>2</sup> ) 630Amps		
	1250 Amps		
	(2) Fixed contact (A/mm <sup>2</sup> ) 630Amps		
	1250 Amps		
i)	Cross section area		
	(1) Moving contact (A/mm <sup>2</sup> ) 630Amps		
	1250 Amps		
	(2) Fixed contacts (A/mm <sup>2</sup> ) 630Amps		
	1250 Amps		
j)	Current density (at rated current)		
	(1) Moving contact (A/mm <sup>2</sup> ) 630Amps		
	1250 Amps		
	(2) Fixed contacts (A/mm <sup>2</sup> ) 630Amps		
	1250 Amps		
k)	Contact pressure		
	(1) Moving contact(Kg/Cm <sup>2</sup> )		
	(2) Fixed contacts(Kg/Cm <sup>2</sup> )		
24	Whether bearings as per clause 1.7.2 are provided		
25a)	Location and number of bearings per each phase		
b)	Manufacturer's bearing no & type designation		
26	Weight of one complete pole (Kg)		
27	Whether separate operating mechanism provided for operation of main blades and earthing blades		
28	Height of location of operating handle above foundation.(mm)		
29	Length of operating handle (mm)		
30	Force required for operation (Kgm)		
31			
i)			
a)	Across the isolating switch		
b)	To earth and between poles		
32 i)			
a)	Across the isolating distance		
b)	To earth and between poles		



ii)		
a)	Across the isolating distance	
b)	To earth and between poles	
33	Maximum minimum visible corona discharge voltage (Kv rms)	
34	Temp. rise of main contact at rated current corresponding to ambient temperature of air in shade (°C)	
35	Maximum temp. rise of main contact at rated short time current for 3 seconds (°C)	
36	Rated mechanical terminal loads (including wind loads (N)	
37		
38	Maker's type designation	
39	Applicable standard and drawing no.	
40	No. of units per stack	
41	Height of stack	
42	1min. power freq. withstand volt. (dry & wet) -Kv rms	
43	Loading details for design of foundation	
i)	For Isolator	
ii)	For Isolator cum earthing switches	
44	* Weight, space requirement etc.	
i)	Weight of complete isolator with operating mechanism supports etc. Space	
ii)	Weight of complete isolator and isolator – cum- earthing operating mechanism supports etc. space	

## 11 SEC-II : GENERAL SPECIFICATIONS OF 66KV L.A.

### **3 GENERAL**

- 3.1 The design, manufacture, inspection, testing and performance of Lighting Arrester shall comply with all currently applicable statutes, safety codes, provision of latest Indian Electricity Act, Indian Electricity Rules and Regulations of Statutory Authorities.
- 3.2 Lightning Arrester shall be certified for acceptance against industrial risk from authorities like Bombay Regional Council, Insurance Association of India, Tariff Advisory Committee, Fire Insurance Authority.

### **4 GENERAL REQUIREMENT OF EQUIPMENT:**

#### **4.1 CONSTRUCTIONAL FEATURES:**

- 4.1.1 Lightning Arrester shall be gapless metal oxide type comprising series connected zinc oxide elements. The elements shall be in hollow cylindrical form, stacked together. Zinc oxide elements shall be of heavy duty type, having non-linear voltage – current characteristic and shall be of heavy duty type having high discharge capability.
- 4.1.2 The entire arrester unit shall be housed in a porcelain insulating casing of high strength, with metallic cover plates and terminal assemblies. The end casting shall be hermetically sealed and leak tested to protect the unit from moisture or breathing.
- 4.1.3 Pressure relief diaphragm, vent pipe, etc. shall be provided on the L.A. for the escape of gases formed. In the event of failure of L.A., indication for failure shall also be provided.
- 4.1.4 Lightning arresters shall be provided with monitor unit comprising of current meter and surge counter. Surge counter shall be provided to maintain counts of operation under gone by the arrester. Duly colour coded leakage current meter shall be provided to indicate healthy and defective status of the arrester. The surge monitoring unit shall be complete with insulating base, fittings, etc. for mounting at the bottom of L.A. at readable level, supporting insulator and necessary hardware. Facility shall be provided for tilting the monitor for viewing from convenient location.
- 4.1.5 All hardware such as clamps, screws, bolts, nuts, washers etc. shall be hot deep galvanized.

#### **4.2 INSULATORS:**

- 4.2.1 The porcelain insulators used shall be made from wet process, and shall be homogenous, free from lamination, cavities and other flaws, which may impair its mechanical or dielectric strength. They shall be thoroughly vitrified, tough and impervious to moisture.
- 4.2.2 The glazing of porcelain shall be uniform brown colour, free from blisters, burns, cracks and other defects. The glazing shall cover all the porcelain part of the insulators except those area which serve as support during firing or are unglazed for the purpose of assembly.
- 4.2.3 The minimum creepage distance shall be as stipulated in data sheets. The petticoats shall be spaced for natural cleaning action by wind and rain and avoid concentrated hot spots where local stresses can precipitate flashover.
- 4.2.4 All live metallic parts shall be suitably painted. All joints shall be fluid-tight and air tight. The design of insulators shall be such, as to produce uniform compression pressure joints.
- 4.2.5 All insulators of identical rating shall be interchangeable.
- 4.2.6 Each bushing shall be provided with aluminium / bimetallic terminal connectors suitable for inter-connection with Aluminium tubular Busbars or ACSR conductor as specified in data sheet.

#### **4.3 ACCESSORIES:**

- Each lightning arrester shall be furnished complete with the accessories as listed below:
- (i) Anti-contamination and pressure relief devices complete with vent pipe.
  - (ii) Arc transfer devices at both ends with current limiting gaps.
  - (iii) Two (2) grounding Terminals.
  - (iv) Base plate suitable for mounting on G.I. structure or concrete structure.
  - (v) Monitoring equipment comprising of leakage current meter and operation counter complete with insulating base, fitting and the necessary hardwares etc.
  - (vi) Line side terminal suitable for specified conductor.

(vii) Other standard accessories which are not specifically mentioned but are usually necessary and provided with lightning arrester of similar type and rating for efficient and trouble free operation.

**5 SPARES:**

Vendor shall quote itemized prices for the spares he recommends for 2 years operation and spares required during commissioning.

**6 INSPECTION:**

4.1 Each Lightning Arrester shall be inspected and checked by the representative of ED daman / consultant, prior to dispatch and routine test shall be carried out on each Lightning Arrester as per IEC-99-4.

\* \* \* \* \*

**12 : SEC - II : SPECIFIC TECHNICAL REQUIREMENT OF 66KV L.A.**

SN	Description	Unit	VALUE
1	Type	Metal oxide Gapless Type	
2	Specification for reference	ICE 99-4,1991	
3	No.units		
4	Rated Voltage	kVrms	60
5	Max. contineous operating voltage(MCOV)	kVrms	50
6	Nominal discharge current (8/20 micro second wave)	kA	10
7	High current discharge capacity (4/10 microsecond wave)	kA	100
8	Long duration discharge class		CLASS 3
9	Max.residual voltage with (8/20 microsecond wave)at:: lightning impulse of:		
	a) 5kA	kVp	154
	b) 10kA	kVp	160
	c) 20kA	kVp	182
10	Sleep current impulse residual voltage at 10kA with one microsecond front- time	kVp	180 *
11	Switching impulse residual voltage at 500A with 30 microsecond front time	kVp	135 Max 120 min
12	One minute PF withstand voltage of arrester housing	kVrms	140
13	Impulse withstand voltage of arrester housing with 1.2/50 microsecond wave	kVp	350kVp
14	Total minimum creepage distance of arrester	mm	1810
15	Pressure relief current/class	kA/class	40/A
16	Resistive and capacitive current of arrester at continuous operating voltage	(IR)mA (Ic)mA	0.4 <1 mA
17	Reference voltage and current	kVrms /mA	As per raring
18	Minimum recommended spacing between arrester center to center	Mm	780 *
19	Height of complete unit from base to the line side terminal	mm	650
20	Whether earthing arrangement provided		Yes
21	A.Terminal connecting clamp for ACSR PANTHER conductor offered		Yes
	B. Whether same is included in scope of supply		Yes

\* DATA TO BE FURNISHED BY MANUFACTURERE

**13 SEC -II : Guaranteed Technical particulars for 66 KV L.A**

1	Name of manufacturer	
2	Type and Model	
3	Application IS/IEC Reference	
4	No.of Units	
5	Rated voltage	KV rms
6	Max. contineous operating voltage	KV rms
7	Nominal discharge current (8/20 microsecond wave)	KA
8	High current discharge capacity (8/20 microsecond wave)	KA
9	Long duration discharge class.	
10	Max. Residual voltage with (8/20 microsecond wave)at:: lightning impulse of: a) 5 KA b) 10KA c) 20KA	KV peak -do- -do-
11	Steep current impulse residual voltage at 10KA with one microsecond front time.	KV peak
12	Switching impulse residual voltage at 500A with 30 microsecond front time.	KV Peak
13	One minute PF withstand voltage of arrester housing	KV rms

14	1.2/50 microsecond lightning impulse withstand voltage of arrester housing	KV (Peak)
15	Total minimum creepage distance of arreter	(mm)
16	Pressure relief current /class	
17	Resistive and capacitive currents of arrester at continuous operating voltage	
18	Reference voltage and current	
19	Cantilever strength of arrester	
20	Weight of complete unit	kg.
21	Height of complete unit from base to the line side terminal	mm
22	Minimum recommanded spacing between arrester center to center.	mm
23	Clearance required for grounded, equipment at various height of arrester unit.	mm
24	Whether earthing arrangement provided. Details shall be given.	
25	Dimentional Details for Mounting flange	
26	Terminal details of connecting clamp suitable for ACSR 'Panther' Conductor.	
27	Details of porcelain shell: a) Make b) Total minimum creepage (mm)	

<b>14 : SECTION - II</b>	
<b>GENERAL TECHNICAL REQUIREMENTS - 66KV RELAY &amp; CONTROL PANEL</b>	
1	The relay & control panel shall be simplex type floor mounted, free standing, dust & vermin proof, suitable for indoor installations.
2	The cubicle shall be fabricated from crc sheet 2 mm thick except front mounting plate & gland plate which shall be made from 3 mm
3	The panel shall be power coated with plant shade RAL 7032. Before painting the ms parts shall be treated for degreasing, derusting, etc.
4	The size of panel shall be 900mm x 600 mm x 2100mm high
5	All the components shall be provided with designation plate
6	All the indicating meters shall be digital acc cl 0.2
7	All the relays shall be NEUMERICAL type complete with programming facility with necessary interface software from a standard windos based PC(MJT & MIB 202)
8	Panel wiring is to be done with 1100V multisrand copper flexible conductor pvc insulated wire. The CT & PT ckt shall be wired with 2.5sq.mm & 1.5 sq.mm wires. The CT & PT ckt wires shall be coloured coded, DC ckt 1.5sq.mm grey colour & Ac ckt black colour wires.
9	Disconnecting type terminals shall be provided for ct ckt & for others shall be Nut type terminals size M4
10	DC & AC fail ALARM Scheme shall be provided.
11	The Mimic diagramme, set of fuses, etc to be provided
12	The trip circuit supervision function shall be provided in both pre & post clause position of CB & the relay shall be hand reset type with reverse flag
13	Base channel 100 mm high to be provided
14	Rear two hinged door shall be provided
15	The digital tvn meter shall have communication output suitable for PC

**15 SECTION - II**

**SPECIFI TECHNICAL REQUIREMENTS OF RELAY & METERING PANEL**

THE RELAY & CONTROL PANEL SHALL BE COMPRISING OF

- 1 NO DIGITAL AMMETER TO READ ALL THREE PHASE CURRENT
- 1 NO DIGITAL VOLTMETER TO READ ALL THREE PHASE VOLTAGE
- 1 NO MULTI PARA METER TO READ A,V, KW, KVA, PF, HZ, KWH, KVAH, KVARH
- 1 NO ANNUNCIATOR 8 WINDOW
- 1 NO TNC SWITCH 25A, 2 POLE
- 6 NOS INDICATING LAMPS ON /OFF/AUTO TRIP/ SP.CHARGED / DC FAIL / TRIP CKT HEALTHY WITH PUSH BUTTON
- 1 NO NEUMERICAL IDMT T.P. O/C & E/F RELAY WITH HIGH SET UNIT
- 1 NO HIGH SPEED TRIPPING RALY
- 2 NOS TRIP CKT SUPERVISION RELAY PRE & POST CLAUSE
- 3 NOS AUX. RELAY HAND RESET TYPE 3 ELEMENT FOR BUCH / WT / OTI / OLTC / MOG ALARM & TRIP.
- 1 NO RESTRICTED E/F PROTECTION RELAY
- 1 NO NEUMERICAL BISED DIFFERENTIAL RELAY
- 1 NO TEST TERMINAL BLOCK 3 PH 4 WIRE
- 3 NOS SEMAPHORE INDICATOR 2 POSITION
- 3 NOS INTERPOSING RATIO 1/1, VK > 50V, Rct < 1 ohm
- 1 NO SPACE HEATER WITH THERMOSTATE & SWITCH
- 1 NO PANEL ILLUMINATION FLORECENT LAMPS 230V AC TO BE PROVIDED
- 1 NO DC FAIL ALARM SCHEME
- 2 NOS AC & DC CONTROL SUPPLY D.P. MCB
- 1 NO SWITCH SOCKET 15 / 5 AMP 230V AC
- 1 NO HOOTER 110V DC
- 1 NO BELL 240V AC FOR DC FAIL
- 1 SET CONTROL FUSES
- 1 No COPPER EARTH BUS SIZE 30 X 6 MM SHALL BE PROVIDED

\* \* \* \* \*



**16 SECTION - II : TECH SPECIFICATION OF  
BATTERY CHARGES FOR 110V. 100AH BATTERY**

**1.0 SCOPE :**

This specification covers design, manufacture, testings at works and supply of the complete battery chargers for (i) Single phase charger for 110 Volts, 1000 AH Batteries (ii) 3-phase charger for 110 Volts 250 AH Batteries.

**2.0 APPLICABLE STANDARD :**

2.1 The design, manufacturer, and performance of the charger shall comply with all currently applicable statutes, regulations and safety codes. NOTHING IN THIS specification shall be construed to relieve the bidder of his responsibility.

2.2 Unless otherwise specified, the battery-charger shall conform to the latest applicable Indian/IEC, standards, and in particulars, to the followings standards.

- |    |           |   |  |
|----|-----------|---|--|
| a) | IS : 3895 | : | Specification for Rectifier equipment in general.                    |
| b) | IS: 2208  | : | Specification for HRC fuses.   |
| c) | IS : 1248 | : | Indication instruments.  |
| d) | IS : 2147 | : | Degree of protection for cubies.                                     |
| e) | IS : 375  | : | Specification for wiring.  |
| f) | IS : 4540 | : | Monocrystalline Semiconductor<br>rectifier assemblies and equipment. |
| g) | IS : 6619 | : | Safety code for semiconductor rectifier<br>equipment                 |
| h) | IS : 2026 | : | Transformers.  |
| i) | IS : 2959 | : | A.C. Contactors for voltage not exceeding<br>1000V.                  |
| j) | IS: 6005  | : | Code of practice for phospharing of Iron and<br>steel.               |
| k) | IS : 5921 | : | Printed circuit board.   |
| l) | IEC : 249 | : | Printed circuit board.   |

2.2 The bidder shall clearly state the standards to which the charger & its parts / items offered by him – Confirm.

**3.0 CONSTRUCTION :**

- (i) It will be indoor, free-standing, floor mounting and naturally air cooled type, designed for continuous operation in a ambient temperature of 50° C. A good ventilation shall be made through side louvers.
- (ii) Each charging equipment offered shall be housed in a sheet steel cubical reinforced by M.S. angle frame and shall be mechanically strong. The cubical shall be dust and vermin proof. The degree of protection shall be IP 42 as per IS 2147.
- (iii) provided & stated in the offer. The rear & front door cover of cubicle shall be hinged and shall have locking arrangement. Thickness of sheet steel shall be 3.0 mm for load bearing members and 2.0mm for other sides.
- (iii) All the accessories and parts/items shall be of adequate rating to suit the above requirement.
- (iv) Dimensions of the charger shall be as near as possible of the following.
  - a) Width 1200mm x Depth 450mm x Height 1400mm for 110V, 100AH Battery charger (single phase).

- b) Gland Plate :Gland plate for incoming/out going cables shall be ] provided.
- (vii) Arrangement for two separate earthing shall be provided.
- (viii) Electrical indicating instruments shall be mounted flush-on panel with only flange projecting. The dial shall be white with black numbers and lettering.
- (ix) The electronic control circuitry should have built in feature of soft start, so that whenever the charger is switched on, the output voltage should increase gradually.

**FINISH :**

Each cubicle will undergo a through process of derusting, clearing, application of red oxide primer point followed by two coats of light gray synthetic enamel paint of shade 631 of IS : 5.

**WIRING :**

All chargers will be complete with internal willing, input and output terminals. The components shall be liberally stated. Standards colour code practice shall be followed, with the use of ferruls for numbering & identification of wires. PVC copper conductor of suitable size shall be used. All hard wares such as screws nuts studs, washers etc. in electrical circuits control power circuit, shall be brass and nonferrous parts.

**4.0 RATINGS :**

The charger for 110 Volts, batteries (consisting of 55 Nos. 2 Volts lead acid cells) shell have following output ratings.

- a) 110V, 100 AH Battery charger :
  - i) Rated DC Voltage : 110V
  - ii) Rated output : 30A

**5.0. DUTY :**

The composite charger shall consist of two separate chargers, namely the float charger and the Boost charger. The charger shall be suitable for the following requirements.

- 5.1 The float section of the charger shall be of fully automatic type during operation on auto mode. However, necessary provision of manual operation control shall also be provided in addition to auto control with required auto/manual selector switch & circuit etc. in the event of failure of auto-control.
  - 5.1.1 Normally the float charger operating in parallel with the 110 Volts, battery and the load, shall supply the DC loads of the substation and also provide the trickle charger for keeping the battery floating totaling upto full capacity. For this condition, the float charger shall be designed to float charge the 55 cells of lead acid battery between 11 / to 126 V and supply DC load of the substation, keeping the load busbar voltage between 110 volts to 126.0 Volts. Hence, the float charger shall have adequate capacity to meet to above demand at constant voltage.
  - 5.1.2 The float charger shall supply the D.C. output voltage as specified under clause 5.1.1. with +/-1% stability of adjusted value for A.C. fluctuation as specified under clause 1.6.0 of the specification and for D.C. load variation from zero to 100% load.
- 5.2 During emergency, when the AC supply fails, the battery shall meet the DC load of the sub-stations and in doing so, will get discharged gradually. The battery will need boost charging.

For this, a separate charger, called the boost charger shall be this, a separate charger, called the boost charger shall be required.

- 5.2.1 Boost charger shall have adequate rating to quick charge the battery fully within 10 hrs. after an emergency during which the complete DC load is met by the battery.
- 5.2.2 While boost charging the battery, the charger may also be called upon to supply the DC load of the sub-station in case of float charger failure. Based on the condition of battery, it shall be possible to set the boost charging voltage between 100 V to 148V for 55 cells of lead acid battery sets with a total output current between zero to full load capacity of the charger with current stability of 2% of set value with voltage on the load bus-bars not exceeding 126.0 volts. The required dropper diodes shall be provided to restrict load busbar voltage not exceeding 126 volts DC.
- 5.2.3 Boost charger shall incorporate static components, comprising of silicon controlled rectifiers with necessary protection. Boost charger, apart from its normal constant current operation shall be also capable of constant voltage operation which shall enable it to operate as a float charger delivering stabilized DC output voltage within +/-1% from no-load to full load in case of float charger failure. Suitable electrical circuitry shall be provided for this purpose. In the constant current mode it shall have a current stability of +2% of the set value. The constant current setting shall have step less range from 10% to 100% of full rated current. Further, the boost charger shall have a provision of manual mode of operation, over & above auto-mode of operation. Required circuitry arrangement with auto/manual selector switch etc. shall also be provided for the purpose.
- 5.2.4 The boost charger and the float charger shall be so interlocked electrically that during boost charging of the battery, the float charger will supply the DC constant load without supplying to the battery, and at the same time will be in parallel with the battery through a reverse current blocking diode at a suitable tapping. One D.C. contactor may be incorporated which shall get energized through N/C contact of the contactor on A.C. side of the boost charger. In case of failure of A.C. supply, this contactor shall connect the entire battery supply to the load through one of its N/O contacts automatically without any interruption of D.C. supply even of a momentary nature. Under no circumstances the voltage across lower taped terminals shall exceed (+) 10 % or fall below (-) 15% of the rated voltage.

### **5.3 LOAD LIMITING :**

The charger shall be provided with load limiting feature for protection against overload. The load limiting curves shall be submitted with the offer. The SCRs/thyristors shall be protected against voltage surge by providing voltage suppressor devices.

### **6.0 INCOMING SUPPLY**

#### **6.1 110V, 100AH Battery charger (Single phase) :**

Incoming A.C. supply of 240 volts, 50Hz. Single phase for float & boost charger shall be available. The variation in incoming A.C. supply shall be +10% and -15% for voltage and ± 3% in frequency which may occur simultaneously.

### **7.0 CHARGER OUTPUT :**

Suitable ripple filtering circuits shall be provided to give a smooth DC output. The ripple content, without connected, battery shall be limited to less than 5% on resistive load. The D.C. output shall be free from switching surges, transients etc.

### **8.0 SPECIFICATION :**

As specification under clause-4, the composite charging equipment shall have a separate float charger and a boost charger. Each charger shall consist of the following components and

components shall be of the best quality and bill of materials along with rating of the same shall be submitted invariably with the offer.

### **8.1 Float Charger (Single Phase) :**

- 1) Single phase A.C. input ON/OFF main switch (Rotary type).
- 2) A.C. input HRC fuse of required capacity.
- 3) Indicating lamp for A.C. supply 'ON' indication (After main AC fuse) with series resistor.
- 4) Double wound impregnated naturally air cooled single phase transformer with taps at normal -15% and 10% on primary side, for achieving required control of DC output voltage.
- 5) Full-wave half controlled rectifier bridge comprising of silicon diodes and silicon controlled rectifiers (SCR) with R/C surge suppressor net work and suitable heatsink alongwith free wheeling diodes & semi conductor fuse protection.
- 6) Ammeter for measuring DC output current of float charger (0-15 Amps.)
- 7) Auto/Manual mode selector switch.
- 8) Potentiometer for controlling DC output voltage in auto and manual modes.
- 9) Suitable filter circuit comprising filter choke, filter condenser with HRC fuse protection & bleeder resistor.
- 10) Blocking-diode with suitable heat sink.
- 11) DC output ON/OFF switch.
- 12) DC output fuses (HRC).
- 13) DC 'ON' indicating lamp with series resistor.
- 14) Any item not specifically mentioned, but which is needed basically for efficient working of the equipment.

### **8.2 Boost Charger (Single Phase) :**

- 1) Single phase A.C. input ON/OFF main switch. (Rotary type)
- 2) A.C. input IIRC fuse of required capacity.
- 3) Indicating lamp for A.C. 'ON' indication (After main AC fuse) with series resistor.
- 4) Double wound impregnated. Naturally air cooled single phase transformer with types at normal 15%, 10% on primary side with necessary secondary tapes for achieving required control of DC output voltage.
- 5) Full-wave half controlled rectifier bridge comprising of silicon diodes and silicon controlled rectifier (SCR) with R/C surge suppressor net work and suitable heatsink along with free wheeling diodes and semi-conductor fuse protection.
- 6) Ammeter for measuring DC output current of boost charger (0.30 Amps.)
- 7) Auto/Manual mode selector switch.
- 8) Constant current/ constant voltage mode selector switch.
- 9) Potentiometer for adjustment of constant current in boost mode.
- 10) Potentiometer for controlling DC output voltage in float mode (Manual and automodes).
- 11) Suitable filter circuit comprising, filter choke, filter condenser with HRC fuse protection & bleeder resistor.
- 12) Thermal relay for overload protection.
- 13) Blocking diode with suitable heat sink.
- 14) Double pole DC output ON/OFF switch.
- 15) D.C. output fuses (HRC).
- 16) D.C. 'ON' indication lamp with series resistor.
- 17) Dropper diodes scheme ON/OFF switch.
- 18) Dropper diodes selector switch with minimum four positions.
- 19) Diodes for diode-dropper scheme (minimum 28 Nos.)
- 20) Any item not specifically maintained but which is needed basically for efficient working of the charger.

**8.5 Other Common Components :**

- 1) DC voltmeter, double pole 4 positions rotary type to measure DC voltage across float section, boost section, load and battery with HRC fuse protection.
- 2) AC voltmeter to measure the AC input voltage with suitable fuse, link and selector switch arrangement. Range 0-300 V for single phase charger.
- 3) DC charge/discharge ammeter with suitable shunt to read discharge/charge currents of the battery.
- 4) Ammeter (Range 100-0-100mA) showing the earth leakage current of the charger & outgoing ckt (load side).
- 5) Space heater with thermostat and lamp for internal lighting with ON/OFF switch for each separately and required fuse.
- 6) Detachable cable gland plate for cable entry from bottom.
- 7) DC contactor inter-locked with boost charger AC contactor.
- 8) Silicon blocker diode with suitable heat sink to be connected to a suitable tapping of battery to maintain D.C. continuity during power failure while batteries are on boost charge.
- 9) Three pin socket with switch and fuse.

**9. OUTGOING CIRCUITS :**

The following outgoing circuits comprising of a double pole ON-OFF rotary switch HRC fuses and indicating lamps with series resistor shall be provided.

a) Single phase Charger :

- 1) 10 Amps. Feeder : 5 Nos.
- 2) 15 Amps. Feeder : 2 Nos.

**10 PROTECTION :**

Following protections with alarm indicating lamps and alarm accept push button and lamp test push-bottom shall be included in the scope of supply.

- 1) Load under voltage relay.
  - 2) Earth leakage relay.
  - 3) Float charger failure.
  - 4) AC mains failure.
  - 5) DC over voltage relay for battery protection.
- 11) Looking to the detailed description of duty requirements of both the chargers and the battery, the manufacturer, shall design a circuit which shall be capable of providing complete protection to various components of the unit and automatic circuit with automatic voltage regulator in the float circuit operation of the Unit without – interruptions.
  - 12) Three sets of each of detailed dimensional drawings, commissioning and operating instructions manual, literature, write-up and test certificates of the manufacturer shall be supplied with the each battery charger.

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**17 SEC –II GUARATEED TECHNICAL PARTICULARS BATTERY CHARGING EQUIPMENT :**

- 1) Name of manufacturer and country :
- 2) Type of charger. (a) Float. :
- 3) (a) Dimensions (mm) (WxDXH) :  
(b) Thickness of sheet steel of  
cunicle (mm) :
- 4) Weight (K.g.) :
- 5) a) Rated A.C. Input supply. :  
b) Variation in AC voltage &  
frequency. :
- 6) Rated D.C. Volts. :
- 7) Rated output (Ampere). :
- 8) Ran ge of DC voltage variation. : FLOAT  
BOOST
- 9) Range of current variation :
- 10) Maximum chargine current that  
will fed to battery.  
a) Float charging. :  
b) Boost charging. :
- 11) Float charging voltage. :
- 12) Whether D.C. output voltage of  
float charger shall be strictly as  
per CI. 5.1.2 or not. :
- 13) Boost charging voltage after 10  
Hrs. operation at rated load. :
- 14) Whether automatic voltage /  
current regulator is offered. :
- 15) Whether smoothing filter offered. :
- 16) Ripple content at rated load :  
(i) with battery. :  
(ii) Without battery :

- 17) Guaranteed Efficiency :

  - (i) At 20% load. :
  - (ii) At 50% load. :
  - (iii) At rated load. :

- 18) Control wiring :

  - a) Voltage grade. :
  - b) Insulation :
  - c) Conductor material. :
  - d) Minimum size of conductor. :
  - e) PF voltage withstand value (KV rms) :
  - f) Colour code. :

- 19) Terminal blocks :

  - a) Make & category :
  - b) Voltage grade (Volts) :
  - c) Current rating. (Amp.) :
  - d) PF voltage withstand capacity. :
  - e) Type of connector. :
  - f) Whether stud type connector provided. :

- 20) Whether bill of materials as per C 1.8.0 is submitted with the offer. :
- 21) Whether literature, GA Drawing and circuit diagram, of the offered items are attached with the offer :
- 22) Whether complete type test report of the offered items is attached with the offer. :
- 23) Whether unpriced schedule is attached. :

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**18 SECTION - II SPECIFICATION OF 110V, 100AH LEAD ACID / MAINTAINS FREE  
TYPE BATTERY**

**1. SCOPE :**

This Specification covers the design manufacture, testing of 110V, 100 AH lead acid/ Maintains free battery cells at the manufacturer's works, supply and delivery at site.

**2. APPLICABLE STANDARDS :**

Unless otherwise specified in this Specification, the lead acid batteries shall comply with the following standards, and latest amendments thereof.

- a) IS : 1651 : Specification for stationary cells and batteries lead acid type (with tubular +ve plates).
- b) IS : 1146 : Specification for hard rubber and plastic containers for lead acid storage batteries.
- c) IS : 6071 : Specification for synthetic separators for lead acid batteries.
- d) IS : 652 : Specification for wooden separators for lead acid batteries.
- e) IS : 266 : Specification for sulphuric acid.
- f) IS : 1069 : Specification for water for storage batteries.
- g) IS : 3116 : Specification for sealing compound for lead acid batteries.

**3. GENERAL REQUIREMENT :**

The batteries shall be of the capacity 110 Volts, 100AH.

3.1.1 Battery of 110V, 100AH rating shall consist of 55 numbers of series connected HDP lead acid cells of 2 volts, having 100 Ampere hours capacity at 10 hours discharge rate.

3.2 The batteries shall be of the capacity 110 Volts, 100 AH.

3.2.1 Battery of 110V 100 AH rating shall consist of 55 numbers of series connected HDP lead acid cells of 2 Volts, having 100 Ampere hours capacity at 10 hours discharge rate.

3.3 The battery offered as per 3.1 & 3.2 shall be of stationary lead acid type with high discharge performance (HDP) conforming to IS :1651 (latest edition) suitable for Indoor operation.



- 3.4 **Charge Rate :**  
Fully discharged batteries should get recharged at 10 Amps. Rate for 10 hours at room temperature. The trickle charge rate shall be 50-100MA.
- 3.5 The cell container shall have prismatic (rectangular), leak proof and vented type construction and shall be made of non-porous hard rubber/poly-propy with acid proof lids and shall be sufficiently robust and free from flaws.
- 3.6 The intercell and internal cell connectors shall be of lead plated copper. The lead plating shall be adequate. The cross section of the connectors shall have adequate area to carry the high currents. However the thickness of these connectors shall, in no case, be less than 4mm. The nos. and dimensions of connectors shall be stated on the drawing.
- 3.7 The positive and negative terminal plates shall be clearly marked and these shall be easily identifiable.
- 3.8 Write up on working of the battery
- 4 The successful bidder shall have to supply the 3 sets of the approved drawings / literature alongwith each battery set to be supplied.
- 5 **PACKING :**  
Battery shall be supplied in uncharged condition suitably packed, securely in wooden crates. Packing shall be suitable for handling during transit by Rail / Road and secured to avoid any loss or damage during transit.
- 6 **TESTS :**  
The followings tests shall be conducted in accordance with relevant Indian Standards if so desired by purchaser. However, bidder shall submit the complete type test report as stated hereunder of the offered item along with the offer. These tests must have been conducted in the Govt. approved laboratory within last 5 years prior to date of submission of the offer otherwise bidder within last 5 years prior to date of submission of the offer otherwise bidder shall have to carry out the type tests as per relevant standard free of cost.

i) TYPE TESTS :

- a) Verification of constructional requirements.
- b) Verification of marking, and packing.
- c) Verifications of dimensions.
- d) Test for capacity.
- e) Test for loss of capacity on storage.
- f) Endurance test.
- g) Ampere-hour and watt-hour efficiency tests.
- h) Test for voltages during discharge.

Acceptance Test :

Shall be carried out as under at Manufacturers works.

- a) Visual inspection.
- b) Dimensional check
- c) Capacity test.
- d) Test for voltage during discharge discharge. The test certificates shall be submitted for approval, before dispatch of the battery sets.

7) TEST REPORTS :

A preliminary copy of the type test/acceptance test as the case may be shall be submitted for approval.

8) UNPRICED SCHEDULE :

Unpriced Schedule (without price) of offered items shall be submitted alongwith the technical bid.

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**GUARANTEED AND TECHNICAL PARTICULARS OF  
LEAD ACID BATTERIES**

S. No.	ITEM DESCRIPTION	UNIT	110-V BATTERY		50-V BATTERY
			300AH	150AH	
1.	Manufacturer's name				
2.	No. of battery sets				
3.	Type of battery				
4.	Manufacturer's catalogue number				
5.	Capacity of battery at 10 hour Rate and 27°C	Ah			
6.	Nominal voltage rating	V			
7.	10-hour discharge rate at 27°C	A			
8.	One-hour discharge rate 27°C	A			
9.	One-minute discharge rate at 27°C				
10.	Short circuit current for a dead shortcircuit at battery terminals when i) floated at ____V pc ii) boost charge at ____V pc	KA KA			
11.	Min. cell voltage during duty cycle	V			
12.	Applicable Standards				
13.	Cells: i) No. of cells per battery ii) Type of the cell iii) Cell designation as per IS iv) Material of container v) Overall dimensions of each cell vi) Weight of cell with acid vii) Recommended maximum period of storage before the first charge				
14.	Inter cell connector. i) Type of connector ii) Material of connector iii) Type of insulation if provided				
15.	Plates: i) No. of positive plate per cell ii) Type of positive plate iii) Type of negative plate				
16.	Separator i) Type ii) Material				

<b>S. No.</b>	<b>ITEM DESCRIPTION</b>	<b>UNIT</b>	<b>110-V BATTERY 300AK</b>	<b>110-V BATTERY 150AH</b>	<b>50-V BATTERY</b>
17.	<b>Electrolyte</b> i) Amount of electrolyte for first filling -Per cell -Per set ii) Sp. gr. Of electrolyte at 27°C for first filling -at the end of full charge -at the end of discharge at 10-h rate				
18.	<b>Racks</b> i) No. of racks per battery ii) No. of cells per rack iii) Material and finish of rack iv) Paint shade				
19.	<b>Recommended start &amp; finish rate for charging the battery in 12 hours (Boostcharging)</b> -current -voltage per cell				
20.	<b>Recommended float charge rate</b> -current -voltage per cell -duration for equalize charging -frequency of equalize charging				
22.	Accessories furnished with battery				
23.	<b>BATTERY CHARGE-DISCHARGE CURES ENCLOSED</b>				

**1 9 S E C - II**

**GENERAL TECHNICAL SPECIFICATIONS OF 11KV HT SWITCHBOARD**

- 1 THE 11KV HT PANEL BOARD SHALL BE FLOOR MOUNTING, FREE STANDING, DUST & VERMIN PROOF, SUITABLE FOR INDOOR INSTALLATIONS, FOR USE ON 11KV, 50 HZ, 500MVA SOLIDLY EARTHED SYSTEM.
- 2 THE PANEL ENCLOSER SHALL CONFIRM TO THE DEGREE OF PROTECTION I.P. 4X.
- 3 THE CUBICLE SHALL BE FABRICATED FROM 2.5 MM THICK M.S. SHEET & SHALL BE PAINTED AFTER PAINT SHADE RAL 7032 AFTER SURFACE TREATMENT.
- 4 THE 11KV CIRCUIT BREAKER SHALL BE VACCUME TYPE AND SHALL HAVE BREAKING CAPACITY 25KA THE VCB SHALL BE HORIZONTAL DRAWOUT TYPE & HORIZONTAL ISOLATION.THE VERTICLE ISOLATION IS NOT ACCPTABLE.
- 5 THE VCB SHALL HAVE INTERLOCK THAT IT SHALL NOT BE POSSIBLE INSERT OR WITHDRAW THE CLOSED CB FROM TEST TO SERVICE OR SERVICE TO TEST POSITION. THE CB CAB BE INSERTED OR WITHDRAWN ONLY IN OPEN CONDITION.
- 6 THE AUTOMATIC SAFETY SHUTTERS SHALL BE PROVIDED.
- 7 THE NECESSARY PRESUURE DISCHARGE FLAP SHALL BE PROVIDED FOR ESCAPE OF GASES
- 8 THE PANEL SHALL HAVE SEPARATE COMPARTMENT EACH FOR C.B. CTS, PTS & INSTRUMENT. THE INSTRUMENT COMPATMENT SHALL BE COMPLETELY ISOLATED FROM HIGH VOLTAGE COMPARTMENT
- 9 THE MAIN BUSBARS SHALL BE ELECTROLYTIC GRADE COPPER & TEMPERATURE RISE OVER AMBIENT SHALL NOT BE MORE THAN 35 DEG CENTIGRADE.
- 10 THE 11KV HT PANEL SHALL BE TYPE TESTED & TYPE TEST CERTIFICATE SHALL BE AVAILABLE.
- 11 THE PABNEL SHOULD HAVE BEEN TYPE TESTED FOR 25KA 3 SEC
- 12 THE CTS SHALL BE CAST RESIN FOR METERING, PROTECTION & DIFFERENTIAL PROTECTION. THE THEMAL CURRENT SHALL BE 18.4KA FOR 1 SEC.
- 13 ALL THE METERS SHALL BE DIGITAL TYPE WITH ACC CL 1.
- 14 THE 11KV CAST RESIN PTS SHALL BE DRAWOUT TYPE.
- 15 VCB TROLLY SHALL BE SUPPLIED A LONG WITH PANEL



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**20 SEC - II : SPECIFIC TECHNICAL REQUIREMENT OF 11KV SWITCHBIARD**

**11KV SWITCHGEAR PANEL BOARD COMPRISING OF**

- 2 NOS : TRANSFORMER FEEDER PANELS  
 1 NO : BUS COUPLER & TRUNKING PANEL  
 8 NO : FEEDER PANELS  
 1 NO : STATION TRANSFORMER

**EACH PANEL SHALL BE COMPRISING OF**

	FEEDER TYPE 	TRANSFORMER FEEDER	BUS COUPLER	FEEDER PANEL	STATION FEEDER
ITEM					
1	CUBICLE	1	1	1	1
2	11KV 25KA 1250 AMP VCB	1	1	1	1
3	11KV CTS RATIO 900 - 600 /5/5/1, 10/10VA, CL0.5/5P15/PS, 25KA/1S 900/5/5, 10/10VA, CL 1 / 5P10, ITH 18.4KA / 1 SEC 400-200/5/5, 10/10VA, CL1/ 5P10, ITH 18.4KA/1 SEC	3	3	3	3
4	PT 11KV /110V, 100VA, CL 1 VF 1.8 / 8 HOURS	1			
5	DIGITAL 3 PHASE VOLT METER	1			
6	DIGITAL 3 PHASE AMMETER	1	1	1	1
7	DIGITAL MW METER			1	1
8	MULTI PARAMETER TO READ A,V,MW, MVA, HZ, PF METER, KWH	1		1	1
9	NUMERICAL IDMT 3 O/C & E/F RELAY WITH HIGH SET INST UNIT	1	1	1	1
10	INTER TRIP RELAY	1			
11	TRIP CKT SUPERVISION RELAY PRE & POST	1	1	1	1
12	NUMERICAL DIRECTION S.P. O/C & E/F RELAY	3			
13	LED TYPE INDICATING LAMPS ON/OFF/AUTO TRIP	3	3	3	3
14	TRIP CKT HEALTHY WITH PUSH BUTTON	1	1	1	1
15	TNC SWITCH 25A, 2 POLE	1	1	1	1
16	ILLUMINATION LAMP WITH DOOR LIMIT SWITCH	1	1	1	1
17	SPACE HEATER WITH THERMOSTATE & SWITCH	1	1	1	1
<p><b>MAKE</b>                      VCB : ABB / JYOTI / CGL                      CTS : ANI / ECS / JYOTI                      PTS : ANI / ECS / JYOTI                      NUMERICAL RELAYS : ER MAKE</p>					

## 21 SECTION –II GTP - 11KV SWITCHBOARD

NO.	PARTICULAR	
1.0	<b>GENERAL:</b>	
1.1	Make	
1.2	Model & Type no.	
1.3	Ambient temperature	
1.4	Atmosphere	
1.5	Location	
2.0	<b>ELECTRICAL DATA:</b>	
2.1	Type of breaker	
2.2	Service	
2.3	Voltage	
2.4	System earthing	
2.5	Frequency	
2.6	No. of phase	
2.7	System fault level	
2.8	Fault current	
2.9	Max. system voltage	
2.10	Auxiliary supply:	
2.11	Rated short time current	
2.12	Making capacity	
2.13	Busbar current rating	
2.14	Cable entry	
2.15	Cable size	
2.16	<b>Breaker particulars:</b>	
	(a) Operating duty	
	(b) Operating mechanism	
	(C) Spring charging motor	
	(D) Trip / Closing coil	
	(E) Anti pumping feature	
	(F) Latching requirement	
	(G) Emergency trip push button	
	(H) Space heater & cubical lamp	
2.17	<b>Constructional requirement</b>	
	(a) Thickness of sheet steel for frame, enclosure, doors, covers & partitions	
	(b) Degree of protection	
	(c) Colour	
	(d) Earth bus size	
	(e) Foundation frame	

	(f) Over all dimension	
	(g) Over load of equipment	
	(h) Minimum area required on front side as well as rear side	
2.18	<b>Annunciation Provided</b>	
2.19	<b>RELAYS</b>	
	(a) Relay no. & detail	
	(b) Type of relay	
	(C) Make of relay	
	(d) Model no.of relay	
2.20	<b>CURRENT TRANSFORMER</b>	
	(a) Type of CT	
	(b) Accuracy class	
	(C) VA burdon	
	(d) CT ratio	
2.21	<b>POTENTIAL TRANSFOREMER</b>	
	(a) Type of PT	
	(b) Accuracy class	
	(c) VA burdon	
	(d) PT ratio	
2.22	<b>PANEL ACCESSORIES</b>	
	(a) Toggle switch for space heater & socket	
	(b) Socket	
	(C) MCB for spring charging motor circuit	
	(d) MCB for ON / OFF	
	(e) Local / Remote selector switch	
	(f) Auto- Off – Manual switch	
	(g) Breaker control switch (Trip – Neutral – Trip)	
	(h) LED indicating lamp (230V A.C)	
	(i) Filament Bulb	
	(j) Space heater	
	(k) Limit switch for test & service position	
	(l) Type of indicating meter provided	
	(m) Parameters covered in Multi function meter	



## **22 SECTION - II : SPECIFICATIONS OF STEEL STRUCTURES**

- 1 The steel structures for mounting various EQUIPMENTS such as circuit Breakers, disconnecting switches, instrument transformers, lightning Arresters, post insulators and accessories, GANTRY & TOWER required shall be designed, fabricated and supplied as a part of the work covered by this part specification to make the installation complete in all respects.
- 2 The structure shall be of lattice type construction fabricated from rolled mill steel sections and hot dip galvanized. Only bolted connections will be permitted. Necessary bolts, nuts, washers including foundation bolts etc shall be supplied with the structures. The design of steel structures shall be governed by the design data Indicated below.
  - i) Generally the design and fabrication of members shall be conforming to IS 802 (latest) and IS 800-1984 wherever applicable.
  - ii) Bolts, nuts and washers shall conform to relevant Indian Standards. All switchyard steel structures shall be hot dip galvanized in accordance with IS : 4759 (latest). Fastening bolts & nuts, washers shall also be hot dip galvanized as per IS 1367 (latest). Galvanizing of each member shall be carried out in one complete immersion with the galvanizing bath containing only approved standard spelter. Before galvanizing, the steel section shall be thoroughly cleaned of paint, rust and other foreign matters, which are likely to interfere with the galvanizing process.
  - iii) The finished surface shall be clean, smooth and shall be free from defects like discolored patches, bad spots, blistered surface, flanking or peeled off Zinc, spiky deposits of Zinc etc. The presence of any of the above defect or deformation noticed on visual inspection even without carrying out any test shall render material liable for galvanizing, method of testing etc. shall conform to IS : 802
- 3 Steel members, bolts, nuts, fittings shall be hot dip galvanized except spring washers which shall be electro-galvanized.
- 4 The galvanized surface shall consist of a continuous and uniformly thick bright coating of zinc, minimum weight of coating being 610 gms/m<sup>2</sup>, firmly adhering to the surface of steel.

The design of the steel structure shall be governed by the following data:

- |      |  |    |   |
|------|--|----|---|
| i)   | Wind Loads   | .. | Shall be as per IS 875 (Part-3) 1987                            |
| ii)  | Seismic loads  | .. | Shall be as per IS 1893 (Part-1) 2002                           |
| iii) | Factor of safety based on maximum loading conditions (on elastic limit for tension members and crippling load for compression members) | .. | 2.0 under normal condition and 1.5 under broken wire condition. |
| iv)  | Factor of safety based on maximum loading conditions (on elastic limit for tension members and crippling load for compression members) | .. | 2.0 under normal condition and 1.5 under broken wire condition. |
| v)   | Factor of safety based on maximum loading conditions (on elastic limit for tension members and crippling load for compression members) | .. | 2.0 under normal condition and 1.5 under broken wire condition. |

- vi) Factor of safety against over-turning .. 2.0 under normal condition and 1.5 under broken wire condition
- vii) Slenderness ratio for individual members should not exceed the following limits:
  - a) for leg members .. 120
  - b) for other load carrying member .. 200
  - c) for members having nominal load .. 250
- viii) Minimum thickness for steel members:
  - a) Main members of girder .. 6mm
  - b) Bracings .. 5mm
- ix) Maximum stresses
  - Tensile stress .. Factor of safety of 2.0
  - Bending stress .. under normal condition and
  - Shear stress on bolts .. 1.5 under broken wire condition
 are to be considered.

Other than the above, for structural design of members relevant IS codes shall be followed wherever applicable.

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**23 SECTION - II : POWER AND CONTROL CABLES & CABLING**  
**ACCESSORIES**

- 1 Supply and installation of cables and cabling accessories from the AC / DC power source supplied by others to the equipment offered by the Successful Tenderer shall be included in the scope of work.
- 2 One (1) lot of 1.1 kV grade power and control cables shall be supplied as required for interconnecting various equipment and accessories covered under this part of specification so as to cover complete auxiliary power and control cabling. This shall include all cabling accessories viz, GI cable trays, supports, clamps pipes, end terminations consumables etc to make the installation complete in all respect.
- 3 Necessary cable schedule will be prepared and approval will be obtained

**Cables and Cabling accessories**

- 1 One (1) lot of 1.1kV grade auxiliary power and control cables shall also be supplied and installed as required for interconnecting various equipment and accessories covered under scope of this specification so as to cover complete auxiliary power and control cabling.
- 2 Power cables shall be Aluminium conductor, XLPE insulated, PVC sheathed armoured cables. Control cables shall be with copper multi strand flexible conductor, PVC insulated & sheathed steel wired armoured cables.
- 3 Minimum size of power cable will be 6 sqmm for aluminium cables and 2.5 sqmm for copper cable. Control cables shall be with 2.5 sqmm cable.
- 4 All cabling accessories viz, GI cable trays, supports, clamps pipes, end terminations consumables etc shall be included to make the installation complete in all respect.

**Applicable Standards**

1. H.V HLPE cable as per IS 7098 1993  
L. V Power & Control cable as per IS 1554  
And other relevant standards ammennents etc.
2. Testing of cable as per IS 10810 and other relevant standards.

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## **24 SECTION - II : E A R T H I N G**

- 1 One lot of earthing stations, earthing conductors and accessories shall be offered for providing complete system and equipment earthing of 66kV outdoor switchyard to meet the stipulations of Indian Electricity Rules, Govt. Electrical Inspector as well as relevant provision stipulated in IS:3043 “Code of practice for earthing”.
- 2 The earthing system shall be so designed as to keep the touch and step potentials within permissible limits in accordance to BIS, IEEE & CBIP regulation and ensure effective operation of protective gears in case of earth faults.
- 3 Tender shall submit design calculations for the earth grid size selection, safe touch and step potential values to the purchaser for his approval.
- 4 The total earth resistance at any point of the earthing systems for substations shall not be more than one ohms. Actual earth resistance shall be measured by the successful Tenderer and if required additional electrode and or conductors shall be provided to achieve the value indicated above.
- 5 The fencing shall be separately earthed, with the earth grid completely segregated from the station earth grid.
- 6 Neutral of instrument transformer shall be earthed by means of detachable screwed link at the panel end only.
- 7 Separate earth mat for disconnecting switches operation shall be provided and interconnected with switchyard earthing.

\* \* \* \* \*

**25 SECTION - II : OUTDOOR SWITCHYARD LIGHTING**

- 1 Tenderer shall include lighting of switchyard in his scope of work. High efficiency HPSV luminaries shall be used for switchyard lighting. Illumination level for lighting shall be 15 to 20 lux.
  
- 2 Scope of work shall include supply and installation of TPN / SPN MCB distribution board, SPN industrial switch socket outlets (minimum 3 nos.) 3C x 2.5 sq,mm copper cable, outdoor junction box, cable termination, earthing and allied works to make the work complete in all respects.
  
- 3 Lighting fitting shall normally be supported to lightning mast or other structures. However street light poles of adequate height and nos. shall be provided if required to achieve desired illumination level.

\* \* \* \* \*

## **26 - SECTION II : INSTALLATION, TESTING AND COMMISSIONING**

### **1.0 GENERAL**

- 1 The Installation herein referred describes the requirements for the electrical equipment & accessories as well as installation materials and the practices to be followed for the same. The procedure to be adopted for testing and commissioning of all electrical equipment and installation is also described in the following sections.
- 2 The work shall cover as described under the following groups:
  - Installation of Electrical Equipment.
  - Installation of Cables and Accessories.
  - Selection and Installation of System and Equipment Earthing.
  - Clearance and Safety.
  - Testing and Commissioning of Electrical Equipment and Installation.
- 3 Safety of equipment and operating personnel, ease of operation and aintenance shall be given prime consideration.

### **2.0 INSTALLATION OF ELECTRICAL EQUIPMENT**

#### **1 General**

All equipment including individual components, fittings and accessories shall be properly stored at site so as to obviate any deterioration of electrical properties and mechanical damages.

All equipment and accessories covered under scope as well as Purchaser supplied equipment shall be installed strictly in accordance with the manufacturer's instructions / drawings. Equipment supplied in sections or in dismantled condition shall be reassembled at site with all associated accessories as per the manufacturer's instructions.

All components. Fittings and accessories which will be dispatched separately, shall be reassembled at site in accordance with the manufacturer's standard and erection drawings furnished by the successful Tenderer.

The installation of transformers shall also generally conform to the Manuel of Transformers by the Central Board of Irrigation and Power (CBIP).

Switch boards, and control panels shall be mounted on steel sections embedded in the floor cable trench / cutout and fixed either by bolting or tack welding after proper aligning and leveling. Supporting structure for placing panel above trench.

Installation accessories, tools & tackles etc. are to be supplied & installed by the successful Tenderer including consumables.

All relays, instruments etc. supplied loose shall be checked and calibrated prior to mounting and connecting at site.

### **3.0 INSTALLATION OF CABLES AND CABLING ACCESSORIES**

#### **1 General**

All power cables shall be of aluminium conductor & all control cables shall be of copper conductors.

Special cables required for signal transmission with good noise immunity in electronic circuits shall be of twisted paired shielded cables. The conductors shall be of standard tinned copper having proper flexibility.

Minimum cross-sectional area of power cable shall be 4 sq. mm in case of aluminium conductor and 2.5 sq. mm in case of copper conductor.

#### **2 Installation of Cables**

##### **1 General**

In the plant buildings, substations, switch / control rooms etc., power and control cables shall generally be taken on cable racks / in concrete trenches, or along building and technological structures.

In the switchyard and control room buildings. Power and control cables shall generally be taken on cable racks either laid in concrete brick masonry trenches or supported from building structures, walls, ceilings etc.

Cables laid on racks / hooks and routed through trenches, etc. shall be taken in embedded / exposed rigid GI pipes / flexible conduits unless directly terminated to the equipment in the panels located above the trench.

Cables are to be taken buried underground where required to suit the site condition in consultation with Purchaser.

All Power & Control Cables shall be of armoured type. Where power / control cables are to be routed through floor chase, vertical run upto 2m and any other cable / utility crossing, the same are to be taken through adequate size medium class GI pipes. Both end of the pipe shall be sealed in an approved manner after laying of cables.

All power cable terminations shall be by means of crimping type cable lugs. Single strand control cable shall be terminated directly at terminal blocks by screws; where as multi strand control cables shall be by crimping type lugs.

No joint shall normally be made at any intermediate point. In cases where jointing is unavoidable, the same shall be made by means of standard cable jointing kits.

Factory made ladder type / perforated type cable racks / trays shall be used for laying of cables in cable trenches and cables routed along technological structures.

The cable racks / trays shall be adopted from standard width of 300 mm, 450 mm and 600mm and shall be hot dip galvanized. The ladder type racks shall be used for laying of power cables while the perforated trays shall be used for control and instrumentation cables.

The cable tray system shall be complete with vertical and horizontal supports made of structural steel with ISMC-100/ channel / 50 x 50 x 6 mm angles / flats etc. required to suit the site condition and subject to Purchaser approval.

## **2 Installation of Cables in Embedded / Exposed GI pipes/ Conduits**

GI pipes shall generally be adopted for routing cables embedded through concrete foundations / floors / walls above floor level for vertical run for protection against mechanical damage. GI pipes shall be hot dip galvanized and shall conform to IS:1239 (Part-1).

GI pipes / conduits of the following sizes shall be used:

- Nominal bore – 25, 40, 63, 80 & 100 mm.

## **3 Installation of Cables Directly Buried in Ground**

Power and control cables laid directly buried in ground shall be laid as per the requirements of code of practice IS:1255. Generally cables shall be taken at a depth of 1,000 mm from finished ground level and shall be provided with at least 75 mm sand cushioning both at top and bottom and precast reinforced concrete protective covers.

## **4 Jointing and Termination**

Cable terminations shall be made in a neat and approved manner by men specialized in this type of job. Terminating and jointing of all cables shall be by means of compression method using compression type lugs.

## **4 SELECTION AND INSTALLATION OF SYSTEM AND EQUIPMENT EARTHING**

- 1 The method adopted for system as well as equipment earthing shall be in accordance with IS:3043 'Code of Practice for Earthing' and shall also comply with the relevant clauses of Indian Electricity Rules. All earthing shall be subject to the approval of the Chief Electrical Inspector, Government of Gujarat.

Transformer neutrals shall be earthed by two separate and distinct earth connections. In case of HT power transformers, the two neutral earthing leads shall be taken to two separate earth electrodes.

- 2 No earth ring shall have less than two earth electrodes.
- 3 Earth conductors for system and equipment earthing shall be kept electrically separated from the metal work of surface pipes which are carrying gases or inflammable liquids.
- 4 Separate earthing system shall be provided for the electronic control system / computer system and associated power devices.
- 5 Conductor size adopted for earthing ring shall in no case be less than that of the earth continuity conductors connected to it. The size of earthing leads connected to earth electrodes shall not be less than that of the earthing ring. Unless otherwise specified, earthing ring for substation building shall not be less than 75 x 10 mm galvanized MS flats. All welded joints are to be provide with 2 coats of primer and 2 coats of bituminous paints.
- 6 Other requirements on earthing are indicated in respective part of specification.
- 7 Successful Tenderers shall furnish calculation to design of earthing conductor no. of earth electrodes etc for Purchaser or his representative for his approval.



## **5.0 CLEARANCE AND SAFETY**

- 1 Electrical (HV & MV) switch board, control panel, etc. that require back access, the space behind the equipment shall generally be 1,000 mm but in no case be less than 760 mm. This space shall also be adequate to permit at least a 90° opening of doors or hinged panels. In such cases where back clearances are provided, there shall be a passage / way from either end of the equipment clear to a height of 1,800 mm. Where the equipment are not required to be attended from the back, the equipment shall be placed along the wall / structure having clearance less than 200 mm.
- 2 For all HV/LV switch boards, control panels, etc, clearances as specified shall be provided equipment in IE rules / recommendations of manufacturers.

The above clearances are minimum and more clearances shall be provided if asked for by the manufacturer.

- 3 For all electrical equipment, a minimum clear head-room of 500 mm shall be provided. Also, the clearance between the top of electrical equipment / panel board and the bottom of the ventilation duct (if provided) in the same room shall be minimum 500 mm.
- 4 All electrical equipment operating on 415 V or higher voltage shall be provided with caution notice boards of approved type and the caution boards shall be affixed permanently in a conspicuous position. Where a group of equipment is located within a switch / control room or within a fenced area, the notice board shall be fixed at the entrance.
- 5 All moving parts of the equipment which are exposed and liable to cause hazard to the operating and maintenance personnel shall be suitably protected by metallic guards.
- 6 In accordance with the requirement of the Indian Electricity Rules. The following shall be provided for safety of personnel.
  - i) Danger boards and shock treatment charts in three languages, viz. English, Hindi and state Language.

## **6.0 TESTING AND COMMISSIONING OF ELECTRICAL EQUIPMENT AND INSTALLATIONS**

### **1 General**

The contractor shall be responsible for the testing and commissioning of the installation work executed by him in compliance with the standard procedure in vogue, codes of practice of Indian Standards and instructions furnished by the equipment supplier and Purchaser.

The contractor shall provide his own test equipment including the high voltage test kit, relay testing sets, continuity tester, multimeters, phase rotation tester, megger etc. and all other equipment required for testing and commissioning of the plant.

The contractor shall coordinate with other agencies working in the same work / equipment for during commissioning and will vendor all assistance required for proper integrated testing of the plant.

The tenderer shall furnish with his offer a complete list of tests site tests be proposed to be conducted at site. The list of tests shall be finalized with successful Tenderer before placement of order.

**2 Tests at Site**

Detailed pre-commissioning and commissioning test procedures shall be prepared and submitted for the equipment under the scope of supply. These shall be meticulously followed for the pre-commissioning/ commissioning test in the presence of purchaser.

Check list shall be prepared for all equipment / accessories for checking the completeness of installation before commencing the pre-commissioning tests and shall be signed jointly by the Successful Tenderer and Purchaser’s supervising engineer.

The tenderer shall furnish with his offer a complete list of site tests he proposed to conduct at site. The following tests shall be carried out by the successful Tenderer as part of pre commissioning tests in addition to the tests proposed by him.

The list of tests shall be finalised with successful Tenderer before placement of the order.

All documents / records regarding test data, oscillograms and values of important parameters obtained during commissioning shall be handed over to the Purchaser in the form of Test Report for their reference and future use.

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**27. SEC-II SPECIFICATION FOR 11KV CLASS 4 STAR RATED DISTRIBUTION TRANSFORMER**

1. This specification covers the design, manufacture, testing, supply and delivery of the 4 Star rated distribution transformer.  
Transformer as per details given below required for Sub-station in rural electric distribution system with nominal voltage of 11KV.

**2. STANDARDS**

The transformers shall conform in, all respect to IS: 1180 ( Part-1)81 and IS: 2026 (Part-I,II,IV/1977) and IS: 2026 (Part-III) 1981 except where specified otherwise in the specifications.

**3. CLIMATIC CONDITONS**

- a) Peak ambient temperature in shade 45 c.
- b) Maximum daily average ambient temperature 40 c.
- c) Maximum yearly average temperature 32 c.
- d) Minimum ambient temperature 10 c.
- e) Maximum relative humidity 90%
- f) Average number of thunderstorm days per annum 33 days
- g) Average number of rainy days per annum 90 days
- h) Average annual rainfall 4000 mm
- i) Minimum wind pressure 100 Kg/Sqmm
- j) Altitude not exceeding 1000Mts.Above MS

**4. TYPE AND RATINGS**

The transformer shall have a core type construction and oil immersed naturally cooled as mentioned below and shall be suitable for outdoor services as a step down transformer. The rating and electrical characteristics of the transformers as follows:-

- a. Continuous capacity (KVA) 100
- b. Rates HT voltage (KV) 11
- c. Rated Voltage ( Volts ) 433-250
- d. Rated frequency ( Hz ) 50
- e. No. of phase 3
- f. Connections ( HT ) delta
- g. Connections ( LT ) Star
- h. Type of cooling ON

**5. PRINCIPAL PARAMETERS:**

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

5.2 The transformers shall conform to the following specific parameters :

Sr. No.	Item	11KV Distribution Transformers
1	System voltage (max.)	12 KV
2	Rated voltage HV	11 KV
3	Rated voltage LV	433 – 250 V*
4	Frequency	50 Hz +/-55*
5	No. of Phases	Three
6	Connection HV	Delta
7	Connection LV	Star (Neutral brought out)
8	Vector group	Dyn-11
9	Type of cooling	ONAN

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

<b>KVA rating</b>	<b>Audible sound levels (decibels)</b>
0-50	48
51-100	51

## **6 TECHNICAL REQUIREMENTS:**

### **6.1.1 CORE MATERIAL – CRGO / AMORPHOUS METAL**

#### **6.1.2 CRGO Material**

6.1.2.1 The core shall be stack / would type of high grade cold rolled grain oriented annealed steel lamination having low loss and good grain properties, coated with hot oil proof insulation, bolted together and to the frames firmly to prevent vibration or noise. The core shall be stress relieved by annealing under inert atmosphere if required. The complete design of core must ensure permanency of the core loss with continuous working of the transformers. The value of the maximum flux density allowed in the design and grade of lamination used shall be clearly stated in the offer.

6.1.2.2 The bidder should offer the core for inspection and approval by The department during manufacturing stage.

6.1.2.3 The transformers core shall be suitable for over fluxing (due to combined effect of voltage and frequency) up to 12.5% without injurious heating at full load conditions and shall not get saturated. The bidder shall furnish necessary design data in support of this situation.

6.1.2.4 No-load current shall not exceed 3% of full load current and will be measured by energizing the transformer at 433 volts, 50 Hz on the secondary. Increase of voltage of 433 volts by 12.5% shall not increase the no-load current by 6% (maximum) of full load current.

#### **6.1.3 AMORPHOUS METAL:**

6.1.3.1 The core shall be high quality amorphous ribbons having very low loss formed into wound cores of rectangular shape, bolted together to the frames firmly to prevent vibration or noise. The complete design of core must ensure permanency of the core loss with continuous working of the transformer. The value of the flux density allowed in the design shall be clearly stated in the offer. Curve showing the properties of the metal shall be attached with the offer.

6.1.3.2 The transformer core shall be suitable for over fluxing (due to combined effect of voltage and frequency) upto 12.5% without injurious heating at full load conditions and shall not get saturated. The bidder shall furnish necessary design data in support of this situation.

6.1.3.3 No load current shall not exceed 2% of full load current and will be measured by energizing the transformer at 433 volts, 50 Hz on the secondary. For increase of voltage of 433 volts by 12.5%, the no-load current shall not increase beyond 5% of the full load current.

## 7 WINDINGS:

### 7.1 Material:

- 7.1.1 HV and LV windings shall be wound from super Enamel covered/Double paper covered , aluminum / copper conductor/ foil 100 KVA and below.
- 7.1.2 HV and LV winding shall be wound from super Enamel covered / Double paper covered copper conductor/foil winding for ratings above 100 KVA.
- 7.1.3 LV winding shall be such that neutral formation will be at top.
- 7.1.4 The winding construction of single HV coil wound over LV coil is preferable.
- 7.1.5 Inter layer insulation shall be Nomex / Epoxy dotted Kraft paper.
- 7.1.6 Proper bonding of inter layer insulation with the conductor shall be ensured. Test for bonding strength shall be conducted.
- 7.1.7 Dimensions of winding coils are very critical. Dimensional tolerances for winding coils shall be with in limits as specified in Guaranteed Technical Particulars (GTP Schedule I).
- 7.1.8 Current density for HV and LV winding should not be more than 2.8 ampere per sq mm for copper and 1.6 Ampere per sq mm for Aluminum Conductor.
- 7.1.9 The core/coil assembly shall be securely held in position to avoid any movement under short circuit conditions.
- 7.1.10 Joints in the winding shall be avoided. However, if jointing is necessary the joints shall be properly brazed and the resistance of the joints shall be less than that of parent conductor. In case of foil windings, welding of leads to foil can be done within the winding.

## 8 TAPS:

- 8.1.1 No tapping shall be provided for transformer up to 100 KVA rating.

## 9 OIL :

- 9.1 The insulating oil shall comply with the requirements of IS 335 or BS 148.  
Use of recycled oil is not acceptable. The specific resistance of the oil shall not be less than 2.5 X 10<sup>12</sup> ohm-cm at 27 C when tested as per IS 6103.
- 9.2 Oil shall be filtered and tested for break down voltage (BDV) and moisture content before filling.
- 9.3 The oil shall be filled under vacuum.
- 9.4 The design and all materials and processes used in the manufacture of the transformer, shall be such as to reduce to a minimum the risk of the development of acidity in the oil.

## 10 INSULATION LEVELS:

Sr. No.	Voltage (KV)	Impulse Voltage (KV Peak)	Power Frequency Voltage (KV)
1	0.433	-	3
2	11	95	28

## 11 PACKING AND MARKING

1. Tender sample
2. Advance sample
3. Tenderers are required to furnish the design calculations and data in support of having fulfilling Requirements stipulated under clause-9 of IS: 2026 ( Part-1) 1977.
4. The manufacture/supplier shall furnish impulse test certificate and short circuit test certificate Done on same design capacity voltage rating of the transformer alongwith their tender. The impulse test carried out shall be in accordance with the clause 13 of IS:2026 (Part-II) 1981 with chopped wave at 75 KVP and short circuit test carried out in accordance with clause 16.11 (special test IS:2026 (Part-I) 1977.

## 12 COOLING.

*The transformer oil shall be capable of giving a continuous output without exceeding specified temperature rise.*

## 13 TRANSFORMER OIL

The transformer oil shall comply with the requirement of IS:335/1972 with amendment No. 1 specification for insulating oil for transformers and switchgears (low viscosity type ).

## 14 FITTINGS

The following standard fittings shall be provided.

- a) Two earthing terminals.
- b) Lifting lugs for complete transformer as well as core and windings.
- c) Rating and terminal marking plates.
- d) Aluminum strips on both HT & LT terminals for connecting aluminum lugs.
- e) Dehydrating breather with weather proof design.
- f) A ricing hanns or 9 Kv 5 KA lightning arrester on HV side – 3 Nos.
- g) Thermometer packet
- h) Oil level indicator with minimum marking of oil.
- i) Conservator.
- j) Breather.
- k) Air release device.
- l) Oil filling hole & cap.
- m) Drain valve with plug
- n) Rollers.
- o) Explosion valve
- p) Filter valve with plus
- q) Base channel 75X40mm, 460m long with hole to fixed

## 15 TANKS

The main tank of the transformer shall be made up of good quality steel sheet of adequate thickness to provide sturdy and robust construction in accordance with the best engineering practice. **IMPORTANT :** The thickness of the cover and the side flange of the tank shall not be less than 6mm. So as to avoid any buckling while tightening nuts and bolts.

**16 BUSHING**

The bushings shall conform to IS:209-1973 specifications alternating voltage for porcelain bushing. The bushing rod shall be aluminum stem as per IS:3347. The dimension of the bushing of the following voltage classes shall conform to Indian Standard mentioned against them. The primary windings shall be connected in delta and secondary windings in star, ( Vector symbolic DY –11) so as to produce positive displacement 300 from the primary to the secondary vector of phases. The neutral of the secondary windings shall be brought out to separate insulated terminal. All the HV & LV coil ends shall be provided with crimped lugs. The star point on the LV side shall be properly sleeved and crimped instead of joining with solder.

All the transformers shall be oil immersed and suitable for outdoor installations. The transformer shall be designed and constructed to conform to the thermal ability to withstand short circuit in accordance with clause 9 to IS: 2026 (Part-I)1977. The special requirement is the transformer (oil immersed) should be maximum permissible value of 200 C (Aluminum winding ) after the average temperature of the winding of the short circuit without any damage or deterioration of the installation. The manufacturers or suppliers shall furnish along with the tender the relevant design data and calculation in support of being fulfilling this requirement stipulated in clause 9 of IS: 2026 ( Part –1) 1977.

**17 TEMPERATURE RISE**

The temperature shall not exceed the limit of 55c ( maximum ) for transformer windings ( measured by the resistance and 45 C measured by the thermometer in top oil when tested in accordance with the clause 16.8 of IS: 2026 (Part-I) 19773

**18 LOSSES & INPEDACE VALUES**

The no load losses shall not exceed the values given in the following table.

No.	KVA rating	No load Losses ( Watts)	load Losses 50% (Watt)	Load losses at 75 C 100 % (Watt)
1.	100KVA	290	475	1650

The above losses are the maximum allowable and there should not be any plus tolerance.  
**IMPEDANCE :** The impedance recommended 4.5% at 75 c.

Voltage class	For porcelain parts	Indian standard for metal
Up to 1.1 KV	IS:3347(part I) Section-1/1979	IS:3347(part I) Section-2/1979
Up to 12 KV	ISS:3347 (Part-III) Section-1/1979	ISS:3347 (Part-III) Section-2/1979

The minimum phase to phase external clearance of 75mm for LV and 355 mm for HV bushing shall be obtained with the bushing mounted on the transformer.

**19 FINISH :**

The exterior of the transformer tank and other ferrous fitting to be thoroughly cleaned, scrapped sand given primer coat and two final coats of epoxy paint of standard quality. The colour of the finishing coats shall be dark gray confirming to No. 1.632 of IS: 5/1978 colours ready mixed paints ( second revision ).

**20 RATING AND TERMINAL MARKING PLATES**

The shall be a rating plate on the transformer containing information specified in the clause 15.2. of IS: 2026 ( Part ), 1977.

**21 TESTS AND INSPECTION**

i) Rating Tests : All the transformers shall be subject to routine tests at the manufactures works. The following routine tests shall be carried out in accordance with the details specified in SIS : 2026 (Part-I), 1977.

- A) Measurement of the winding resistance.
- B) Measurement of Voltage ratio and check of the voltage relationship.
- C) Measurement of the impedance voltage, short circuit impedance and load current.
- D) Measurement of no load losses and no load current.
- E) Measurement of insulation resistance.
- F) Induced over voltage withstand tests.
- G) Separate source voltage withstand tests.

ii) Type Tests : In addition to the prescribed tests, temperature rise tests shall invariably be done on the transformers of same design, capacity and voltage rating. The manufactures/suppliers shall furnish impulse test certificate and short circuit test certificate done in same design. Capacity and voltage rating of the transformer along with the tender. The impulse test carried out shall be in accordance with clause 13 of IS : 2026 ( Part-3) 1981 with the chopped wave at 75 KVP and short circuit test carried out in accordance with clause 16.11 ( Special test ) IS : 2026 ( Part-I) 1977.

iii) Test Voltage : The transformer shall be capable of withstanding the power frequency and impulse test prescribed below :

Nominal System	Highest System	Impulse test	Power frequency test voltage.
11KV RMs	12KV RMs	75KV Peak	28KV RMs

**22 TOLERANCE ON THE ELECTRICAL PERFORMANCE**

The tolerance shall be according to clause 11 of IS : 2026 (Part-I)1977 except for losses in references with the clause 6.

**23 PACKING**

The transformer shall be delivered by road suitably packed. Although the method of packing is left to the description of the manufacture it should be robust enough for rough handling during the transportation by road.

**24 MARKING**

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

All the transformer shall have the following markings in paint on the body for the identification.

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**ELECTRICITY DEPARTMENT,  
ADMINISTRATION OF DAMAN & DIU**

**SPECIAL CONDITIONS:**

- a)** I.S.I. registered companies with certification marks are given highest preference.
- b)** The insulation between core and winding and between HT & LT should not be hygroscopic. It should be H.D.P.V.
- c)** There should be at least six cakes in each HT limb i.e. voltage drop in each cake should be less than 1.1 KV.
- d)** The HT coil to which external supply is connected should have higher insulation to withstand against over voltage entering the transformers.
- e)** The HT coil should be enamel, insulated as well as double paper or double clothed insulation.
- f)** The bushing rod should have rain shed cups to prevent direct entry of water through the studs.
- g)** The bushing rod and insulation assembly should have a non rod rotational arrangement to prevent loosening of inside connection at the time of fitting overhead jumpers.

**ANNEXURE 'A'**

**SCHEDULE OF REQUIREMENT :**

1. Step up step down : Step down 4 Star rating
2. Max. continuous rating in KVA :  
at secondary terminals in the :  
specified voltage, rating, frequency :  
and temperature : i)100KVA – 433C.50c/s) rise  
45C
3. Double wound or auto wound  
Transformer.  
a) Aluminum wound or copper : Double Al.wound.  
Wound. :  
b) No. of phases in system : 3 Phases.
4. Type whether indoor or outdoor : Out door
5. Type of cooling required if other  
Than oil natural cooled : Oil cooled ( ON type)
6. No load voltage ration : 11000 V/433 V.
7. Inter phase connection HV side : Delta ( ) connected.
8. Inter phase connecting LV side : Star (\*) connected
9. Vector group : DY-11
10. Impedance voltage if other than  
IS : 2026/77 : 4.5%
11. Tap Changer on HV side off circuit  
Or otherwise. : No.
12. Tappings to be provided : No.
13. Terminal arrangement ( give details : Busing type on HT & LT for  
of bushing or cable boxes on HT :  
& LV side. : outdoor & cable boxes type for  
Indoor.
14. Whether oil type thermometer to : Required  
indicate the temp. of oil required.
15. No load current at rated voltage : Less than 3% full load current  
&frequency

16. Whether transformer shall be fitted  
With breather . : -Yes
17. Fitting required for each transformer  
In reference to clause 14 of IS:2026/  
Pt.1/77 give list of accessories. : Enclosed
18. Whether first filling of oil desired : Yes
19. Purpose for which required : as Station transformer.
20. Whether the area, where the  
Transformer is to be used, may be  
Taken as that of high incidence of  
Lightening. : Yes
21. Requirement of impulse test  
a) Whether actual impulse test  
Conducted or similar transformer  
Will suffice value of impulse test  
Voltage and whether chopped or  
Unchopped wave may be informed. : Actual impulse test is required to  
be carried out from your end and  
certificate may be submitted to this  
office.  
b) Same position as per ( a ) above in  
Respect of short circuit test. : Yes
23. Site condition : Normal with 3 Months heavy rain
24. Any other important point : Anti-corrosive painting required  
for transformer body.

**SPECIFICATION FOR 100 KVA DISTRIBUTION TRANSFORMERS.**

1. Outdoor type, 4 Star rated step down, 11000/433V, 3 Phase double wound, Aluminium wound, transformer with ON cooling, Vector group DY-11,

Confirming to IS: 2026/1977 amended upto date with following fittings.

a)	Rating & diagram plate	----	1 No.
b)	Breather	----	1 No.
c)	Lifting lugs	----	2 Nos.
d)	Oil guage	----	1 No
e)	Filter valve	----	1 No.
f)	Drain Valve	----	1 No.
g)	Air release plug	----	1 No.
h)	Thermometer pocket	----	1 No.
i)	Earthing terminals	----	2 Nos.
j)	Oil conservator	----	1 No.
k)	Explosion vent	----	1 No.
l)	Sampling valve	----	1 No.

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28. **POWER TRANSFORMER**

28.1 Vector Group of 15 MVA

Dyn-11

66/11.55KV Power Transformer

1. The agency shall ensure supply of power transformer of Reputed make approved by GECTO (Gujarat Electricity Board) Danke / IMP / Volt-Amp HEL / CGL make only.
2. The design of the power transformer shall be type tested in Reputed Laboratories like ERDA or CPRI.
3. The bidders shall have to confirm :

Sr. No.	Particulars	confirmation
(i)	That they shall offer the core for inspection and approval by the purchaser during the manufacturing stage. Bidders call notice for this purpose should be accompanied with the following documents as applicable as proof towards the use of prime core material : (a) Invoice of the supplier (b) Mills Test Certificate (c) Packing List (d) Bill of landing (e) Bill of entry Certificate to customs	YES/NO
(ii)	That the core material shall be directly procured Either from the manufacturer or though their Accredited marketing organization of repute and not through any agent.	YES/NO
(iii)	That they have in-house core cutting facilities for better control of quality and to avoid possibility of mixing prime core material from second grade core material. In the event if the bidder is sending the core to their sub-vendor for cutting purpose, in that case, they shall have to confirm that they will provide documentary evidence and other means (manufacturer’s original seals provided to the CRGO rolled sheet) to prove that the prime core material is not being mixed with second grade core material or second grade core material is not used by their sub-vendor during the cutting process of the core material.	YES/NO
(iv)	That they have in-house facility for drawing out the required cross section of copper winding material. They also have to confirm that they will furnish the details such as name, address, contact persons, phone number etc. of their sub-supplier from where they procure the required cross section of the copper winding materials. Also, the sub-supplier must be authorized by the original manufacturer for supply of such copper winding materials.	YES/NO
(v)	That they agree to submit copy of test certificate of copper winding material purchased from the original manufacturer.	YES/NO
(vi)	That the EHV grade transformer oil be used in the power transformers will be Nepthenic based.	YES/NO

Sr.No.	Item	Make	Grade / Type
1	CRGO silicon steel laminations (Core material)		
2	Electric grade-copper used for (a) HV winding (b) MV winding (c) LV winding		
3	Insulating paper		
4	Power Oil		
Sr.No.	Item	Make	Grade / Type
5	Steel used for (a) Yoke (b) Main Tank (c) Other accessories		
6	HV Bushing (i) Complete bushing (ii) Hollow insulators		
7	LV & Neutral bushing		
8	OLTC		
9	Radiators		

The bidder may mention various reputed make of raw material, but the test certificates will have to be submitted for the exact make at the time of drawing approval. The bidder will not be permitted to use any other make at later without approval, once make is indicated/confirmed. The bidder should have make arrangement for various **stage inspection** of transformer. (Core material, winding etc)

#### 28.5 POWER TRANSFORMER PRINCIPLE PARAMETERS

The transformer requirement shall confirm to the following specific parameters.

Sr. No.	Item	Specification
1.	Type of power transformer	3ph Double copper wound, Core Type Transformer, suitable for Outdoor installation.
2.	Rated capacity	15 MVA
3.	Type of mounting	on wheels mounted on rails
4.	System Frequency	50 HZ
5.	Rated voltage Ratio	66/11.5 KV
6.	Type of cooling	ONAN
7.	Method of connection	HV-Delta LV-Star
8.	Connection Symbol	Dyn 11
9.	System earthing	Neutral solidly grounded
10.	Transformer Neutral earthing	Directly earthed
11.	Percentage impedance at rated MVA and normal tap .	7% with ±10% Tolerance
12.	Tap changing gear	
	(i) Type	on LOAD
	(ii) Class (KV)	66
	(iii) Provide on	HV winding for LV variation
	(iv) Tap range	-5% (looking from LV side)

#### (A) VOLTAGE CLASS OF BUSHINGS & THEIR TYPES

(a) HV winding line end	72.5 KV OIP condenser Bushing
(b) LV winding (11.55KV)	24KV Solid porcelain type Bushing
(c) LV winding neutral of 66/11.55KV Transformer	24 KV Solid porcelain Bushing

NOTE: Bare terminals on transformer bushing stem for connection to rigid bus bars or over head conductor.

(d) Minimum clearance (mm)

	(i) PH to PH	HV-790	LV (11.55)-270
	(ii) PH to E	HV-690	LV (11.55)-270
23.	Terminal connectors	HV Bimetalic Terminal Connectors Suitable for twin ACSR panther Conductor and the Rated current of HV winding terminal	LV LV Copper terminal connectors suitable connecting 2 or 3 No. 11 KV / 240 Sq. mm . XLPE Cable and the rated current of LV Terminals.

(Connectors must withstand all short circuit currents, when bus fault occurs. They shall be duly tested at 25 KA currents. Type test certificate of Connectors should be enclosed with relevant detailed drawings, as stated in Data sheet “ A1 “ of section “D(i)A”- Clamps & connectors).

24.	Earthing Conductor Material/ Size	Copper strip size 2x50x6mm
25.	a) Type Test Required	(a) Impulse test full wave and with Chopped wave on HV & LV Phases
	b) Special Test	(b) Heat Run Test Short Circuit Test

\*These tests will have to be carried out only if Department desired after placing the order

26.	Transformer to be Transported	Filled with oil or that filled with inert gas along with reducer connection, Pressure gauge is preferred.
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#### 28.14 APPLICABLE STANDARDS

1.	POWER TRANSFORMER	*IS 2026	BS 171	IEC76
2.	FITTING & ACCESSORIES	*IS 3639		
3.	CLIMATE PROOFING	*IS 3202	BS-CP-1014	ICE296
4.	LOADING OF OIL IMMERSED TRANSFORMER	*IS 6600	BS-CP-1010	ICE 354
5.	TRANSFORMER OIL	*IS 335	BS-148	IEC 296
6.	BUSHING	*IS 2099	BS 223	IEC 137
7.	DEGREE OF PROTECTION	*IS 2147	IS 2147	
8.	TESTS	*IS 2020	BS 171	IEC 76
9.	TOLERANCE ON GUARANTEED PARTICULARS	*IS 2026	BS 171	IEC 76
10.	BUCHHOLZ RELAY	*IS 3637		
11.	ELECTRICAL INSULATION BY THERMAL STABILITY	*IS 1271	BS 2727	IEC 85

NOTE:-

1. EQUIPMENT, ACCESSORIES, COMPONENTS / PARTS, RAW MATERIALS AND TEST SHALL IN GENRAL CONFORM TO IS/BS/IEC
2. APPLICABLE STANDARD.

28.15 CONTROL CABINET

28.15.1 LOCAL OLTC CONTROL CABINET & REMOTE OLTC PANEL

a)	i)	Each three phase transformer unit shall be provided with local OLTC control cabinet and with automatic voltage regulating relay As per specification at Annexure – II to be mounted in Transformer Control and relay panel.
	ii)	The cabinet shall be provided with non disconnecting stud type Terminal blocks. Each of the terminal block in the above panels should have 20% spare terminals exclusively for owner’s/purchaser’s use. Necessary scheme of wiring shall be designed to co- ordinate with voltage regulating relay for remote operation and parallel running of transformers.
	iii)	The Local OLTC control cabinet shall house all necessary devices meant for OLTC control and indication.
	iv)	Following cabling are specifically included in the scope of the Bidder. And interconnection drawings for the same are to be submitted by the Bidder.
	i)	Cabling between remote voltage regulators mounted in transformer panel to local OLTC cabinet for remote control and parallel operation.
	ii)	Cabling between Local OLTC cabinet to purchaser’s / owner’s panel.
b)		The sheet steel used shall be at least 3mm thick for outdoor used The degree of protection shall be IP 55 (For OLTC cabinet & marshaling Box in accordance with IS 13947. Purchaser reserves the right to ask for tests of degree of protection for the panels.
c)		The temperature indicators shall be so mounted that the dials are not at height more than 1600 mm from ground level. Glass door of suitable size shall be provided for convenience of reading.
d)		A space heater and cubical lighting with ON-OFF switch shall be provided.
e)		<b>TERMINAL BLOCKS</b>
	i)	The terminal blocks to be provided shall be fully enclosed with removable covers and made of moulded non inflammable plastic material with block and barriers moulded integrally. Such block shall have washer and binding nut bolts for external circuit wire connections. A white marking strip for circuit identification and moulded plastic cover.
		All terminals shall be clearly marked with identification numbers or letters to facilitate connection to external wiring

	ii)	All internal wiring to be connected to be connected to the external shall be terminated on terminal blocks, preferably vertically mounted on the said of each panel. The terminal blocks shall be 1100 V grade and have 10 amps continuous rating, moulded piece complete with insulated barriers, non-disconnecting stud type terminals, washers, nuts and lock nuts. Terminals block design shall include a white fiber marking strip with clear plastic, slip on terminal cover. Marking on the terminal strips shall correspond to wire number and terminal numbers on wiring diagrams. The communication cables between voltage regulating relay and OLTC cabinet and transformer shall be in scope of bidder and shall be as recommended by voltage regulating relay supplier.
	iii)	At least 20% spare terminals shall be provided on each panel. These spare terminals shall be uniformly distributed on all terminal blocks.
	iv)	Unless otherwise specified, terminal block shall be suitable for connecting the following conductors on each side.
	a)	For all circuits, minimum of one no.2.5 sq mm. copper.
	v)	There shall be a minimum edge clearance of 250 mm between the first row of terminal blocks and the associated cable gland plate. Also the clearance between two rows of terminal blocks shall be a minimum of 150 mm.
	vi)	Arrangement of the terminal block assemblies and the wiring channel within the enclosure shall be such that a row of terminal blocks is run parallel and in close proximity along each side of the wiring duct to provided for convenient attachment of internal panel wiring. The side of the terminal block, opposite



		the wiring duct shall be reserved for the purchaser's/owner's external cable connection. All adjacent terminal block shall also share this field wiring corridor. A steel strip shall be connected between adjacent terminal block rows at 450 mm intervals for support of incoming cables.
	vii)	The number and sizes of the multi core incoming cable will be decided by Bidder as per requirement.
(f)		The gaskets shall be of neoprene rubber.

#### 28.15.2 BOLTS & NUTS

All bolts and nuts exposed to weather shall be hot dip galvanized/cadmium plated.

#### 28.15.3 WIRING AND CABLING

(a) All external cabling will be carried out by bidder based on wiring diagram & interconnection schedule to be supplied by the bidder.

Cable box / sealing end shall be suitable to following types of cables:-

(i) 415 Volt power : 1100Volt grade PVC insulated  
Aluminum conducted cable armour.

(ii) Control : 1100 Volt grade PVC insulated 7/0.737mm

Stranded copper conductor cable with armour.

- b) compression type cable connector shall be provided for termination of power and control cables.
- c) Not more than 2 wire shall be connected to one terminal. Each terminal shall be connected to one terminal. Each terminal shall be suitable for connecting two 7/0.737 mm stranded copper conductors from each side.
- d) All internal wiring shall be securely supported, neatly arranged, readily accessible And connected to equipment terminals and terminal blocks.
- (e) Engraved code identification plastic ferruls marked to correspond with schematic Diagrams shall be fitted at both ends of wires. Ferruls shall fit tightly on wires and shall not when the wire is disconnected from terminal block.

#### 28.15.4 Local OLTC Control Cabinet

The auxiliary devices for electrical control of the OLTC shall be housed in a weather Proof cabinet. It shall be completed with the following:

- (i) A contactor with thermal overload devices for controlling the AC auxiliary supply to the OLTC motor.
- (ii) Cubicle light with door switch.
- (iii) Space heaters to prevent condensation of moisture.
- (iv) Padlocking arrangement for hinged door of cabinet.
- (v) Cable terminal glands for power and control cables to the OLTC gear.

**28.15.5 Remote OLTC Control Equipment (Voltage regulating relay equivalent to eaberly as specified at annexure-II).**

- (a) Loose equipment mounted on control panel: Control and signal devices required to be Included in voltage regulating relay minimum for remote OLTC poperation
- (i) Actuator for electrical raise / lower control
  - (ii) Remote tap position indicator.
  - (iii) Signal lamps for change in tap position
    - (a) Tap changer in progress
    - (b) Tap changer out of step
    - (c) Tap changer motor trip

**28.15.6 CONTROL CABINET**

**SPECIFIC REQUIREMENT**

SR. NO.	PARTICULARS	
(A)	General	
(i)	Designation	Marshalling box, OLTC local cabinet,.
(ii)	Location & Degree of Protection	IP 55 for OLTC cabinet & marshalling box (as per IS 13947)
(iii)	Type of mounting	See Note 1
(iv)	Finishing colour - outside	Hot dip galvanizing for marshalling box and D.M. for OLTC.
	-Inside	Glossy white,
(v)	Cable entry	Bottom
(vi)	Short circuit level KA	2.5
(vii)	Thickness (mm)	2.6 For indoor & 3.0 for outdoor

(B)	Main Bus Bar & Associated equipment	
(i)	Design ambient temperature	50 C
(ii)	Continuous current rating (AMP)	By bidder
(iii)	a) Short time current duration (sec)	Three
	b) Short time current (KA rms)	25
(C)	Auxiliary power supply	430 V, 3PH, 50 HZ
(i)	For power devices, drive motors	Duplicate feed provided.
(ii)	Space hearted/Lighting supply	240 V, 1 PH,50hz
(iii)	Control supply voltage	110 V, Single phase AC and 110 V, DC for annunciation.
(D)	Control schematic for control cabinet	Not enclosed
(E)	Purchaser's earthing control material size	Galvanized steel strip 25x4
(F)	Control switch with NAC	Required/Nat contacts
(G)	No. of control switches & No. of contacts	To suit control scheme.
(H)	Annunciator	Required for OLTC

**NOTE**

1. OLTC LOCAL CABINET, MARSHALING BOX TO BE TANK MOUNTED.

**CONTROL CABINET  
APPLICABLE STANDARD**

<b>SR. NO.</b>	<b>EQUIPMENT</b>		
1	Switchgear general Requirements	*	IS-4237 BS-162 IEC
2	Air break switches	*	IS-4047 BS-3185 IEC-408
3	Fuses	*	IS-2208 BS-3185 IEC-259-1
4	Contactors	*	IS-2959 BS-7751 IEC-158-1
5	Starters	*	IS-1822 BS-4941 IEC-292
6	Indicating instruments	*	IS-1248 BS-89 IEC-51
7	Panel wiring	*	IS-375 BS-158 IEC
8	Degree of Protection	*	IS-13947 BS- IEC-529

**NOTES**

- 1 EQUIPMENT, ACCESSORIES, COMPONENTS/PARTS, RAW MATERIALS AND TESTS SHALL, IN GENERAL, CONFORM TO IS / BS / IEC
- 2\* APPLICABLES STANDARD

POWER TRANSFORMERS

Sheet 1 to 7

GUARANTEED TECHNICAL PARTICULARS  
(to be filled by the Bidder)

SR.NO.	ITEM
1.0	Transformer application/designation
2.0	Applicable standards
3.0	Quantity offered
4.0	Full load rating (MVA)
5.0	3 Phase unit/bank of three 1 phase units
6.0	Auto wound/two winding transformers/ Three winding transformers.
7.0	Rate no-load voltages: (a) HV KV (b) LV KV
7.1	Rate current. (a) HV Amp. (b) LV Amp.
8.0	Cooling FOR THE TRANSFORMER.
9.0	Guaranteed Percentage Impedence at rate Current at the principle tap at 75 C.
10.0	Efficiency at 75 C, at unity p.f (a) At full load % (b) At $\frac{3}{4}$ full load % (c) At $\frac{1}{2}$ full load %
11.0	(a) Regulation at full load, 0.8 PF at 75 C winding temperature (b) Regulation at full load, at unity P.F.
12.0	Rated frequency (Hz)
13.0	External short circuit withstand capacity in view of Specified system short circuit level (MVA).



POWER TRANSFORMERS

Sheet 3 to 7

GUARANTEED TECHNICAL PARTICULARS  
(to be filled by the Bidder)

SR.NO.	ITEM
17.3	If remote control, whether the Remote control cubicle included In BIDDER'S scope of supply
17.4	Voltage class of the OLTC
17.5	Current rating of the OLTC
18.0	Winding insulation category : a) HV uniform/non-uniform b) LV uniform/non-uniform
19.0	Type of axial coil supports HV LV
20.0	Type of radial coil supports HV LV
21.0	Impulse voltage withstand 1.2/50 MICRO second wave a) HV (KV peak) b) LV (KV peak)
22.0	Power frequency withstand voltage (dry and wet) a) HV KV (rms) b) LV KV (rms)

POWER TRANSFORMERS

Sheet 4 to 7

GUARANTEED TECHNICAL PARTICULARS  
(to be filled by the Bidder)

SR.NO.	ITEM
23.0	Guaranteed maximum temperature rise : a) Oil (by thermometers) C b) Winding (by resistance) C
24.0	Tank cover conventional/Bell shaped
25.0	Minimum clearance height for lifting Core and windings from tank (mm)
26.0	Bushings : a) Rated voltage class (KV) b) Rated current (Amp) c) 1.2/50 Ms impulse voltage Withstand (Kvp) d) One minute power frequency Withstand dry and wet (KV rms) e) Minimum clearance in air (mm) f) Minimum total creepage distance (mm) g) Quantity of oil in oil filled bushings (Litres & Kgs). h) Free space required at top for Removal (mm)
27.0	Maximum guaranteed Load loss at rate current At 75 C winding temperature Without any positive tolerance (KW)

## POWER TRANSFORMERS

Sheet 5 to 7

GUARANTEED TECHNICAL PARTICULARS  
(to be filled by the Bidder)

SR.NO.	ITEM
28.0	Maximum guaranteed No load loss (core loss and dielectric loss) at 100% rate voltage and frequency, without any positive tolerance (KW)
29.0	Guaranteed no-load current : (a) When excited from LV side at 100% rate voltage (Amp) (b) When excited from LV side at 110% rate voltage (Amp)
30.0	Maximum flux density : a) At rated voltage (Tesla) b) At 110% rated voltage (Tesla)
31.0	Over fluxing capability
32.0	Current density HV – A/cm <sup>2</sup> LV – A/cm <sup>2</sup> a) Plain/flanged b) Unidirectional/bidirectional c) Quantity d) Gauge (s) mm
32.1	Rollers for transformer.
33.0	Vacuum withstand capability : main Tank (mm of Hg)
34.0	All accessories supplied as specified Yes/No.



**GUARANTEED TECHNICAL PARTICULARS**  
(to be filled by the Bidder)

SR.NO.	ITEM
35.0	OLTC control scheme conforms to Specification Yes/No.
36.0	Weights
36.1	Net weight of the core                      Kg
36.2	Net weight      a) HV                      Kg
	Of copper        b) LV                      Kg
	Winding        c) Total                      Kg
36.3	Oil                      Kg
	Liter
36.4	Tank, coolers and fittings Kg
36.5	Total weight of transformer Kg
36.6	Un taking weight Kg
37.0	Material & Sheet metal thickness of transformer tank (mm)
37.1	Thickness of Indoor OLTC control cabinet (mm)
37.2	Thickness of Outdoor OLTC control cabinet (mm)
38.0	On-load tap changer
38.1	Make
38.2	Type designation
38.3	Suitable for auto/manual Operation
38.4	Rate voltage                      (KV)
38.5	Rate current                      (Amp)
38.6	Number of steps
38.7	Step voltage                      (Volts)
38.8	Rate voltage of drive motor (Volts)

## POWER TRANSFORMERS

Sheet 7 to 7

GUARANTEED TECHNICAL PARTICULARS  
(to be filled by the Bidder)

SR.NO.	ITEM
38.9	Rated voltage of control Circuit (Volts)
38.10	Time to complete tap changing Operation from any one step to Next higher or lower step on manual Operation through push button (Sec)
39.0	List of routine tests to be carried out.
39.1	List of acceptance tests to be carried out.
40.0	List of other test which will be carried out Carried out against extra price quoted Elsewhere.
41.0	Drawing number of the general Outline drawing enclosed with the Bid Showing the transformer with Accessories.

GUARANTEED TECHNICAL PARTICULARS  
ON LOAD TAPCHANGING GEAR  
(to be filled by the Bidder)

Sheet 2 to 2

SR.NO.	ITEM
13.0	Separate conservator and oil Surge relay provided (YES/NO)
14.0	Local outdoor cabinet general Arrangement drawing number (enclosed with the Bid).
15.0	Remote indoor control cabinet General arrangement drawing Number (enclosed with the Bid).
16.0	Quantity of oil in the OLTC Chamber (Ltrs)
17.0	Capacity of OLTC conservator Tank in Cu, Mtr.

Signature of Bidder

Date:-

GUARANTEED TECHNICAL PARTICULARS  
ON LOAD TAPCHANGING GEAR  
(to be filled by the Bidder)

Sheet 1 to 2

SR.NO.	ITEM
1.0	Manufacturer's name and Country
2.0	Indoor/outdoor application
3.0	Design ambient air temperature (C)
4.0	Thickness of sheet steel for outdoor & indoor panels(mm).
5.0	Degree of protection provided (as per IS:13947 or equivalent)
6.0	Bill of material for various equipment Giving make, type, ratings etc. Enclosed (Yes No)
7.0	Color of finish paint b) Outside c) Inside
8.1	Temperature rise at rated current over Specified ambient temp of 50 C (C)
8.2	Continuous current rating (Amp)
8.3	Three second current rating (KA)
9.0	Control wiring
9.1	Material of conductor For various Circuits
9.2	Size of conductor For various circuits mm <sup>2</sup>
9.3	Conductor-solid/stranded

SR.NO.	ITEM
10.0	Terminal Blocks
10.1	Make
10.2	Current rating
	a) Power terminals (Amp)
	b) Other terminals (Amp)
11.0	All tests as specified in section-D (ii) DATA SHEET A 1 Specification for The control panel will be carried out YES/NO
11.0	Space heater rating (Watts)

Signature of Bidder

Date:-

**ADMINISTRATION OF DAMAN & DIU  
ELECTRICITY DEPARTMENT  
DAMAN**

**TENDER SPECIFICATION  
FOR**

**INSTALLATION OF 2 X 15 MVA 66/11KV  
SUB-STATION  
AT BHIMPORE, DAMAN**

**SECTION – IV**

**BIDDING SCHEDULE**

**PRICE SCHEDULE**

**A For Turnkey Construction of 66/11 KV SUBSTATION at Bhimpore Daman with associated 66 kv D/C transmission line**

SN	PARTICULARS	QTY	UNIT	COST OF MATERIAL		COST OF ERECTION	
				RATE (RS)	AMOUNT (RS)	RATE (RS)	AMOUNT (RS)
1	Design, Engineering, Proto assembly, type test, Fabrication, Galvanising, Inspection and supply of Gantry structure and equipment support structure including the supply of Galvanised Foundation bolt, Nut & bolt for Gantry structure, Liaison and Conducting Fat etc complete.	1	Lot				
2	Supply, erection, Testing & commissioning of 66 KV Lightning Arrester of approved make and technical specification as per tender.	12	NO				
3	Supply, erection, testing & commissioning of 66 KV isolators (with E-S ) of approved make and technical specifications as per tender	5	NO				
4	Supply, erection, testing & commissioning of 66 KV isolators (with out E-S ) of approved make and technical specifications as per tender	12	NO				
5	Supply, erection, Testing & commissioning of 66 KV Current Transformer of approved make and technical specification as per tender.	15	NO				
6	Supply, erection, Testing & commissioning of 66 KV Potential Transformer of approved make and technical specification as per tender.	6	NO				
7	Supply, erection, Testing & commissioning of 66 KV SF - 6 Circuit Breaker of approved make and techinal specification as per tender.	5	NO				
8	Supply, erection, Testing & commissioning of Station Service Transformer of approved make and techinal specification as per tender.	2	NO				
9	Supply, erection, Testing & commissioning of 11 KV VCB panels of approved make and techinal specification as per tender. (2 - incomer + 6 - outgoing + 1 Bus Coupler + 2 st n tr)	11	NO				
10	Supply, erection, Testing & commissioning of 11KV Take off structure including the A.B Switch, D.O Fuse arrangements, L.A including Civil Foundations. 6 No included DP.	1	Lot				

11	Supply, erection, Testing & commissioning of 15 MVA Power Transformer of approved make and technical specification as per tender.	2	NO				
12	Supply & erection of 0.4 ACSR Zebra conductor for twin bus including the required Clamps & Connector (All the clamps and connectors should be crimped type, bolted type are not allowed).	1	Lot				
13	Shield wire with required structural material for peak and associated hardware	1	Lot				
14	Single Tension string with required Glass/ Long Rod Polymer insulators	1	Lot				
15	Single suspension string polymer insulator	1	Lot				
16	Double tension string polymer insulator	1	Lot				
17	Double suspension string polymer insulator	1	Lot				
18	Hardware's such as single T- AL - for 0.4 Zebra conductor, Twin on main & single on Tap 225/100 SAB , Isolator Palm Connector CU, Spacer for 0.4 Zebra Conductor.	1	Lot				
19	Marshalling Kiosk	1	Lot				
20	Galvanised Cable trays perforated/ Ladder of sizes 400 x 40mm, 300 x 40 mm, 200 x 40 mm, 100 x 40 mm, 80 x 20 mm, 50 x 10 mm cable tray along with G.S Angle Support and interconnecting plates and Jumpers for earthing continuity	1	Lot				
21	L. T Copper Control cables (Armoured) of following sizes: a) 19 C x 2.5 sq. mm, b) 12 C x 2.5 sq mm, c) 10 C x 2.5 sq. mm, d) 7 C x 2.5 sq. mm, e) 5 C x 2.5 sq. mm, f) 4 C x 2.5 sq. mm, g) 2 C x 2.5 sq.mm,						
22	a) Supply of XLPE HT Power cable (Armoured) 3.5 x 300 sq. mm Aluminium cable along with its termination kit. b) Power cables (Armoured) 3.5 C x 185 sq. mm c) Power cables (Armoured) 3.5 C x 120 sq. mm d) Power cables ( Armoured) 3.5 C x 95 sq. mm e) Power cables 4 x 10 sq. mm f) Power cables 3 x 25 sq. mm.	1	Lot				
23	Control & Relay panel for 66 KV single bus 110 V DC						



	a) Incomer feeders	2	NO				
	b) For Transformer	2	NO				
	c) For bus coupler	1	NO				
24	110 volts DC Battery set along with battery chargers and						
	DCDB one set with D.C Fail supervision system	1	SET				
25	AC Distribution board A type	1	NO				
26	Electrification & illumination of control room						
	& Switch Yard with provision for emergency lighting both in switch yard & control room	1	LS				
27	Laying Earth Mat						
	a) 75 x 10 mm	1	Lot				
	b) 50 x 8 mm	1	Lot				
28	Earthing pit with earth electrode of Cast iron pipe of 3 mtr, Length x 100 mm internal Dia x 13 mm thick with required clamps & Connectors etc complete	1	Lot				
29	Fire fighting system for control room & switchyard	1	LS				

30	Communication system	1	LS				
31	Misc Items : 5% mandatory spares for all above mentioned equipments including transformers, safety charts, provision for first aid, operator console ( Furniture ) , Computer System with printer and (Tools & Plants for substation ) & providing SCADA system	1	LS				
	CIVIL WORKS:						
32	Geo - technical investigation of soil: - taking trial bore. Trial pit for the design of foundation of gantry, transformer and equipment support structure etc complete.	1	Lot				
33	Land development for Substation						
	a) Levelling & cutting of earth in entire area. The tentative quantity may be : 50,000 cum. It is advisable for bidder to visit the site for offering the quote.	1	Lot				
	b) Filling and compaction of earth in the substation area( required Procter density will be checked to assure proper compaction)	1	Lot				
34	Construction of Culvert for diverting the ( Rain / storm ) water rushing down from the adjacent hill as per requirement	1	Lot				

35	Civil works fro Gantry and equipment foundations. This should include the following : Evacuation in all earth soil, providing shoring and shuttering for concreting, P.C.C. & R.C.C. of mix M- 20 & M- 25 as per requirement, providing and fixing of reinforcement steel of required sizes as per approved drawing						
	a) For, Gantry Foundations Excavation	1	Lot				
	b) For, Equipment Support Structure Foundations	1	Lot				
	c) For, Transformer Foundations	1	Lot				
36	Construction of Strom water drain inside switchyards, cable trench, trench cover, brick work with R.C.C. cover to house the earthing electrode, approach and internal road, 3 mtr, wide of cement concrete control room building & store water supply arrangement for drinking water for earthing along with bore well & pipeline	1	Lot				
37	Construction of control room & building ( Duplex type) as per the drawing approved by E.D. proven for earthquake 7.6 ricter scale ( 45000 sq ft)	1	Lot				
38	Supply and spreading, levelling of metal in switchyard.	1	Lot				
39	Construction of Soak pit and fire wall for transformers.	1	Lot				
40	66 KV D/C TRANS/ LINE ( LILO)						
	Construction of 66 KV 66 D/C transmission line						
	Route length : 250 mt.						
	This include the following:						
	Walk - over Survey, detailed survey, finalization of Route map, tower schedule, location marking, design of foundation as per soil strata, excavation for foundation , tenplate setting, casting of foundation, providing earthing, design of towers, type test, prpto test as per requirement, supply of template, supply of tower, danger board, phase plate, ckt plate & no. plate, tower accessories, supply of 2.0 Panther ACSR Panther conductor, supply of 120 KN & 90 KN Glass' polymer type insulator, Earth wire 7/3.15 Hardware for conductor i.e SSN, STN, DTN etc, Supply of vibration damper, armour rod etc, Erection of tower, stringing of conductor and earth wire, testing, commissioning and charging of transmission line. Note: - Bidders are advised to visit the site and to carry out the walk - over survey of transmission line and get acquainted with the ROW problems. Transmission line required to be diverted to minimise the R.O.W. problems	1	Lot				

1	Total Rs.						
	<b>Note: - The contract will be awarded to overall lowest Tenderer</b>						

Signature

Name

Status

Whether authorized

Attorney of the

Tendering company: