

INTER UNIVERSITY ACCELERATOR CENTRE (IUAC)
(AUTONOMOUS CENTRE OF UNIVERSITY GRANT COMMISSION)
NEW DELHI
NOTICE INVITING TENDER

TENDER NO: IUAC/NIT/02/UGN/2018-19

Name of the work : Supply, Installation, Testing and Commissioning of 1600KVA, 11KV/433V, Compact Substation

Estimated Amount : Rs. 72Lakhs

Earnest Money : Rs. 144,000/- in the form of D. D.

Tender Cost : Rs. 500/- in cash or D. D
(Tender fee is not payable if tender documents are downloaded)

Last Date and Time of Submission of Tender : 18-05-2018 at 3 p.m.

Date & Time for opening of Tender (Techno-commercial bid - Part-A) : 18-05-2018 at 3.30 p.m.

Date & time for opening of Price Bid (Part-B) : To be intimated later on to technically qualified tenderers.

Address for submission of tender : Administrative Officer (S&P),
Inter University Accelerator Centre
Aruna Asaf Ali Marg
Post Box: 10 502
New Delhi-110067.

Place of opening of the Tender : Committee Room of above address.

Tender Documents can be purchased from Administrative Officer(S&P), at a cost of **Rs. 500/-** (Rupees Five Hundred Only) either in cash or Demand draft. The tender documents can also be downloaded from IUAC web site www.iuac.res.in or Central Public Procurement Portal (CPPP): <https://eprocure.gov.in/epublish/app> . Tender fee is not payable if tender documents are downloaded.

For any clarifications / amendments / corrigenda etc. to NIT before last date of submission of tender will only be available on our website www.iuac.res.in. Tenderers are requested to keep visiting this web site for all updates and in case of any correspondence for clarifications you may contact Administrative Officer(S&P) e-mail: joseph@iuac.res.in

INTER UNIVERSITY ACCELERATOR CENTRE
ARUNA ASAF ALI MARG, POST BOX NO. 10502
TENDER NO: IUAC/NIT/02/UGN/2018-19

**Name of the work : Supply, Installation, Testing and Commissioning of 1600KVA,
11KV/433V, Compact Substation**

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GENERAL CONDITIONS OF TENDER:

1. Submission of Tender: Tenders should be submitted in sealed envelopes in two parts separately, i.e. "Techno-commercial bid" (Part-A) and "Price bid" (Part-B). Both the parts should be further sealed in an envelope super-scribing NIT No & name of work, due date for opening, tenderers name & address. The tender duly filled in may be sent to above mentioned address either by post or hand delivered in the tender box kept in the area near west side entrance, after ensuring that due entries are made in the register kept at the counter. It should not be handed over to any employee of the Centre. No tender shall be accepted later than the time schedule specified above. Tender once submitted will remain with IUAC and never be returned to the tenderers.

2. Techno-commercial Bid (Part-A): In this bid, the tenderer should submit his company profile, history and structure of firm, name of directors/partners/proprietor with technical staff, list of plant, machinery & tools in his possession, copies of work orders and completion certificates for successfully executed works during the last 7 years, copy of Income tax clearance certificate for last two years. No deviations in respect of NIT conditions are acceptable. The following specific conditions are essential for technical qualification.

- i). Copies of work orders for “**Supply, Installation, Testing and Commissioning of 11KV/433V, Compact Substation**”

Eligibility criteria for Sub Station works shall be “Experience of having successfully completed works during last seven years ending last day of the month previous to the one in which applications are invited for reputed Public Ltd. Companies, Public Sector and other Govt. Institutions in the following manner:-

Three similar works each of value not less than 40% of the estimated cost put to tender with capacity of individual transformer being 80% of individual capacity (rounded off to next available higher capacity) of the equipment i.e. transformer proposed in NIT.

OR

Two similar completed works each of value not less than 50% of the estimated cost put to tender with capacity of individual transformer being 80% of the individual capacity (rounded off to next available higher capacity) of the equipment i.e. transformer proposed in the NIT.

OR

One similar completed work of value not less than 80% of the estimated cost put to tender with capacity of individual transformer being 80% of the individual capacity (rounded off to next available higher capacity) of the equipment i.e. transformer proposed in the NIT. All amounts rounded off to a convenient figure. (Modified vide OM DG/MAN/261 dt. 18.01.2013)

- ii). The tenderer must have a valid Electrical Contractor's License issued by any State / Union government. Copy of the license must be submitted.
- iii). Earnest Money Deposit.
- iv). Entire NIT (except Price bid) duly signed & stamped by the tenderer.
- v). Detailed technical specifications/ leaflets of the system offered.
- vi). Satisfactory work completion certificate from at least one client with contract details. The work order and completion certificate should be for the same work
- vii). List of submittals as per the annexure-I
- viii). The Centre reserves the right to either visit the works of the tenderers and the similar site

of installations of the tenderers and carryout the verification of the works claimed to have been completed by them during last five years for qualification of their bids.

3. **Price Bid (Part-B):** In this bid the tenderer is required to quote his items rates/prices for the works mentioned in the scope of work & technical specifications. The rates/price should be inclusive of all material cost, labour, services, charges for the plant/machinery/tools & tackles required for completion of work, freight, insurance, Octroi, up to IUAC site basis. However GST charges will be paid extra as applicable. No charges towards quantity variations, escalation, site difficulties, other hidden cost even though they may not have been explicitly mentioned in the scope and schedule of works shall be payable extra or separately. It is mandatory on tenderer to quote all items rate as asked for in the **BOQ/ Schedule of Prices**. Failure to adhere to this condition will lead to rejection of tender. The tenderers should quote unconditional rates, neatly written without any overwriting and duly signed & stamped by all pages
4. **Earnest Money:** An earnest money of **Rs. 144,000/-** has to be enclosed along with the Techno-commercial bid (Part-A). The EMD shall be only in the form of Bank Draft in favor of **Inter University Accelerator Centre**, payable at **New Delhi**. No Cheque/Cash shall be accepted as EMD. EMD of technically disqualified tenderers will be returned within 15 days from the date of evaluation of the technical bids. The refund of EMD to all other tenderers except the lowest tenderer shall be made within 15 days from the date of opening of price bid. The refund of EMD of the successful tenderer shall be made after completion of works and acceptance of system by IUAC upon his written request.
5. **Exemption from EMD:** Unit registered with National Small Scale Industries Corporation (NSIC) are exempted from payment of Tender cost and EMD, subjected to: The unit being registered with NSIC for the items tendered. Self-Attested copy of valid NSIC registration Certificate. Photocopy of application for registration as NSIC or for renewal of NSIC will not be acceptable. Such offers will be treated as offers received without EMD.
6. **Validity of Tender:** Tender shall be valid for our acceptance without any change in rates and NIT conditions for a period of 90 days from the date of opening of price bid..
7. **Escalation:** No escalation over and above items rates quoted by the tenderer shall be paid during the execution of contract.
8. **Performance Guarantee:**
 - i). **SUBMISSION:** The successful tenderer has to submit a performance guarantee of an amount equal to 10% of total contract value within a period of 15 days from the date of issue of LOI/Purchase Order. Performance Bank guarantee shall be drawn in favor of Inter University Accelerator Centre as applicable. Performance Bank guarantee shall be Valid for entire contract period and two extra months. In case of contract extension with or without LD the validity of BG shall also be extended for the extended period with additional two months..
 - ii). **FORFEITURE:** Performance Bank guarantee established under Clause 8 (i) shall contain a statement that it shall be automatically and unconditionally forfeited without recourse and payable against the presentation by INTER UNIVERSITY ACCELERATOR CENTRE to the relevant company/ correspondent bank, as the case may be, together with a simple statement that tenderer has failed to comply with any term or condition set forth in the Contract.
 - iii). **RELEASE:** Performance Bank guarantee will be released without interest within fifteen (15) days on successful taking over of the project by IUAC on receipt of written request from tenderer seeking release subjected to submission of BG towards defect liability period as per the clause no-16.

9. **Completion time:** The time shall be the essence of this contract and entire work as detailed in schedule of rates is to be completed in all respect within a period of 240 days from the date of submission of Performance Bank Guarantee (as per clause 8 above) by the Tenderer. Any delay in completing the work for reasons attributable to the Contractor is liable for liquidated damages as per clause 19 of NIT. However, under the force-majeure conditions or delay due to reasons beyond control of the tenderer, IUAC may grant suitable time extension for which the contractor has to request along with the justification/reasons well in advance to the Director, IUAC for approval without any prejudice to price escalation. No time extension request shall be considered after the expiry of completion period of contract. The decision of the Director will be final and binding on the tenderer.
10. **Scope of Work:** Detailed scope of work, terms and conditions, technical specifications, list of approved makes etc. are enclosed with this NIT.
11. **Deviations:** No deviation from the stipulated commercial terms and conditions will be allowed. Tenders should be unconditional.
12. **Quantity variation in ordered and executed quantity of works:** IUAC reserves the right to decrease the quantity of all/any item as per site requirement. However, any increase in quantity of any/all items as per site requirement up to 25% of ordered quantity the tenderer has to execute the same without any change in prices. Quantities in the tender are estimated quantities. Quantities required is to be assessed by the contractor after award of work and before procurement. Payment shall be made for the actual quantity used in the work.
13. **Site Conditions:** Tenderer shall acquaint himself fully with the site conditions and the working environment of the IUAC before quoting his rates. Every tenderer shall submit the certificate of site visit. No compensation on account of any site difficulties will be entertained at a later date after award of works.
14. **Correspondence:** All the correspondence in respect of tender/contractual obligation shall be made to A.O.(S&P), Inter University Accelerator Centre, Aruna Asaf Ali Marg, New Delhi-110067. E-mail: joseph@iuac.res.in
15. **Terms of Payment and billing:** The payment shall be made on submission of the bills by the tenderer and after due certification by the IUAC person responsible for supervision of the work in following manner: -
- (a) 70% after initial inspection and delivery of goods at site in good condition on pro-rata basis.
 - (b) 20% after completion of installation in all respects.
 - (c) Balance 10% will be paid after testing, commissioning & handing over to the department for beneficial use. Release of this payment is subjected to submission of bank guarantee of amount equivalent to 10% of final bill value valid for 365days towards the defect liability period.
 - (d) Tenderer to submit the following documents against dispatch of each consignment wherever applicable, submission of these are mandatory for release of payments against supply:
 - i). Consignee copy of LR
 - ii). Tenderer detailed invoice showing commodity description, quantity, unit price, total price and basis of delivery.
 - iii). Original certificate issued by IUAC confirming receipt of material at site and acceptance of the same.
 - iv). Dispatch clearance & inspection report issued by the IUAC/inspection authority
 - v). Packing List.
 - vi). Test Reports
 - vii). Guarantee Certificate.

16. **GUARANTEE/DEFECT LIABILITY PERIOD:** The tenderer should guarantee for the works/items executed/supplied by him from the manufacturing/engineering defects and bad material/workmanship for a period of **365 days** from the date of acceptance of works by IUAC. During this period if any replacement of items and/or repairs/rectification is needed, he shall make the same free of cost or else IUAC reserves the right to get the defects rectified at cost of contractor and same shall be recovered from the BG. Bank guarantee worth 10% of final bill value held with IUAC for the guarantee period and will be released only after completion of guarantee period.
17. **Labour Laws:** The contractor will abide by all the rules and regulations related to labour laws, accident, Workman Compensation Act, workmen insurance, ESI, PF etc. This will be the sole responsibility of the contractor. IUAC will not be a party at any stage in any of the disputes relating to the above. In case any liability arises due to non-conformance by the contractor, under no circumstances IUAC will be liable for the same.
18. **Rules governing the Contractor's employees working in the IUAC Premises:** The contractor's employees working inside the IUAC campus will abide by the instructions which is furnished to them by Engineer in-charge from time to time. Any damage to the IUAC property due to mishandling, carelessness on the contractor's or his workmen's part will be recoverable from the contractor's bills.
19. **PENALTY FOR DELAY:** _
- a) If supply of items / equipments is delayed beyond the supply schedule as stipulated in purchase order then the Tenderer shall be liable to pay to the Purchaser as penalty for delay, a sum of 0.5% (point five percent) of the contract price for every week delay.
 - b) The total amount of penalty for delay under the contract will be subject to a maximum of 5% (five percent) of the contract price.
 - c) The Purchaser may, without prejudice to any method of recovery, deduct the amount for such damages from any amount due or which may become due to the Tenderer or from the Performance Bond or file a claim against the tenderer.
 - d) In such case, incomplete work shall be worked out by deducting value of works actually executed to the working condition from total order value.
 - e) However, in case the works are delayed beyond the scheduled completion/ contract period, IUAC reserves the right to get the work done by any other contractor at the risk and cost of the tenderer and amount to this affect will be deductible from tenderer's bills/dues with an additional amount @ 10% as departmental charges.
20. **Right of The Director IUAC: The Director, IUAC reserves the right to accept or reject any tender without assigning any reason and does not bind himself to accept the lowest tender.**
21. All the persons deployed by the contractor at IUAC site will have to carry valid gate passes, which will be issued after submission of their bio-data in desired format by the contractor. Any negligence/offence on their part will attract immediate removal of person(s) from site.
22. The contractor will provide for all necessary materials, tools equipments, measuring instruments and working consumables etc. needed for execution of the works. Safe custody of all such materials will be contractor's sole responsibility. No extra charges will be paid for the same.
23. Watch and ward of all material till the system is taken over by IUAC shall be the sole responsibility of the contractor and pilferage etc. shall be entirely to his account.
24. All the employees of the contractor working at our site will have to be covered under insurance against any personal accident and IUAC will not be liable for payment of any compensation on that account.

25. Suitable lighting arrangements will have to be arranged by the contractor at his own cost. However, IUAC will provide the power/light points at nearest available point from the place of work.
26. The works shall be carried out as per the norms set by the manufacturer of respective equipment/material, specification and specific instructions as may be issued by the IUAC Engineer responsible for work from time to time.
27. During execution of work the contractor should follow all standard norms of safety measures/precautions to avoid accident/damages to persons, machines and buildings. On non-adherence of this clause, suitable fines as decided by the Director IUAC shall be imposed.
28. Transfer and Sub-Letting: The Tenderer shall not sublet, transfer, assign or otherwise part with the Contract or any part thereof, either directly or indirectly, without prior written permission from IUAC.
29. Manpower deployed by the contractor at our site for carrying out contracted works is strictly prohibited being associated with any other works in the campus.
30. No material belonging to the contractor whether consumable or non-consumable should be brought inside the IUAC campus without proper entry at the main gate nor any material should be taken out without proper gate pass issued by the Centre.
31. IUAC will provide free water and electricity during installation work at IUAC at one point. The contractor has to make his own arrangements for drawing power and water from that point as per his requirement.
32. Tenders once submitted will remain with the Centre and will never be returned to the tenderers.
33. **Termination of Contract**: The Director, IUAC reserve the right to terminate the contract on account of poor workmanship, failure to start the work within 30 days, non-compliance of set norms/ specifications for the works, delay in progress of work, violation of any contract provisions by the Contractor. The contract can also be terminated at the request of Contractor within 10 days from the date of LOI/ purchase order. In such case the EMD of the Contractor will be forfeited. If the contractor requests the termination of contract any time after submission of performance bank guarantee, the Performance Bank Guarantee shall be en-cashed along with forfeiture of EMD.
34. **Any dispute arising out of this contract will be subjected to jurisdiction of New Delhi/Delhi.**

Accepted

(Signature & Seal of Tenderer)

Note:- Entire NIT (except price bid) is to be attached with "Techno-commercial bid (Part-A)" duly signed & stamped by the tenderer

SCOPE OF CONTRACT WORK

2.1 **Introduction:**

Existing electrical installation at Inter University accelerator Centre (IUAC), Aruna Asaf Ali Marg, New Delhi -110067 requires upgrading due to additional load requirements., supplying and installing a compact substation of 11kV, 1600KVA capacity (Non-walking in steel enclosure), 11KV HT XLPE cable, LT cables and earthing grids. Tenderers who desire to visit site before quoting may do so after taking prior appointment. Supply, installation, testing and commissioning of all items as per Schedule of prices is included in scope of this contract.

2.2 **Supply, Installation , Testing and Commissioning of :-**

Scope of schedule-I to IV of Schedule of prices includes (but not restricted to) the following: -

- a. Four way 11KV Non-Extensible Ring Main Unit Compact substation of 11kV, 1600KVA : Design, manufacture, testing and inspection prior to dispatch at manufacturer's works. IUAC reserves the right to participate in inspection of any equipment/ item prior to dispatch at manufacturer's works. This inspection will be done by IUAC Engineer and shall not absolve the contractors from their overall responsibility to complete the entire job of supply, installation, testing and commissioning of all items of contract at IUAC in the required manner.
- b. Outdoor LT panel (IP54) with 600kVAR Power factor improvement panel: at a location decided by IUAC. Work shall include a suitable PCC platform Cable trenches and grouting.
- c. HT cable, and cable joints.
- d. Earthing electrodes and conductors.
- e. Construction materials for foundations and masonry trenches.

2.3 **Documentation:**

Preparation of shop drawings in respects of Compact substation for IUAC approval prior to fabrication. Preparation & submission of foundation drawing for Compact Substation, LT panel and cable trenches. Preparation & submission of earthing layouts. Submission of copies of test reports of tests carried out at manufacturers works in triplicate.

2.4 **Sequence of work**

The contract work requires part of existing electrical installation at IUAC to be disconnected and reconnected in modified manner. To have interruption minimum it is essential to complete installation of items for incorporation. As far as possible the shutdown shall be arranged on holidays/ after office hours.

2.5 **Contractor**

The contractor shall be a valid licensed electrical contractor, employing licensed supervisors and skilled workers having valid permits as per IE rules and local electrical inspector requirements.

2.6 **Regulation and standards**

Refer CL 4.0.1

2.7 **Inspection at Factory/ fabrication site**

Tenderer shall invite Engg-in-charge for inspection of CSS at the manufacturers place with a prior notice of 15 days for inspection and witnessing the required testing.

2.8 **Approval of work by local authorities**

The contractor shall be fully responsible for meeting all statutory obligations of local inspectorates wherever applicable for this work. The contractor shall prepare all necessary drawings and obtain approval from competent Electrical Inspectorate authorities and also have

the equipment and installation inspected and got approved. IUAC shall pay the required fees to inspection authorities against demand in writing from the appropriate authority.

2.9 **Submittals:**

- a) Required with bid –annexure-I
- b) Required after award for approval –annexure-II
- c) Prior to dispatch –annexure-III

2.10 Acceptable makes: Makes acceptable are given as per annexure –VIII

TECHNICAL SPECIFICATIONS

SECTION-I

1.0.0 CODE & STANDARDS:

- 1.1.0 All equipment and material shall be designed manufactured and tested in accordance with the latest applicable Indian Standard / IEC standard.
- 1.2.0 Equipment and material conforming to any other standard which ensures equal or better quality may be accepted. In such case copies of English version of the standard adopted shall be submitted.
- 1.3.0 The electrical installation shall meet the requirement of Indian Electricity Rules as amended upto date relevant IS code of practice and Indian electricity act.
- 1.4.0 The Unitized Sub-station offered shall in general comply with the latest issues including amendments of the following standards but not restricted to it.

Title	Indian & IEC Standards
High Voltage Low Voltage Pre-Fabricated Substation	IEC:62271-202
11 kV, Switchgear cubicles	IS: 13118, IS: 3427, IEC:60694, IEC:60298
Ring main unit 11 kv grade,	IS:9920, IEC:60265
Code of practice for selection, installation and maintenance of Switchgear	IS:10118
Distribution Transformer	IS: 1180
Indian Electricity Rules	1956
Indian Electricity Act	1910

2.0.0 DESIGN CRITERIA

- 2.1.0 Compact Sub-station shall consist of 4 way **11KV SF6 Insulated compact switchgear with SF6 / Vacuum Circuit Breaker as protection to transformer + Transformer + L.T. Switchgear** with all connection accessories, fitting & auxiliary equipment in an pre-fabricated Enclosure to supply Low-voltage energy from high-voltage system as detailed in this specification. The complete unit shall be installed on a substation plinth (base) as **Outdoor substation**. 11KV Load Break Cable Switches controls for incoming-outgoing feeder cables of the 11KV ring distribution system. The SF6 / Vacuum Circuit Breaker shall be used to control and isolate the 11kV/433V Distribution transformer. The transformer's L.T. side shall be connected to L.T. switchgear by means of flexible copper bus-bar. The connection cables to consumer shall be taken out from the L.T. switchgear.

- 2.2.0 The pre-fabricated unitized substation shall be designed for :

- Compactness,
- Fast installation,
- Maintenance free operation,
- Safety for worker/operator & public.

- 2.3.0 The Switchgear and component thereof shall be capable of withstanding the mechanical and thermal stresses of short circuit listed in ratings and requirements clause without any damage or deterioration of the materials.

2.4.0 For continues operation at specified ratings temperature rise of the various switchgear components shall be limited to permissible values stipulated in the relevant standard and / or this specification.

2.5.0 Service Conditions:

2.5.1 The equipment offered shall be suitable for continuous satisfactory operation in tropical area of Installation.

The Enclosure consisting of High Voltage switchgear-control gear, Low Voltage switchgear-control gear & Transformer of the Unitized substation shall be designed to be used under **normal outdoor service condition**. The enclosure should take minimum space for the installation including the space required for approaching various doors & equipment inside. The enclosure construction shall be such that it fully protects ingress of rain water, dust & rusting.

3.0.0 SPECIFIC REQUIREMENT

3.1.0 The main components of a prefabricated-unitized substation are Transformer, High-voltage switchgear-control gear, Low-voltage switchgear-control gear, corresponding interconnections (cable, busbars) & auxiliary equipment. The components shall be enclosed, by either common enclosure or by an assembly of enclosure. All the components shall comply with their relevant IS/IEC standards.

3.1.1 Ratings:

Description	Unit	Value
Rated Voltage / Operating Voltage	kV rms	11
Rated frequency & Number of phases	Hz & nos.	50 & 3
Rated maximum power of substation	kVA	1600 KVA, (Oil Type Hermeatically sealed Transformer)
Rated Ingress protection class of Enclosure	IP:	IP: 54 for LT Switchgear & HT Switchgear compartments and IP-34 for Transformer compartment.
HV Network & Busbar		
RMU		4 WAY (1No.Isolators + 3No. V C Breaker)
Rated current	Amp	630A for 11kV
Rated short time withstand current	kA rms / 3secs	21 for 11 kV,
LV Network		
LV Incomer: 4P ACB 2500 Amp rating and fault withstand capacity of 50kA.-1no.		

3.2.0 OUTDOOR ENCLOSURE:

3.2.1 The enclosure shall be made of 2.0 mm thickness Galvanized Sheet Steel tropicalised to meet Indian weather conditions including all the partition sheets & doors.

3.2.2 The base of the enclosure shall be of 4.0 mm thickness Hot Dip Galvanized Sheet Steel to ensure rigidity for easy transport & installation. The entire Package Substation shall be Factory Assemble & Factory Fitted.

3.2.3 The structure of the substation shall be capable of supporting the gross weight of all the equipment & the roof of the substation compartment shall be designed to support adequate loads. Incase of relocation of the Package Substation, the entire substation should be capable of getting lifted and placed as a Single Unit without dismantling of any of the major equipments inside. The lifting arrangement should be from the bottom of the enclosure & not from the top.

- 3.2.4 There shall be proper / adequate ventilation inside the enclosure so that hot air inside enclosure are directed out by help of duct. Louvers apertures shall be provided so that there is circulation of natural air inside the enclosure. The Package Substation should be designed & engineering to have natural cooling & ventilation instead of forced cooling / ventilation as the same would derate the Transformer further and shall be an additional load on the Transformer.
- 3.2.5 The complete design shall be compartmentalized.
- 3.2.6 **Interconnection:** I/c Interconnection between RMU and transformer using suitable Aluminum unarmored XLPE single core cables. I/c Interconnection between transformer and LT switchgear shall be using suitable copper
- 3.2.7 **Internal Fault:** Failure within the unitized substation due either to a defect, an exceptional service condition or mal-operation may initiate an internal arc. Such an event may lead to the risk of injury, if persons are present. It is desirable that the unit shall be tested for Internal Arc fault test to the tune of atleast 20KA for 1 second adhering to as per latest IEC 62271-202.
- 3.2.8 **Covers & Doors:** Covers & doors are part of the enclosure. When they are closed, they shall provide the degree of protection specified for the enclosure. All covers, doors or roof shall be provided with locking facility or it shall not be possible to open or remove them before doors used for normal operation have been opened. The doors shall open outward at an angle of at least 90degrees & be equipped with a device able to maintain them in an open position. Proper padlocking facility shall be provided for doors of each compartment. Transformer compartment doors must be open from both the sides & should not have access from outside.
- 3.2.9 **Earthing:** All metallic components shall be earthed to a common earthing point. It shall be terminated by an adequate terminal intended for connection to the earth system of the installation, by way of flexible jumpers/strips & Lug arrangement. The continuity of the earth system shall be ensured taking into account the thermal & mechanical stresses caused by the current it may have to carry. The components to be connected to the earth system shall include :
- a) The enclosure of Unitized / prefabricated substation,
 - b) The enclosure of High voltage switchgear & control gear from the terminal provided for the purpose.
 - c) The metal screen & the high voltage cable earth conductor,
 - d) The transformer tank or metal frame of transformer,
 - e) The frame &/or enclosure of low voltage switchgear,
- 3.2.10 **Internal Illumination:** There shall be arrangement for internal lighting activated by associated switch on doors for HV & LV compartments separately.
- 3.2.11 **Labels:** Labels for warning, manufacturer's operating instructions etc. & those according to local standards & regulations shall be pasted / provided inside and shall be durable & clearly legible.
- 3.2.12 **Painting and Fabrication process :**
- a) The paints shall be carefully selected to withstand tropical heat rain. The paint shall not scale off or crinkle or be removed by abrasion due to normal handling. For this purpose powder coating shall be used.
 - b) Special care shall be taken by the manufacturer to ensure against rusting of nuts, bolts and fittings during operation. All bushings and current carrying parts shall be cleaned properly after final painting.
 - c) The fabrication process shall ensure that there are no sharp edges on the GI sheets used.

3.2.14 Enclosure GTP:

1)	Ambient Temperature	46° C
2)	Type of Ventilation for a) Normal Condition b) Hot Condition	- Natural - Natural
3)	Compartmentalized	Yes
4)	Rated temperature enclosure class	10
5)	Degree of protection for external enclosure	IP34 Transformer Compartment. IP54 MV & LV Compartment
6)	Applicable Standard	IEC 62271 / 61330
7)	Enclosure material	Galvanized sheet Steel/CRCA
8)	Thickness of sheet (GI only)	2mm for enclosure. 4mm for PSS Base.

Note: No capacity de-ration of equipment / components upto 40°C ambient temperature.

3.3.0 11kV Switchgear

3.3.1 Non-extensible SF6 Insulated Compact Switchgear as required shall consist of following items:

3.3.2 Load Break Cable Switch with integral earth switch having full making capacity shall be used for Incoming cables.

3.3.3 SF6 / Vacuum Circuit Breaker shall be used for distribution network of HT switchgear. Circuit Breaker complete with operating mechanism, self powered, static type O/C,E/F protection relay with associated Current Transformers shall be used for control and protection of Transformer. An integral cable earthing switch with full making capacity shall be provided.

3.3.4 The above Load Break Cable Switch, SF6 / Vacuum circuit breaker, Bus bars should be mounted inside a sealed for life, cast resin / stainless steel tank. The operating mechanism of the switches and breakers shall be outside the SF6 tank and accessible from front. The tank should be filled with SF6 gas at an adequate pressure. The degree of protection for gas tank should be IP67. There shall be provision for filling the SF6 gas at site. Moreover the Cast Resin / Stainless Steel Gas Tank shall conform to the sealed pressure system as per IEC and ensure the gas leakage to 0.1 % per year as per IEC.

3.3.5 The Circuit Breaker is required to control 11 kV/433 volts distribution Transformer of rating upto 990KVA and relay settings and Current Transformers shall be selected accordingly.

3.3.6 **General Finish:** Totally enclosed, metal enclosed, vermin and dust proof suitable for tropical climate use as detailed in the specification.

3.3.7 **Ratings:** The bus bars shall have continuous rating of 630 Amps. The isolator shall have a continuous rating of 630 Amps. SF6 Circuit Breaker or Vacuum Circuit Breaker shall have a continuous rating of 200 Amps. in accordance with relevant IS / IEC standard

- 3.3.8 Breaking & Making Capacity:** The Load Break Cable Switches shall be capable for breaking rated full load current. The same along with its earthing switch shall also be suitable for full making capacity of the system as specified. The complete switchgear shall be suitable for breaking capacity of 21kA symmetrical at 11000 volts three phase for 11kV system for 3 sec
- 3.3.9 Busbar:** Switchgear shall be complete with all connection, bus-bars etc. Copper bus-bars continuous rating shall be 630 Amps. The busbars should be fully encapsulated by SF6 gas inside the tank.
- 3.3.10 Remote Operation:** Provision shall be there for remote operation of the switchgear's Isolator & Breaker shall be possible using Motors fitted to the operating mechanism at a latter date. It shall be possible to fit the motors either directly in manufacturing plant or on site as & when required. Installation on site shall be possible
- 3.3.11 Protection:** The circuit breaker shall be fitted with static type self powered relay inside the front cover to avoid any tampering. The same shall be used in conjunction with suitable CT's and Tripping Coil for fault tripping of the Circuit Breakers. CT's shall be mounted on bushing of breaker. CT's mounted on cable inside cable compartment are also acceptable.
- 3.3.12 Cable Termination:** Each Cable compartment shall be provided with three bushings of adequate sizes to terminate the incoming outgoing 11kV, 3 Core cables as the case may be. There shall be enough height from the base of the mounted switchgear so that the cables can be bent and taken vertically up to the bushings. The Cable termination shall be done by Heat shrinkable Termination method so that adequate clearances shall be maintained between phases for Termination. Cable Termination boots shall be supplied by the switchgear manufacturer.
- 3.3.13 Earthing of the main circuit :** The moving contacts of the earthing switch shall be visible in the closed position through transparent covers.

Locking Arrangement: Suitable padlocking arrangements shall be provided as stated below:

- Circuit Breaker manual operating handle in the "OFF" position.
- Each feeder Panel operating handle in 'Closed' 'Open" or 'Earth' position.
- Each isolator operating handle in 'Closed', ' Open', or 'Earth' position.

Ratings :

Non-Extensible ring compact switchgear with SF6 / Vacuum breaker / Vacuum Circuit Breaker		
		11kV
3.4.1	Switchgear Data	
a)	Service	Indoor
b)	Type	Metal clad
c)	Number of phases	3
d)	Voltage	1100V
e)	Rated Frequency	50 Hz
f)	Rated Current	630 Amp (isolator)
g)	Short Circuit rating	
	i) Breaking	21kA rms for Breaker
	ii) Short time withstand for 3 Sec.	21 kA rms
	iii) Rated S/c making	52.5 kA peak for Breaker
h)	Rated insulation level kV rms	28 kV
i)	Rated Level kV impulse	75 kV
j)	System earthing	Solidly earthed at substation

3.4.2	Breaker	
a)	Type	SF6 / Vacuum Breaker in SF6 tank
b)	Rated voltage	11kV
c)	Breaking current	
	i) Load breaking	21 KArms.
d)	Making current	52.5 KA peak
e)	Rated current	630 Amps.
f)	No. of poles	3
g)	Operating mechanism.	Trip free & free handle type with mechanically operated indication & pad locking.
3.4.3	Isolators	
a)	Type	Load breaking and fault making in SF6 tank
b)	Rated current	630 Amps.
d)	Rated breaking capacity	630 Amps.
e)	Fault making capacity	52.5 KA peak
f)	No. of poles	3
g)	Operating mechanism	Operating handle with ON, OFF, Earth positions with arrangement for padlocking in each position.
3.4.4	Busbars:	
a)	Material	Copper
b)	Type	SF6 insulated
c)	Rated Current	630 Amps

3.5 Isolator:

- 3.5.1 The Isolators offered shall conform to IS: 4710/9920 as amended to date. The isolator shall be triple pole, spring assisted, hand operated, non-automatic type with quick break contacts. The operating handle shall have three positions 'ON', 'OFF' and 'EARTH' which shall be clearly marked with suitable arrangement to padlock in any position. A safety arrangement for locking shall be provided by which the isolator operation shall be prevented from 'ON' position to 'EARTH' position or vice versa.

Switchgear:

Sealed for life, the enclosure shall meet the "sealed pressure system" criteria in accordance with IEC: 298 (a system for which no handling of gas is required through out service life of approximate 30 years.) There shall be no requirement to 'top up' the SF6 gas. In addition, manufacturer shall confirm that maximum leakage rate is lower than 0.1% per year. It shall provide full insulation, making the switchgear insensitive to the environment. Thus assembled, the active parts of the switchgear unit shall be maintenance free.

The switchgear & switchboard shall be designed so that the position of different devices is visible to the operator on the front of the switchboard & operations are visible as well. The switchboard shall be designed so as to prevent access to all live parts during operation without the use of tools.

RMU should be tested for internal arc fault test.

Circuit Breaker:

The Unit shall consist Tee-off spring assisted, three pole SF6 breaker, with integral fault making / dead breaking earth switch. The function shall be naturally interlocked to prevent the main & earth switch from being switched 'ON' at the same time & the circuit breaker not allowed to trip in 'Earth On' position. The selection of the main/earth switch

lever on the panel, which is allowed to move only if the main or earth switches in the off position. The lever shall be able to pad locked in either the main or earth position.

Protection :

Protection Relays: The Circuit breaker shall be fitted with static type self powered relay inside the front cover to avoid any tampering.

3.7.0 Transformer

3.7.1 11KV/ 433 volt Volts distribution transformer shall be a part of packaged substation which will be housed in the enclosure.
The transformers shall be installed in hot, humid tropical atmosphere. All equipment accessories and wiring shall be provided with tropical finish to prevent fungus growth.

The transformers shall be capable of continuous operation of rated output under the operating conditions of voltage and frequency variations as per statutory limits governed by relevant Indian Standard and Indian Electricity Rules, 1956 / IEC with latest amendments in force.

Use of Prime Grade core ,directly from reputed Manufacturers like Nippon / Posco/ AK steels ensures high endurance of core. Fully automated core cutting line ,that ensures uniform cutting of core resulting in low burr level and hence low core degradation ensures lower maintenance cost. Boltless , Step lap core design carried out automatically on Hydraulic Platform that avoids Multiple Handling thus ensuring low losses. Automated Foil Winding for LV coils that Make coil capable of withstanding higher thermal & mechanical stresses.

Requirement: 11000/433 Volt ONAN Transformer double wound, Dyn11, core type with Copper conductor. Oil immersed ONAN suitable for packaged substation housed in a enclosure with corrugated tank arrangement hermetically sealed.

3.7.2 **Voltage Ratio:** No load voltage 11000/433 volts within tolerance as stipulated in IS: 1180.

3.7.3 Insulating material shall be of proven design. The insulating materials shall be **class "A"** for ONAN

3.7.4 **Rating:** The transformer shall have a continuous rating as specified at any of the specified tapping position and with the maximum temperature rise specified. The rated KVA shall be the product of the rated voltage in kV, the corresponding rated current and the phase factor 1.73. When the transformer is operated with the rated primary voltage applied to the terminals of the primary winding, the apparent power (kVA) at the terminals of the secondary winding, when carrying the rated secondary current differs from rated kVA by an amount corresponding to the regulation of the transformer and is the product of the actual secondary voltage, the rated secondary current and phase factor 1.73.

3.7.5 **Temperature Rise:** The maximum temperature rise at the specified maximum continuous output shall not exceed 40°C by thermometer in the hottest portion of the oil or 45°C measured by resistance of winding above ambient temperature of 50°C. Adequate fan cooling is required during peak summer .

3.7.6 **Type of Load:** The transformer shall be suitable for carrying load within temperature rise indicated in the Indian Standard specification IS: 6600 'Guide for loading of oil immersed Transformer'.

3.7.7 **Overloads:** The transformers shall be suitable for carrying overload within temperature rise indicated in IS: 6600 'Guide for Loading of oil immersed Transformer'.

3.7.8 **Connections:** H.V. Delta and L.V Star connected with neutral brought out on the secondary side for connection to earth; Vector group DYn11 of IS: 1180.

3.7.9 **Tapping:** Each transformer shall be provided with Off circuit **Rotary type tap Switch** so as to provided for a voltage adjustment on H.V. from **+5% to -5%(In steps of 2.5%)** of

rated voltage of 11000 volts in 4 equal steps (5 position) to obtain rated voltage of 433 volts on LV side.

3.7.10 Transformer Losses: It should be as per IS1180.

Level 2 : @50% 4200 W
 @100% 11800 W

List of Fittings:

- 1) OTI with alarm & trip contact for oil type transformer only
- 2) WTI with alarm & trip contact.

3.8.0 LT SYSTEM

For 1600KVA PSS

LT compartment : **433V, 2500A LT devices with PVC sleeved Aluminium busbars** shall be suitable to house following equipment,

INCOMER:

1 No. 4 pole 2500A, 50kA, Manually operated fixed type ACB WITH microprocessor based over current, short circuit and earth fault release.

The design should comply for the following standards.

1. IEC-439-1, 1992 Low voltage Switch gear and Control gear assemblies Part-I, type tested and partially type tested assemblies.
2. IEC-947-1, 1998 Low voltage Switch gear and Control gear Part-I general rules.
3. IEC-1180-1, 1992 High voltage test techniques for low voltage equipment Part-I definition test and Procedure requirement
4. IEC-529, 1989 Degree of protection provided by enclosures (IP code)

4.0 Package Substation – Configuration

HV Side Options	Transformer Options	LV Side Options
3 Way RMU Comprising: Two ON load break SF 6 insulated switches and a SF 6 circuit breaker for transformer	Hermetically sealed oil type (ONAN) transformer	4P ACB Note: Ics=Icu=Icw for 1 Sec for ACB's

5.0 VOLTAGE CONFIGURATIONS OF PACKAGE SUBSTATION

- a. 11 kV / 433 V

6.0 TYPE TESTS

11 kV / 433 V Compact substations HT switchgear must be type tested for 20 kA/0.2sec.
 Enclosure must be type tested for IAC 20ka/1sec.
 Enclosure must be type tested for Ingress protection on each compartment.
 It is mandatory to have temperature rise test on enclosure for K10class.

7.0 OUT DOOR L.T. PANEL WITH CAPACITOR PANEL

LT compartment will have no in-house switchgears. However an outdoor standalone panel of IP 54 will be connected by suitable sized Al. cables from transformer LT terminals. The outdoor panel shall have the following switchgears

7.1 **SPECIFIC REQUIREMENTS**

INCOMER:

2 Nos. 4 pole 2500A, 50kA, EDO type ACB with microprocessor based over current, short circuit and earth fault release, door sealing frame and digital power monitor EM6400 or equivalent. both electro-mechanically interlocked with required level of safety.

OUTGOING:

- i) 2 Nos. 4 pole 1250A, 50kA, EDO type ACB with microprocessor based over current, short circuit and earth fault release, door sealing frame and digital power monitor EM6400 or equivalent.
- ii) 4Nos. 4 pole 630A, 36kA, EDO type ACB with microprocessor based over current, short circuit and earth fault release, door sealing frame and digital power monitor EM6400 or equivalent.
- iii) Supply, Installation testing and commissioning of 600KVAR Capacitors.
 - 63A TP MCB(10KA) Thermal Magnetic Release -4 Nos
 - 125A TP MCCB(36KA) with Thermal Magnetic Release-10 Nos
 - 25KVAR Capacitor Duty Contactor-4 Nos
 - 50KVAR Capacitor Duty Contactor-10 Nos

 - 440V MPP HEAVY Duty Capacitor-4 Nos
 - 50KVAR,440V MPP HEAVY Duty Capacitor-10 Nos
 - Control MCB, 6A, SP-As required

The design should comply for the following standards.

- 1. IEC-439-1, 1992 Low voltage Switch gear and Control gear assemblies Part-I, type tested and partially type tested assemblies.
- 2. IEC-947-1, 1998 Low voltage Switch gear and Control gear Part-I general rules.
- 3. IEC-1180-1, 1992 High voltage test techniques for low voltage equipment Part-I definition test and Procedure requirement
- 4. IEC-529, 1989 Degree of protection provided by enclosures (IP code)

EQUIPMENT SPECIFICATION

7.2 Air circuit breaker (ACB)

ACB of CSS: These shall be fixed type with manually operated (MFO type) mechanism. The short circuit mechanism and breaking capacity as shall be supported by test certificate. The test certificates should be from CPRI / any Govt. approved recognized test house / laboratory.

ACB of Out Door LT Panel: These shall be EDO type) mechanism. The short circuit mechanism and breaking capacity as shall be supported by test certificate. The test certificates should be from CPRI / any Govt. approved recognized test house / laboratory.

The circuit breaker shall be fitted with CT operated thermal overload and short circuit releases devices for suitable current rating.

- a) Overload releases should be settable from 50% to 100% of the rated current I_n .
 - b) Ambient temperature compensated type and there should not be de-rating of ACB current carrying capacity at 50°C. The testing of ACB for the temperature rise shall be carried out by the manufacturer as per the prevailing, IS / IEC or any other international standards.
 - c) ACB shall be provided with very sensitive overload and short circuit release. Short circuit release should have settable value as required with an adjustable times having setting range of 40 – 460 m seconds, to have a proper co-ordination with short circuit release of outgoing MCCBs.
- 1) 3 phase, 4 wire, neutral earthed having link arrangement.
 - 2) Rated current thermal current - as required
 - 3) Service voltage - 415 volts
 - 4) No. of break / pole - one
 - 5) Frequency - 50 c / s
 - 6) Rated insulation voltage - 1000 volts
 - 7) Rated short circuit breaking capacity
Rated services S/C breaking capacity I_{cs} (rms) – 50kA
Rated ultimate S/C breaking capacity I_{cu} (rms) – 50kA
 - 8) Break Time - less than 40ms
 - 9) S/C making capacity 1cm (peak) - 105kA
 - 10) Rated short time withstands current - I_{cw} 50kA for 1 sec.
 - 11) Suitable for outdoor installation.
 - 12) It shall conform to IS 13947 / pt.2 / 1993 with latest amendment, if any.
 - 13) Performance category - Utilization category – B.
 - 14) The status of open and close shall be clearly visible.
 - 15) The trip indication separated for overload and individual phase wise trip indication for short circuit to be provided.
 - 16) The ACB shall have the provision to lock the operating mechanism in off position.
 - 17) The operating mechanism should be form front and the compartment should have the degree of protection IP – 54.
 - 18) Separator shall be provided between all phases inside. ACB enclosed to prevent travel of arc during short circuit.
 - 19) The CT's mounted for thermal overload release shall have secondary winding inaccessible including tripping mechanism of O/L and magnetic releases to avoid tampering CT's should also have provision of separators.
 - 20) Two nos. earthing bolts for propose of earthing of ACB may also be provided & suitable for G.I stay wire of size 7 / 10 SWG.
 - 21) The bus bar size shall be confirming to relevant IS and the neutral bus bar shall be of same wire of size as phase bus bar and should be suitable for connecting neutral.
 - 22) The ACB shall be tested in accordance with the provision of IS: 13947 – Part I or relevant IEC

7.3 Interconnecting bus bar

Bus bar shall be of high conductivity aluminum (E91E) supported on insulators made of non-hygroscopic, non-inflammable material with tracking index equal to or more than that defined in BIS. The main bus bars shall have uniform current ratings throughout their length as specified in data sheet / job specification. The current rating of the neutral shall be half that of the phase busbars. Removable neutral links shall be provided on feeders to permit isolation of the neutral bus bar.

Only zinc passivated or cadmium plated high tensile strength steel bolts, nuts and double spring washers shall be used for all bus bar, joints and supports.

The hot spot temperature of bus bars including joints at design ambient temperature shall not exceed 95°C for normal operating conditions. It must be recorded during type tests.

The current rating of the bus bars shall be as required for design ambient temperature at site conditions and for being inside the cubicle at fully loaded condition. The vendor shall suitably de-rate the nominal rating to suit the above condition.

Minimum clearance between live parts, between live parts / neutral to earth shall be 19mm. However clearances between terminals at components shall be as per applicable individual standard for components.

Interconnections between the main bus bars and individual units shall be made using vertical / horizontal aluminum bus bars of adequate rating.

7.4 POWER FACTOR IMPROVEMENT CAPACITOR PANEL

- i). Power Factor Improvement Capacitor Panel shall comprise of 433 volts, 3 phase, 50 Hz capacitor banks and associated switchgears.
- ii). Capacitors shall conform to IS: 13341-1992, 13340-1993. The capacitors shall be suitable for 433/440 volts, 3 phase, 50 Hz. Capacitors shall be suitable for indoor use up to ambient temperature of 50°C.
- iii). Capacitors shall be hermetically sealed in sturdy corrosion proof, sheet steel containers and impregnated with non-inflammable synthetic liquid. The capacitors shall withstand voltage of 2500V (power frequency test voltage). The insulation resistance shall not be less than 50 megaohm when tested with 500V megger.
- iv). Main connections from the active element shall be brought out through porcelain bushing. Care shall be taken to solder the bushing to the cover to ensure perfect hermetic sealing. Capacitor units shall be provided with externally mounted discharge resistors to reduce the residual voltage to less than 50 volts in one minute of switching off.
- v). Individual unit shall be provided with adequate capacity of MCCBs, contactors (capacitor duty) bus bars and terminal chambers to make bank of required KVAR. Terminal chamber shall be suitable for bottom/top cable entry. Two earth terminals shall be provided to each capacitor bank.
- vi). All routine and type tests as per IS: 2834 relevant to capacitor banks as amended up to date shall be carried out at manufacturer's works and test certificates shall be furnished to the department.
- vii). Capacitor banks shall be installed at least 30CM away from the walls on suitable metal frame work of welded construction. The earth terminals provided on the body of capacitor bank shall be bonded to the main capacitor panel earth bus with 2 Nos. 8 SWG copper or 6 SWG GI earth wires.
- viii). Insulation resistance with 500V DC Megger shall be carried out test results recorded.
- ix). APFC relay shall be Micro-controller based intelligent with inbuilt harmonic filters to Work under high harmonic content loads with of 8 stages. Relay shall be True RMS

relay, Compact panel mounting type 144 X 144 mm DIN en-closure. Relay shall have built-in digital PF meter.

Technical Features:

1. A micro controller & RISC processor.
2. Intelligent switching operation, fast response, high break relays
3. Polarity reversal indication.
4. Phase wise dynamically reactive compensation.
5. Operating power factor 0.6 – 0.99Lag

TECHNICAL SPECIFICATIONS

SECTION-II

CABLES (XLPE)

1.0 11 KV. CABLES (XLPE):

- 1.1 11 KV Cables shall be aluminum conductor of cross-linked, polyethylene insulated, steel armoured construction. The conductor shall be made from electrical purity aluminum of $\frac{3}{4}$ H or H temper conforming to IS: 8130. The conductor shall be sector shaped standard conductors. The cable shall conform to IS: 7098-1985 (Part-II) lay in trench.
- 1.2 The cable shall be 11 KV rated and 3 core, 185-sq. mm. Armoured, Al. conductor, XLPE insulated.
- 1.3 The conductor shall be screwed by employing a semi-conductor extrusion over the conductor. XLPE insulation of high quality shall be extruded on the conductor with screen. A Layer of semi conducting material shall be applied over the XLPE insulation to prevent partial discharge at the surface of the insulation. This shall be followed by a metallic aluminum tape screen. The core shall be discharge tested. The built core shall then be laid up and filler core added. The combined core shall be provided with HR PVC sheathing by extrusion. The cable is then armoured with galvanized steel wires or strips & finally sheathed overall with special heat resistant PVC.
- 1.4 The cores shall be identified by the numbers 1, 2 & 3 printed on the insulation.
- 1.5 The current rating is worked out based on the following conditions: -
 - (a) Max. Conductor temperature. : 90⁰C
 - (b) Ambient air temperature : 40⁰C
 - (c) Ground temperature :30⁰C
 - (d) Depth of Laying : 90cm.in the built-up trenches.
- 1.6 Short circuit rating for the cables shall be as per IS 7098-1985 (Part-II) laid in trenches. Max. Permissible short circuit temperature shall be 250⁰C.
- 1.7 The Cables have been selected considering the following: -
 - a). Max. connected load
 - b). Ambient temperature
 - c). Grouping of cables
 - d). Short circuit levels
- 1.8 H.T. cables shall be laid in trenches/trays/ducts unless otherwise specified. Generally, laying, jointing and commissioning shall be as per the regulations of local authorities.
- 1.9 On receipt of H.T. cables at site, cables shall be inspected to detect any damage during transit. The ends of the cables shall be in sealed condition. After inspection cables, shall be stored in a proper place with battens of cable drums being replaced. The cable drums shall not be stored 'ON FLAT' with flanges horizontal.
- 1.10 Cables shall be laid by skilled workers only in the built-up trenches/trays.
- 1.11 Cable jointing shall be made as per the instructions of the cable manufacturer. Cable jointing shall be heat shrinkable type and shall be carried out by highly professional and qualified/experienced HT jointers only. A copy of manufacturers recommendations shall be submitted to IUAC for approval and jointing shall not be done without prior approval of IUAC. XLPE cables shall be terminated in to HT switchgear by using RAYCHEM/PUSHON cable jointing kits.
- 1.12 TESTING:
 1. Insulation.
 2. H.T. cable shall be pressure tested to withstand a voltage of 15 KV for 15 minute after

the jointing is completed. However the test voltage and duration of the test shall be in conformity with the local standard. Before carrying out DC high voltage test, the cable shall be laid in its final positions with all the end terminations left unfinished so the substation equipments are not subjected to the test pressure.

1.2 LT. CABLES (XLPE) & WIRES:

1.2.0 CABLES: All cables shall be 3.5core, 240sq.mm. Al. Conductor, armoured, XLPE insulated and rated for 1.1kV grade as per IS 7098 (part-1) 1998.

1.2.1 WIRES: single core flexible cables generally conforming to IS 694: 1990 voltage grade up to 1100 volts size 120 sq.mm. (608/0.5). Shall be manufactured from bright-annealed 99.97% pure bare copper conductors. These cables shall have low conductor resistance. These wires are shall be insulated with a special grade PVC compound formulated and manufactured and shall be impervious to water, oil, grease, acids, etc. and are tough to protect from any mechanical abuses.

1.3.0 EARTHING:

1.3.1. All non-current carrying metal parts of the electrical installation shall be earthed as per IS: 3043. All metal enclosures, cable armour, switch gears; meters etc. shall be bonded together by two separate and distinct conductors to earth electrodes/grid. Earthing shall also be in conformity with the provisions of rules 32,61,62,67 and 88 of IER 1956. These specifications apply to both copper and GI earthing system. All non-current carrying metal parts of the electrical installation shall be earthed as per IS: 3043. The Backfill having not more than 0.20 Ohm/cm resistance, ecofriendly, non-degradable and non-soluble. The earthing pit shall be designed and supplied with Poly-plastic Pit Cover nonconductive, environment friendly and test terminal.

1.3.2. Chemical earthing: Earth electrodes shall be of copper chemical earthing type. The electrode shall be copper/GI made of at least 70 mm dia, 3000 mm long suitable for latest chemical earthing & designed as per requirements of clause 17.2 of IS: 3043-1987. The electrode shall be electrolytic grade copper rod pre-filled with hygroscopic filling compound. The back-fill compound shall be capable of absorbing & retaining moisture for a long period. It shall reduce the soil resistivity. At least 50 kg back fill compound shall be used with each earth pit. Suitable concrete work and CI cover shall be provided as per IS standards. The type of earth electrode material and size to be used for earth electrodes and conductor is described and scheduled in BOQ.

1.3.3. Testing: On completion of the entire installation these tests shall be conducted
Earth resistance electrodes
Impedance of earth continuity
Effectiveness of earth as per E-4 & E-5 of IEE Regulation

1.4.0. CABLE TRAY:

Perforated Type Cable Tray:

Perforated type of Cable tray shall be with covers made out of hot dipped G.I. Sheet of suitable sizes as mentioned in the schedule. Tray shall be made out of 2.0 mm thick G.I. sheet and cover shall be made out of 1.6mm G.I. sheet. Tray sections shall be joined by using proper coupler plates and G.I. nuts and bolts. All accessories like tray bends, tee's, reducers etc. shall be pre-fabricated and galvanized.

1.4.1. SUPPORTS:

M.S. Supports:

The tray shall be mounted on proper supports made of angle iron of suitable section and welded to the existing structure. Wherever structure is not available necessary support will be fabricated and fixed to wall/roof using anchor bolts. All nuts, bolts, washers etc. used for fixing and joining of the cable tray shall also be of GI only. All welded supports shall be painted after proper cleaning, with 2 coats of enamel painting over 1 coat of primer.

1.4.2. SUB STATION FOUNDATION:

a). FOUNDATION FOR CSS

Scope involves Supply and erection of compact substation foundation with a static load of approximately 6-7 tons and as per the manufacturers drawing including supply of all the required construction material for execution of civil works for foundation 1600KVA capacity package, required cable trenches of depth minimum 1.2 mtr for LT and HT cables, provision of foundation bolts M12x13D, top of the plinth to a precise level (with max variation of 4mm), Provision of earthing terminals, and all other sundry materials required in completion whether it is part of schedule or not. Clear height of the foundation above ground level shall be decided later however it shall never be less than 450mm.

b). FOUNDATION FOR OUTDOOR LT PANEL WITH CAPACITOR

Scope involves Supply and erection of foundation with a static load of approximately 5 tons and as per the manufacturers drawing including supply of all the required construction material for execution of civil works for foundation, provision of foundation bolts M12x13D, top of the plinth to a precise level (with max variation of 4mm), Provision of earthing terminals, and all other sundry materials required in completion whether it is part of schedule or not. Clear height of the foundation above ground level shall be decided later.

1.4.3. MASONARY TRENCHES:

- a). Excavation of the cable trenches in hard rock not exceeding 1.5 meter in width, and lift upto 1.5 meter, including getting out the excavated soil and disposal of excavated soil as directed within a lead of 50 meter.
- b). Providing brick work (in width 225 mm or more) with F.P.S. bricks of class designation 7.5 in cement mortar 1:4 (1 cement : 4 coarse sand) at all levels.
- c). Providing 15 mm thick cement plaster of mix 1:4 (1 cement : 4 fine sand) at all levels.

1.4.4. SAFETY REQUIREMENTS

SCORE

This section covers the requirements of items to be provided in the sub-station for compliance with statutory regulations. Safety and operational needs.

REQUIREMENTS

Safety provisions shall be generally in conformity with appendices (A) and (C) of CPWD General Specifications of Electric Works (Par I Internal) 2013. In particular, following items shall be provided:

(a) Insulation mats

Insulation mats conforming to IS: 15652-2006 shall be provided in front of main switch boards as well as other control equipments as specified.

(b) First Aid Charts and First Aid Box

Charts (one in English, one in Hindi, one in Regional language), displaying methods of giving artificial respiration to a recipient of electrical shock shall be prominently provided at appropriate place. Standard first aid boxes containing materials as prescribed by St. John Ambulance brigade or Indian Red Cross should be provided in each sub-station.

(c) Danger Plate

Danger Plates shall be provided on HV and MV equipments. MV danger notice plate shall be 200 mm x 150 mm made of mild steel at least 2mm thick vitreous enameled white on both sides and with the descriptions in signal red colour on front side as required. Notice plates of other suitable materials such as stainless steel, brass or such other permanent nature material shall also be accepted with the description engraved in signal red colour.

(d) Fire Extinguishers

Portable Co₂ conforming to IS: 2878-1976/ chemical conforming to IS: 2171-1976 extinguishers, HCFC Blend A (P-IV) shall be installed in the sub-station at suitable places. Other extinguishers recommended for electric fires may also be used.

(e) Fire Buckets

Fire buckets conforming to IS: 2546-1974 shall be installed with the suitable stand for storage of water and sand.

(f) Tool Box

A Standard tool box containing

TECHNICAL SPECIFICATIONS

SECTION-III

DATA SHEETS

1.0 Technical Particulars of transformer Oil

Sr No	Item description	Specification requirement
2.1	Appearance of oil	Clear, transparent and free from suspended matter or sediments
2.2	Density at 29.5°C Max.	0.89 g/cm ³
2.3	Kinematics viscosity Max.	16 cSt at 27°C 11 cSt at 40°C
2.4	Interfacial tension at 27°C	0.04 N/m min
2.5	Flash point Pensky-Marten (Closed), Min.	140°C
2.6	Pour Point, Max	- 15°C
2.7	Neutralization value	
	i) Total acidity, Max.	0.03 mg KOH/g
	ii) Inorganic acidity/ Alkalinity	Nil
2.8	Corrosive sulfur	Non-corrosive
2.9	Electric strength breakdown voltage	Average value of six samples
	i) New unfiltered oil. Min.	30 kV (rms) min.
	ii) After filtration Min.	60 kV (rms)
2.10	Dielectric dissipation factor (tan δ).	0.002 at 90°C, Max 0.0005 at 27°C, Max
2.11	Specific resistance	(resistivity)
	i) At 90°C, Min	150 X 10 ¹² ohm-cm
	ii) At 27°C, Min	3000 X 10 ¹² ohm-cm
2.12	Oxidation stability	
	i) Neutralization value after oxidation, Max.	0.15 mg KOH/g
	ii) Total sludge, after oxidation, Max.	0.03 % by weight
	iii) Max Tan delta	0.1 at 70°C
2.13	Ageing characteristics after accelerated ageing	(open breaker method with copper catalyst)
	i) Specific resistance (resistivity)	
	a) At 27°C Min.	27 X 10 ¹² ohm-cm
	b) At 90°C Min	2 X 10 ¹² ohm-cm
	ii) Dielectric dissipation factor (tan δ)	0.10 at 90°C Max
	iii) Total acidity, Max	0.05 mg KOH/g
	iv) Total sludge, Max	0.05 % by weight
2.14	Presence of oxidation inhibitor	no antioxidant additives
2.15	Water content, Max	40 ppm
2.16	List of clients	To be enclosed
2.17	PCA content	3% max
2.18	PCB content	Not detectable

**2.0 OUT DOOR L.T. PANEL WITH CAPACITOR PANEL:
RATINGS (GUARANTEED TECHNICAL PARTICULARS)**

- 2.1 Declared voltage:** – 3 Phase, 400V±10% at 50 Hz,
- 2.2 Neutral:** – Solidly earthed at substation.
- 2.3 General finish:** - Tropical, totally enclosed, metal-clad, weather-proof, vermin and dust proof.
- 2.4 Construction: Enclosure:** - Dead Front type of enclosure shall be able to provide the degree of Protection **IP: 54.**
- 2.5 Circuit Ways:**

Incomer:

2500 A, 4pole, 433V, 50Hz, 50KA, EDO type ACB with Microprocessor based O/L, S/C, E/F release. Rated Insulation Voltage $U_i = 1000V$, Utilization category = B

Qty: 2 sets

Digital Multifunction Meter with A, V, KW, KWH, PF, CI-0.5 with Port (Conzerv-EM 6400) – 2 Nos. LT Metering CT's – 3 Nos, 2500/5A, Cast Resin Type, CI - 0.5, R, Y, B, ON, OFF LED Indicating Lamps - 5 Nos. Control MCB, 6A, SP – As required

Outgoing:

i). 1250 A, 4Pole, 433V, 4pole, 50Hz, 50KA, EDO type ACB with **Microprocessor based O/L, S/C & E/F release.** Rated Insulation Voltage $U_i = 1000V$, Utilization category = B LT Switchgear should be suitable for termination of 3run X 3 ½ C X 240 Sq.mm aluminum armored Cable. R, Y, B, ON, OFF LED Indicating Lamps - 5 Nos. Control MCB, 6A, SP - As required. **Qty: 2sets**

ii). 630 A, 433V, 4pole, 50Hz, 36KA, EDO type ACB with **Microprocessor based O/L, S/C & E/F release.** Rated Insulation Voltage $U_i = 1000V$, Utilization category = B LT Switchgear should be suitable for termination of 2runs X 3 ½ C X 240 Sq.mm aluminum armored Cable. R, Y, B, ON, OFF LED Indicating Lamps - 5 Nos. Control MCB, 6A, SP - As required **Qty: 4sets**

3.0 TYPE TESTS FOR THE PACKAGE SUBSTATION COMPLETELY ASSEMBLED:

3.1 Type Test: The Package Substations offered must be type tested as per IEC 61330. The copy of type test summary should be submitted along with the tender.

3.2 Routine Tests:

The sequence of routine testing shall be as follows:

- i). Visual and dimension check for completely assembled transformer Measurements of voltage ratio Measurements of winding resistance at principal tap and two extreme taps
- ii). Vector Group and polarity test
- iii). Measurements of insulation resistance*
- iv). Separate sources voltage withstand test.
- v). Measurement of iron losses and exciting current at rated frequency and 90%, 100% and

110% rated voltage

- vi). Induced voltage withstand test.
- vii). Load losses measurement at 50 % & 100 % of load.
- viii). Impedance measurement of principal tap (HV and LV) of the transformer.
- ix). Routine test of tanks
- x). Induced voltage withstand test (to be repeated if type tests are conducted).
- xi). Measurement of Iron loss (to be repeated if type test is conducted).
- xii). Measurement of capacitance and Tan Delta for Tr. winding and for transformer oil.
- xiii). Ratio of CT
- xiv). Oil leakage test on completely assembled transformer
- xv). Magnetic balance test
- xvi). Power frequency voltage withstand test on all auxiliary circuits
- xvii). Certification of all test results.
- xviii). Temperature Rise Test #
- xix). Dissolved gas analysis
- xx). Calibration of temperature indicators and relays.

a) *Insulation resistance measurement shall be carried out at 5kV for HV and 1kV for LV. Value of IR should not be less than 1000 M Ohms. Polarization Index (PI = IR_{10min}/IR_{1min}) should not be less than 1.5 (If one minute IR value is above 5000Mohms and it is not being possible to obtain an accurate 10 minutes reading, in such cases polarization index can be disregarded as a measure of winding condition.)

b) #Temperature rise test may be necessary to be carried one unit/lot. Purchaser's engineer, will at its discretion, select transformer for temp. rise test from any lot offered for inspection at manufacturer's works and witness the same for comparison with ERDA/CPRI type test results

Test Witness: Routine test as per relevant IEC/IS standards shall be performed in presence of Owner's representative for which the Contractor shall give at least fifteen (15) days advance notice of the date when the tests are to be carried out.

Test Certificates:

Certified reports of all the tests carried out at the works shall be furnished in three (3) copies for the Owner.

Annexure-I

Submittals required with bid:

- i). Certificate/ Undertaking for the site visit as per annexure-A
- ii). Completed technical data schedule
- iii). Descriptive literature giving full technical details of equipment offered;
- iv). Outline dimension drawing for each major component, general arrangement drawing showing component layout and general schematic diagrams;
- v). Guaranteed Technical Particulars
- vi). CPRI Type test certificates be enclosed for all type tests applicable as per I.S./ IEC 61330.
- vii). Detailed reference list of customers already using equipment offered during the last 5 years with particular emphasis on units of similar design and rating;
- viii). Deviations from this specification. Only deviations approved in writing before award of contract shall be accepted;
- ix). Recommended spare parts and consumable items for five years of operation with prices and spare parts catalogue with price list for future requirements

Annexure-II

Submittals required after award for Approval and subsequent distribution

- 1). Programme for production and testing
- 11). Construction drawing for foundation for the compact sub station
- 111). General arrangement drawing for the compact substation and its components
-RMU, LT panel, Transformer and Capacitor panel.
- 1111). Single line diagrams for RMU, LT panel and Capacitor panel.
- 11111). Control Schematics for- RMU isolators and vacuum circuit breakers, LT EDO Air circuit breakers and Capacitor panel.
- 111111). BOM for RMU, LT panel, Transformer and Capacitor panel.
- 1111111). Transport / shipping dimensions with weights, wheel base details, untanking height etc.
- 11111111). Terminal arrangements and cable box details (A)
- 111111111). List of makes of all fittings and accessories (A)

Annexure-III

Submittals required point prior to dispatch

- i). Inspection and test reports carried out in manufacturer's works
- ii). Test certificates of all bought out items
- iii). Operation and maintenance Instruction as well as trouble shooting charts/ manual

Annexure-IV
CODES & STANDARDS

INDIAN STANDARDS

I: ELECTRO –TECHNICAL VOCABULARY:

IS: 1885 (Part-I) 1961	Fundamental definition
IS: 1885 (Part-VIII) 1986	Secondary cells and batteries (Superseding IS: 1147-1957)
IS: 1885 (Part-X) 1993	Electrical power system protection
IS: 1885 (Part-XI) 1966	Electrical Measurement
IS: 1885 (Part-XVII) 1979	Switchgear and control gear (First revision)
IS: 1885 (Part-XXX) 1971	Overhead transmission and distribution of electrical energy
IS: 1885 (Part-XXXII) 1993	Cables, conductor and accessories for Electrical supply (Superseding IS: 1591-1960)
IS: 1885 (Part-XXXVIII) 1993	Transformers (First revision)

II: GRAPHICAL SYMBOLS USED IN ELECTRO TECHNOLOGY:

IS: 8270 (Part-I) 1976	Guide for preparation of diagrams, charts & tables for electro technology. Definitions and Classification (Superseding
IS: 2032 (Part-I) 1962	Item designation
IS: 8270 (Part-II) 1976	General requirements for diagrams
IS: 8270 (Part-III) 1977	Circuit diagrams
IS: 8270 (Part-IV) 1977	Inter connection diagrams and table
IS: 8270 (Part-V) 1976	

III: CONDUCTOR AND POWER CABLES:

IS: 694/1990	PVC insulated cable for working voltages up to and including 1100 volts (Second revision) (Superseding IS: 3035 Part I 1965)
IS:1554 (Part-I)/ 1988	PVC insulate (Heavy duty) working dielectric cables for voltage up to & i/c. 1100 volts (Second revision)
IS: 1554 (Part II)/1988	For working voltage from 3.3 KV up to and including 11KV
IS:3961 (Part I) 1967	Recommended current ratings for cables: Paper insulated lead sheathed cables.
IS: 3961 (Part II) 1967	PVC insulated and PVC sheathed heavy duty cables.
IS: 15086 (Part-5).	Application guide for nonlinear resistor type Surge arrester for alternating current system (First revision)
IS: 5819-1970	Recommended short circuit ratings of high voltage PVC cable
IS: 8130/1984	Conductors for insulated electric cables and flexible cords.
IS: 8623 Part I & II/ 1993	Bus bar trunking system (Air insulated &, sandwich insulated type) IS: IEC 60439-Part I & II
IS 7098-2 (2011):	Crosslinked Polyethylene Insulated Thermoplastics Sheathed Cables

IV: LEECTRICAL INSTALLATION CODE OF PRACTICES:

IS: 10028 (Part-II & III):	Installation and maintenance of transformers
IS: 1866/2000	Insulation oil in service, maintenance and supervision code of practice
IS: IS:3043/1987	Earthing
IS: 13234	Guide for short circuit calculations
IS: 732/1989	Electrical wiring installation (system voltage not exceeding 650 volts)
IS: 1255/1983	Paper insulated power cables (Up to and including 33KV (first revision)

V: SWITHC GEAR AND CONTROL GEAR:

IS: 13947 (Part-I)	Degree of protection provided by the (enclosure for Medium Voltage switchgear and control gear)
IS: 9224 (Part-II)	HRC cartridge fuse links up to 650 volts.
IS:13947 (Part -II)	Circuit breaker AC requirements & tests for voltages not exceeding 1000 Volts AC or 1200 volts DC
IS: 13118-1991	General and definition. Section 2- Voltages above 1000 volt AC.
IS: 13118-1991	Type tests & Routine test for voltage above 1000 Volt AC.
IS: 4064	Heavy duty air break switches and composite units of air break switches & fuses for voltages not exceeding 1000 volts.
IS: 13947 (Part-I)	General requirements for switch gear, control gear for voltage not exceeding 1000 volts.
IS:1000 V AC or 8623/1993	Factory built assemblies of switch gear and control gear for voltages up to & including 1200 V DC.
IS: 8623 (Part II)/1993	Particular requirements for bus bar trunking system (Bus ways)
IS: 13118-1991	High Voltage alternating current circuit breakers IEC: 60056 63
IS: 9920-2002	High Voltage Switches –Part I: Switches for Rated Voltages Above 1 Kv and Less Than 52Kv
IS: 3427-1997	A.C Metal Enclosed Switchgear and Control gear for Rated Voltages Above 1 Kv and UP to and Including 52 Kv
IS: 1248	Electrical Measuring Instruments and their Accessories

VI: TRANSFORMERS AND REACTORS:

IS: 11171-1985	Dry type power transformer Power transformer
IS:2026 (Part-I) – 1977:	General
IS: 2026 (Part-II)-1977:	Temperature rise
IS: 2026 (Part-III)/1981	Insulation level and di-electric tests
IS: 1180	Distribution transformers
IS: 3637/1966	Gas operated relays
IS: 3639/1966	Power transformers fittings and accessories
IS: 6600/1972	Guide for loading of oil immersed transformers
Part I to III IS: 2705/1992	Current transformers
Part I to III IS: 3156/1992	Voltage transformers
IS: 2099/1986:	Outdoor type three- phase distribution transformers 64

VII: CHEMEICALS:

IS: 5/1994:	Colours for ready mixed paints and enamels (Third revision)
IS: 104/1979:	Ready mixed paint brushing zinc chrome priming (IInd revision)
IS: 2932/2003 :	Enamel, synthetic exterior (a) under coating (b) finishing (Ist revision)

VIII : INSULATING LIQUIDS :

IS: 6103/1971 :	Specific resistance (resistivity) or electrical insulating liquids, methods of tests for
IS: 6792/1992 :	Electric strength of insulating oils, methods for determination of
IS: 335/1993:	New insulation oils for transformers and switchgears (2nd revision)
IS: 15625/2006:	Insulating Mats

IX: SAFETY EQUIPMENTS:

IS: 2878/1976:	CO2 based Fire Extinguisher
IS: 2171/1976:	Chemical based Fire Extinguishers
IS: 15505-2004: HCFC Blend-	A Extinguishing System
IS: 15625-2006:	Insulating Mats

IEC Standards

IEC 60071	Co-ordination of Insulation.
IEC 60076	Power transformers.
IEC 60044	Current Transformers.
IEC 60214	On Load Tap Changers
IEC 60354	Loading Guide for Oil-Immersed Power Transformers.
IEC 60296	Specification for Unused Mineral Insulating Oils for Transformers
IEC 60156	Method for Determination of the Electric Strength for Insulating Oils.
IEC 60445	Basic& Safety principles for man-machine interface, marking and identification, Identification of Equipment Terminals and conductor terminals
IEC 60529	Degrees of Protection Provided by Enclosures (IP Code).
IEC 60551	Determination of Transformer and Reactor Sound Levels.
IEC 60606	Application Guide for Power Transformers.
IEC 60616	Terminal and Tapping Markings for Power Transformers.
IEC 60947	Low-Voltage Switchgear and Control gear.
IEC 60947	Bushing for alternating voltage above 1000V

British Standard

BS 148	Determination of Transformer and Reactor Sound Levels.
BS 223	Application Guide for Power Transformers.
BS 2562	Terminal and Tapping Markings for Power Transformers.

Indian Electricity Rules

Indian Electricity Act

CBIP manual

In the event of direct conflict between various order documents, the precedence of authority of

documents shall be as follows -

- i. Guaranteed Technical Particulars (GTP)
- ii. This Specification
- iii. Indian Standards / IEC standards
- iv. Approved Vendor Drawings
- iv. Other documents

ANNEXURE- V

Confirmation/deviation (by Tenderer)

Name of the work : Supply, Installation, Testing And Commissioning of 1600 KVA, 11KV/433V, Compact Substation

Specification and Scope of supply:

Design, manufacture and SITC of Compact Substation of 11KV/415 Volts, equipped with 1600 kVA Cast Resin Transformer, 4 way 11kV Ring Main Unit consisting of 1 no. 630A at 11kV fault making load breaking switch with 3nos. tee-off as **SF6 insulated Vacuum Circuit Breaker** & with 2500A Air Circuit Breaker as secondary side control as detailed below. The detail bill of material for each Compact Substation shall be as under:

S.No	Description	Specification / Confirmation	Deviation
1.0	HT Switchgear: (Inside CSS) Four way 11KV Non-Extensible Ring Main Unit Compact switchgear consisting of 630 A one number fixed manual fault making / Load break Switches & three numbers Fixed manual SF6 insulated vacuum circuit breakers. SF6 insulated Vacuum circuit breakers with self- powered relay having Transformer protection, over current and earth fault protection. I/c Interconnection between RMU and transformer using suitable Aluminum unarmored XLPE single core cables. I/c Interconnection between transformer and LT switchgear shall be using suitable copper Qty: 1 set	Vendor to confirm	
1.1	Make of HT switchgear: Siemens / Schneider / ABB/ C&S/L&T make	Vendor to specify	
1.2	Make of relay to be used with VCB: Ashida / ABB / Areva / Siemens / Schneider make only.	Vendor to specify	
2.0	Transformer: (Inside CSS) 1600 KVA, 11KV / 433, DYn11, Oil Natural Air Natural Cooling Type Transformer with off circuit tap links 5% to -5% @ 2.5% on HT side of transformer with WTI and OTI Scanner (make: PECON Electronics model TR 7570) with Alarm and trip contact. Qty: 1 no	Vendor to confirm	
2.1	Make of the transformer. Siemens / Schneider / ABB/ C&S/L&T make or OEM approved make only.	Vendor to specify the make offered	
2.2	Impedance, no-load/ load losses, efficiency, temperature rise above ambient of winding of the transformer.	Vendor to specify	
3.0	LV Switchgear: 2500 A, 4pole, 433V, 50Hz, 50KA, fixed type with manually operated (MFO type) mechanism ACB with Microprocessor based O/L, S/C, E/F release. Rated Insulation Voltage $U_i = 1000V$, Utilization category = B Qty: 1No.	Vendor to specify	
3.0	LV Switchgear: (Outdoor separate standalone OUT DOOR L.T. PANEL WITH CAPACITOR PANEL: -IP 54)) 433V Outdoor LV panel with Aluminum Bus bars, fabricated using CRCA Sheet steel, Ingress Protection IP54, Compartmentalized complete with internal wiring consisting of following. Incomer: 2500 A, 4pole, 433V, 3P, 50Hz, 50KA, EDO	Vendor to confirm	

	type ACB with Microprocessor based O/L, S/C, E/F release. Rated Insulation Voltage $U_i = 1000V$, Utilization category = B Qty: 2 sets		
3.1	Make of the ACB - Siemens-3WT /ABB/ Schneider/C&S/L&T make only.	Vendor to confirm and specify make offered	
3.2	LV Switchgear: Metering (for Incomers) Digital Multifunction Meter with A, V, KW, KWH, PF, CI-0.5 with Port (Conzerv-EM 6400) – 2 Nos. LT Metering CT's – 3 Nos, 2500/5A, Cast Resin Type, CI - 0.5, R, Y, B, ON, OFF LED Indicating Lamps - 5 Nos. (Make- Technic/Vaishno/STS/Rep.) Control MCB, 6A, SP – As required (from approved makes)	Vendor to confirm	
3.3	LV Switchgear: Outgoing 1250 A , 4pole ,433V, 50Hz, 50KA, EDO type ACB with Microprocessor based O/L, S/C & E/F release . Rated Insulation Voltage $U_i = 1000V$, Utilization category = B LT Switchgear should be suitable for termination of 3run X 3 ½ C X 240 Sq.mm aluminum armored Cable. R, Y, B, ON, OFF LED Indicating Lamps - 5 Nos. (Make-Vaishno/STS/Rep.) Control MCB, 6A, SP - As required. (from approved makes) Qty: 2 sets 630 A , 4pole ,433V, 50Hz, 36KA, EDO type ACB with Microprocessor based O/L, S/C & E/F release . Rated Insulation Voltage $U_i = 1000V$, Utilization category = B LT Switchgear should be suitable for termination of 2run X 3 ½ C X 240 Sq.mm aluminum armored Cable. R, Y, B, ON, OFF LED Indicating Lamps - 5 Nos. (Make-Vaishno/STS/Rep.) Control MCB, 6A, SP - As required. (from approved makes) Qty: 4 sets.	Vendor to confirm	
3.4	Make of the ACB - Siemens /ABB/ Schneider/C&S/L&T make only.	Vendor to confirm and specify make offered	
3.5	600KVAR APFC Panel Timer- 1no. (GIC/Selectron Make) Control MCB, 6A, SP - As required 63A TP MCB(10KA)-4 Nos.(Make-MDS/L&T/GE/ABB) 25KVAR Capacitor Duty Contactor-4 Nos. (L&T/ABB/GE) 415/440V MPP Normal Duty Capacitor-4 Nos. (Make-Epcos/Neptune/Matrix) 125A TP MCCB(35KA) with Thermal Magnetic Release-10 Nos. (Make-MDS/L&T/GE) 50KVAR Capacitor Duty Contactor-10 Nos. (L&T/ABB/GE) 50KVAR,415/440V MPP Normal Duty Capacitor-10 Nos. (Make as per approved list) Control MCB, 6A, SP-As required. (Make as per approved list)	Vendor to confirm and specify make offered	
4.0	Enclosure for compact substation:	Vendor to specify	

	Outdoor type enclosure having modular construction of Galvanized Sheet Steel. The degree of protection for HT & LT switchgear compartment shall be IP54 & degree of protection of transformer compartment of the enclosure shall be minimum IP23. The enclosure exterior shall be painted with polyurethane paint / powder coated and tropicalized to Indian weather conditions. Each compartment will be provided with the door and pad locking arrangement. The Compartment illumination lamp with door-operated switch shall be provided for each compartment. Structure of the substation shall be able to withstand the gross weight of all equipment. It should be possible to transport the equipment along with transformer, RMU & LT Panel from one site to another. Qty: 1 set	the actual degree of protection.	
5.0	Interconnection between HT switchgear & Transformer using XLPE cable & Interconnection between Transformer & LT switchgear using Aluminum bus bars. Internal earthing connections by GI strips. Qty: 1 set	Vendor to confirm	
5.1	Dimension of the compact substation (approx.)	Vendor to specify	
6.0	1. Package Sub-Station shall be outdoor mounted on an elevated foundation type. 2. Erection, Commissioning and Civil work for package substation is in the scope of tenderer. However, the tenderer shall furnish the foundation details. 3. Package sub-station will be complete with the internal Interconnections & Earthing (GI) and extending of earth bar of Neutral and body terminals to the frame of the CSS for connecting to the earth pits. 4. Vendor/OEM shall assemble the Compact substation at factory and no assembly of the same shall be allowed at site. 5. Vendor/OEM shall be responsible for supervision at site free of cost during the time of Installation & commissioning CSS. 6. Required technical data sheet of the transformer, HV/ MV switchgear, relay etc. should be furnished with the offer. 7. Color of paint to be mentioned in the offer and to be decided mutually. 8. The equipments should be SCADA compatible in future by providing motor in future. 9. Vendor shall supply suitable & required no. of HT & LT Cable termination kits along with CSS for HT & LT Cable terminations.	Vendor to confirm	
7.0	Pre-Dispatch Inspection: Vendor/OEM shall offer for pre-dispatch inspection at OEM's works. Only after the equipments are cleared by IUAC in writing, the vendor/OEM can dispatch the equipment. Routine tests to be conducted and original test certificates to be submitted at the time of PDI.	Vendor to confirm	
8.0	Pre- Qualification Requirements		
8.1	Refer clause 2(vi) of general terms and conditions at page-3	Vendor to confirm & provide documentary evidence	
8.2	All the pre-qualification requirements should be supported by documentary evidence failing which the bids will be out rightly rejected.	Vendor to confirm	
9.0	Training		

9.1	Two IUAC persons shall be trained at OEM's principles in the area of design, maintenance, and operation of Compact Substation for a period of 10 working days.	Vendor to confirm	
9.1	Air-fare, boarding & lodging for the trainees shall borne by IUAC.	Vendor to confirm	
9.2	Competent, English speaking experts shall be arranged by the vendor/OEM for satisfactory & effective training of IUAC personnel.	Vendor to confirm	
11.0	Commissioning Spares		
11.1	The following additional commissioning spares required - Digital Multifunction Meter - 1 Nos, Indication lamps-3 Nos, Protection relay – 1 No., Spring Charging handles-2 Nos and Panel Keys – 2 Nos.	Vendor to confirm	
12.0	Documentation		
12.1	Certified reports of all the tests carried out at the works shall be furnished in three (3) copies	Vendor to confirm	
12.2	Approved Drawings of CSS during pre-dispatch inspection furnished in three (3) copies shall be	Vendor to confirm	
12.3	O&M Manuals of CSS during pre-dispatch inspection shall be furnished in three (3) copies	Vendor to confirm	
13.0	Guarantee		
13.1	As per commercial terms and conditions	Vendor to confirm	
	Tenderer is required to select one or more of the make of items mentioned under S.No. 1.1, 1.2, 1.3, 2.1, 3.1, 3.2, 3.3, 4.0, 4.1, 4.2 & 4.3 In case the Tenderer is offering a make other than those indicated, the offer is liable for rejection.	Vendor to confirm	

Signature & Seal of Tenderer

ANNEXURE- VI

Guaranteed Technical Particulars (Data by Tenderer)

Name of the work : Supply, Installation, Testing and Commissioning of 1600 KVA, 11KV/433V, Compact Substation

Sr.No.	Item description	Data to be filled by Tenderer
	RING MAIN UNIT	
1	Switchgear Data	
	1.1 Service	
	1.2 Type	
	1.3 Number of phases	
	1.4 Voltage	
	1.5 Rated Frequency	
	1.6 Rated Current	
	1.7 Short duration power freq.	
	1.8 Insulation Level	
	1.9 System earthing	
	1.10 Short Circuit rating	
	i) Breaking	
	ii) Short time withstand for 3 Sec.	
	iii) Rated S/c making	
2	VC Breaker	
	2.1 Type	
	2.2 Rated voltage	
	2.3 Breaking current	
	2.4 Load breaking	
	2.5 Making current	
	2.6 Rated current	
	2.7 No. of poles	
	2.8 Operating mechanism.	
3	Isolators	
	3.1 Type	
	3.2 Rated current	
	3.3 Rated breaking capacity	
	3.4 Fault making capacity	
	3.5 No. of poles	
	3.6 Operating mechanism	
4	Bus bars: (If any)	
	4.1 Material	
	4.2 Type	
	4.3 Rated Current	
	4.4 Short time rating for 3 Sec.	
5	TRANSFORMER	
	5.1 Service	
	5.2 Type	
	5.3 Cooling system	
	5.4 No. of Phases	
	5.5 No. of winding per phase	
	5.6 Rated output (kVA)	
	5.7 With ONAN cooling	
	5.8 Rated voltage in KV (Line to Line)	
	5.9 Rated frequency	
	5.10 Temperature rise above 50°C	
	5.11 In winding by resistance	
	5.12 In oil by Thermometer	
	5.13 Guaranteed losses at 75°C and at normal tap position without any positive tolerance	

	5.14	No Load loss (W)	
	5.15	Full Load loss (W)	
	5.16	Total loss (W)	
	5.17	Insulation level	
	5.18	H.V. Power Freq. KV rms	
	5.19	H.V. (kVpeak) Impulse	
	5.20	L.V. (kV)	
	5.21	Vector Group	
	5.22	Parallel operation	
	5.23	Type of taps provided	
	5.24	Taps provided on	
	5.25	Range of taps	
	5.26	Method of Tap Change control	
	5.27	Manual load	
	5.28	Percentage impedance at 75 Deg. C	
	5.29	System earthing	
	5.30	H.V.	
	5.31	L.V.	
	5.32	Terminal arrangement	
	5.33	H.V.	
	5.34	L.V.	
	5.35	L.V. Neutral	
	5.36	Transformer-bushing voltage class	
	6.0.0	H.V. (kV)	
	5.37	b) L.V. (kV)	
	5.38	System fault level	
	5.39	H.V. side	
	5.40	L.V. side	
	5.41	Short circuit withstand capability duration	
	5.42	L.T. side C.T. ratings	
	5.43	Current Ratio	
	5.44	Class of Accuracy	
	5.45	Burden	
	5.46	Type	
	5.47	Temperature indicator/controller	
6	OUTDOOR LT PANEL		
6.1	7.1.1	Fabricator	
	7.1.2	Name	
	7.1.3	List of supplies during last 3years	
	7.1.4	Test certificate from CPRI Bangalore	
	7.1.5	Testing equipment available	Yes/no
6.2	Width and depth for compartments for ACB feeder MCCB feeder Metering compartment Bus chamber vertical/horizontal Cable alley		<hr/> <hr/> <hr/>
6.3	Bus bars		

	7.3.1 Material	
	7.3.2 Grade	
	7.3.3 Current density	
	7.3.4 Deviating factor	
	7.3.5 Whether insulated	
	7.3.6 Bus support material and thickness	
	7.3.7 Bus support intervals	
	7.3.8 Rated short circuit withstand	
	7.3.9 Bus bar size	
	7.3.10 Type of connection adopted	
	7.3.11 Clearance between phases, phase and neutral and phase & earth	
	7.3.12 Whether testing as per specs included	
6.4	ACB's	
	6.4.1 Make	
	6.4.2 Type	
	6.4.3 Standards applicable (ISS/IEC)	
	6.4.4 Rated current	
	6.4.5 Rated breaking capacity at 415 volts	
	6.4.6 Whether withdrawable carriage included	Yes/No
	6.4.7 Door interlocks provided	Yes/No
	6.4.8 De-interlocking for door provided	Yes/No
6.5	MCCB's	
	7.5.1 Make	
	7.5.2 Type	
	7.5.3 Standards applicable (ISS/IEC)	
	7.5.4 Rated current	
	7.5.5 Rated breaking capacity	
	7.5.6 Whether shunt/UV release included	Yes/No
6.6	Type of contacts	
	11.6.1 Material of casing	
	11.6.2 CT's	
	11.6.3 Make	

	11.6.4 Standards applicable (ISS/IEC)	
	11.6.5 Ratio	
	11.6.6 output	
	11.6.7 Class of accuracy	
7	APFC PANEL	
7.1	7.1.6 Fabricator	
	7.1.7 Name	
	7.1.8 List of supplies during last 3years	
	7.1.9 Test certificate from CPRI Bangalore	
	7.1.10 Testing equipment available	Yes/no
7.2	Width and depth for compartments for 63A MCCB Feeder with contactor 50KVAR capacitor feeder 25KVAR capacitor feeder Metering compartment Bus chamber vertical/horizontal Cable alley for incomer	
7.3	Bus bars	
	7.3.1 Material	
	7.3.2 Grade	
	7.3.3 Current density	
	7.3.4 Deviating factor	
	7.3.5 Whether insulated	
	7.3.6 Bus support material and thickness	
	7.3.7 Bus support intervals	
	7.3.8 Rated short circuit withstand	
	7.3.9 Bus bar size	
	7.3.10 Clearance between phases, phase and neutral and phase & earth	
	7.3.11 Whether testing as per specs included	
7.4	MCCB's	
	7.5.1 Make	
	7.5.2 Type	
	7.5.3 Standards applicable (ISS/IEC)	
	7.5.4 Rated current	
	7.5.5 Rated breaking capacity	

7.4	Capacitor duty contactors	
	7.5.6 Make	
	7.5.7 Type	
	7.5.8 Standards applicable (ISS/IEC)	
	7.5.9 Rated current	
	7.5.10 Rated breaking capacity	
7.4	Normal duty Capacitor	
	7.5.11 Make	
	7.5.12 Type	
	7.5.13 Standards applicable (ISS/IEC)	
	7.5.14 Rated current	
	7.5.15 Rated breaking capacity	
7.4	APFC RELAY	
	7.5.16 Make	
	7.5.17 Type	

Guaranteed Technical Particulars of Transformer Oil (Data by Tenderer)

Sr No	Item description	Specification requirement	Data by Vendor
1	Manufacturer Name		
1.1	Address		
1.2	Contact person		
1.3	Contact telephone no		
2	Appearance of oil	Clear, transparent and free from suspended matter or sediments	Yes / No
3	Density at 29.5°C Max.	0.89 g/cm ³	
4	Kinematics viscosity Max.	16 cSt at 27°C 11 cSt at 40°C	
5	Interfacial tension at 27°C	0.04 N/m min	
6	Flash point Pensky-Marten (Closed), Min.	140°C	
7	Pour Point, Max	- 15°C	
8	Neutralization value		
	i) Total acidity, Max.	0.03 mg KOH/g	
	ii) Inorganic acidity/ Alkalinity	Nil	
9	Corrosive sulfur	Non-corrosive	
10	Electric strength breakdown voltage	Average value of six samples	
	i) New unfiltered oil. Min.	30 kV (rms) min.	
	ii) After filtration Min.	60 kV (rms)	
11	Dielectric dissipation factor (tan δ).	0.002 at 90°C, Max 0.0005 at 27°C, Max	
12	Specific resistance	(resistivity)	

	i) At 90 ⁰ C, Min	150 X 10 ¹² ohm-cm	
	ii) At 27 ⁰ C, Min	3000 X 10 ¹² ohm-cm	
13	Oxidation stability		
	i) Neutralization value after oxidation, Max.	0.15 mg KOH/g	
	ii) Total sludge, after oxidation, Max.	0.03 % by weight	
	iii) Max Tan delta	0.1 at 70 ⁰ C	
14	Ageing characteristics after accelerated ageing	(open breaker method with copper catalyst)	
	i) Specific resistance (resistivity)		

Sr No	Item description	Specification requirement	Data by Vendor
	a) At 27 ⁰ C Min.	27 X 10 ¹² ohm-cm	
	b) At 90 ⁰ C Min	2 X 10 ¹² ohm-cm	
	ii) Dielectric dissipation factor (tan δ)	0.10 at 90 ⁰ C Max	
	iii) Total acidity, Max	0.05 mg KOH/g	
	iv) Total sludge, Max	0.05 % by weight	
15	Presence of oxidation inhibitor	no antioxidant additives	
16	Water content, Max	40 ppm	
17	List of clients	To be enclosed	
18	PCA content	3% max	
19	PCB content	Not detectable	

Signature & Seal of Tenderer

Annexure VII
Recommended Spares (Data by Tenderer)

**Name of the work : Supply, Installation, Testing and Commissioning of 1600kVA, 11KV/433V,
Compact Substation**

List of recommended spares as following –

Sr. No	Description of spare Part	Unit	Quantity

Signature & Seal of Tenderer

Annexure VIII
LIST OF APPROVED MAKES

S. No	Item description	Make
1.	Compact substation	Siemens / Schneider / ABB/ C&S/L&T make
2.	HT Switchgear	Siemens / Schneider / ABB/ C&S/L&T make
3.	LT Switchgear	Siemens / Schneider / ABB/ C&S/L&T make
4.	Transformer	Siemens / Schneider / ABB/ C&S/L&T make or as per OEM of Compact substation
5.	Bushings	Baroda Bushing/CJI/Jaipur
6.	Tap changer	Always /Paragon
7.	Valves	Newman
8.	Transformer oil	Apar/Savita/Raj
9.	CRGO	Nippon/JFE/Posco/
10.	Copper	Birla copper/Sterlite
11.	Radiators	CTR/Hi-Tech Radiators /Tarang Engineers
12.	Corrugated Tank	MPP/Reputed make
13.	ACBs/MCCBs	Siemens / Schneider / ABB
14.	Make of relay to be used with VCB	Ashida / ABB / Areva / Siemens / Schneider
15.	LT CT's	Siemens / Schneider / ABB / Pragati / ECS / Kappa or as per OEM of Compact substation
16.	HT Cable	CCI/Industrial Cable/NICCO/Gloster/Incab
17.	Capacitors	L&T/Siemens/Herodex/GE Power Control/ABB/ Thai cap/EPCOS/NEPTUNE/
18.	APFC relay	L&T/Neptune / ABB Make
19.	Current Transformer	AE / Kappa
20.	Instruments/meters	AE / Rishab/Secure
21.	Multi-function meters	Siemens/Schneider/ABB or equivalent
22.	H.T. Cable Termination	Raychem / M Seal / 3M Birla
23.	L.T. Cable gland(single/double)	Comet/Diamond
24.	Indication lights	BCH / Siemens / L&T / Concord
25.	Selector switch	L&T / Kaycee
26.	Push button	L&T / Siemens
27.	Terminal strip	Connect Well / Elmex
28.	Steel /PVC Conduit	BEC/AKG/ATUL/STEEL KRAFT/RKG/SETIA
29.	PVC insulated 1.1KV grade copper wires	National/Ralison/RKG/Finolex/Polycab/Havells/Kalinga / Lapp cable/ L&T/ Skytone
30.	LT XLPE Aluminium Armoured Cables up to 1100v	Plaza/Skytone/ National/Ralison/PYTEX/Paragon/ KEI/Gloster/CCI
31.	MS RACEWAY	MURPHY/SLOTCO/REECO/ALERON/CUSTOMISED

Certificate/Undertaking

- a) Certified that I/ we have visited the site on _____ and assessed the nature and amount of work involved before submitting our offer. I we will be able to complete the work within stipulated time and to execute the works suit the site condition.
- b) I/we undertake that I/we visited the place for “**Supply, Installation, Testing and Commissioning of 1600 KVA, 11KV/433V, Compact Substation**” . No extra cost will be claimed by us later on for any difficulties/ modifications involved during execution of work as mentioned in the tender. I/we also understand that the work is related with already operational/functional Institute

(Signature of Bidder):

(NAME):

(SEAL)

Engg-in-charge
(Electrical Department)

Note: (i) A certificate for the site inspection should be duly signed by Engg-in-charge or his representative as per annexure-A. This certificate shall form part of submittals as per annexure-I

(ii) Above certificate/ undertaking is to be on the letter pad of the builder.

SCHEDULE OF PRICES

**Name of the work : Supply, Installation, Testing and Commissioning of 1600 KVA,
11KV/433V, Compact Substation**

Abstract of Cost

Heads	Amount
Sub Head – I (Equipments)	-----
Sub Head – II (Cabling)	-----
Sub Head- III (Earthing)	-----
Sub Head – IV (Safety Equipment)	-----
Total	_____

(Signature of Bidder):

(NAME):

(SEAL)

SCHEDULE OF PRICES –(Contd.)

Name of the work : Supply, Installation, Testing and Commissioning of 1600 KVA, 11KV/433V, Compact Substation

Sub Head-I

(Compact substation Equipments-HT Panel Board, Transformer, LT panel & interconnecting H.T. Cable etc.)

S. N.	Description of Items	Unit	Qty.	Unit rate (Rs.)	Total (Rs.)
1.0	Supply, Installation testing and commissioning of 1600kVA, 11Kv/433 volts PACKAGE SUB STATION with enclosure and following equipments as per specifications.	Set	1		
	<p>HT Switchgear: (Inside CSS) Four way 11KV Non-Extensible Ring Main Unit Compact switchgear consisting of 630 A ONE number fixed manual fault making / Load break Switche & THREE numbers manual operated SF6 insulated vacuum circuit breakers. SF6 insulated Vacuum circuit breakers with self- powered relay having Transformer protection, over current and earth fault protection. I/c Interconnection between RMU and transformer using suitable Aluminum unarmored XLPE single core cables. I/c Interconnection between transformer and LT switchgear shall be using suitable copper Qty: 1 set.</p> <p>Transformer: -1600 KVA, 11KV / 433, DYn11, Oil Natural Air Natural Cooling Type, oil filled hermetically sealed, Transformer with off circuit tap links 5% to -5% @ 2.5% on HT side of transformer with WTI and OTI Scanner (make: PECON Electronics model TR 7570) with Alarm and trip contact. with both low and high voltage windings of high purity electrolytic copper. The transformer shall be complete with rating and diagram plate, 2 Nos. earthing terminals. And i/c connection to LV through 415 volts 2500 Amp. PVC sleeved Al. bus bars. Qty: 1 no</p> <p>LT Switchgear: 2500 A, 4pole, 433V, 50Hz, 50KA, fixed type with manually operated (MFO type) mechanism ACB with Microprocessor based O/L, S/C, E/F release. Rated Insulation Voltage $U_i = 1000V$, Utilization category = B Qty: 1No.</p>				
2.	Supply, Installation testing and commissioning OUT DOOR L.T. PANEL WITH CAPACITOR PANEL: 1No LT Panel with following switchgears and protections & specifications.	Set	1		

S. N.	Description of Items	Unit	Qty.	Unit rate (Rs.)	Total (Rs.)
	<p><u>Incomer:</u> 2500 A, 4pole, 433V, 50Hz, 50KA, EDO type ACB with Microprocessor based O/L, S/C, E/F release. Rated Insulation Voltage $U_i = 1000V$, Utilization category=B Digital Multi-function Meter with A, V, KW, KWH, PF, CI-0.5 with Port (Conzerv-EM 6400) – 2 Nos. LT Metering CT's – 3 Nos, 2500/5A, Cast Resin Type, CI - 0.5, R, Y, B, ON, OFF LED Indicating Lamps - 5 Nos. Control MCB, 6A, SP – As required- Qty: 2 sets</p> <p><u>Outgoing:</u> i). 1250 A, 4Pole, 433V, 4pole, 50Hz, 50KA, EDO type ACB with Microprocessor based O/L, S/C & E/F release. Rated Insulation Voltage $U_i = 1000V$, Utilization category = B LT Switchgear should be suitable for termination of 3run X 3 ½ C X 240 Sq.mm aluminum armored Cable. R, Y, B, ON, OFF LED Indicating Lamps - 5 Nos. Control MCB, 6A, SP - As required. Qty: 2sets</p> <p>ii). 630 A, 433V, 4pole, 50Hz, 36KA, EDO type ACB with Microprocessor based O/L, S/C & E/F release. Rated Insulation Voltage $U_i = 1000V$, Utilization category = B LT Switchgear should be suitable for termination of 2runs X 3 ½ C X 240 Sq.mm aluminum armored Cable. R, Y, B, ON, OFF LED Indicating Lamps - 5 Nos. Control MCB, 6A, SP - As required. Qty: 4sets</p> <p>iii). Supply, Installation testing and commissioning of 600KVAR Capacitors. 63A TP MCB(10KA) Thermal Magnetic Release -4 Nos 125A TP MCCB(36KA) with Thermal Magnetic Release-10 Nos 25KVAR Capacitor Duty Contactor-4 Nos 50KVAR Capacitor Duty Contactor-10 Nos</p> <p>440V MPP HEAVY Duty Capacitor-4 Nos 50KVAR,440V MPP HEAVY Duty Capacitor-10 Nos Control MCB, 6A, SP-As required</p>				
3.	Providing and laying PCC foundation as per as per Package Sub-station manufacturers design for 1600KVA CAPACITY PACKAGE SUB-STATION i/c supply of all required construction material, execution of civil works, making required cable trenches for LT and HT cables.	lot	1		
	Total of Sub Head I				

Sub Head-II: Cabling, Cable Trays and Steel Supports

4.	Supplying of Unearthed/earthed armoured, aluminum conductor XLPE power cable of 11KV grade confirming to IS 7098 (Part II) amended up to date as per the following size (a) 3x150Sqmm as per specifications.	Mtr	50		
5.	Laying of 1 No. XLPE insulated power cable of grade exceeding 1.1KV but not exceeding 11KV of size exceeding 150Sqmm direct in ground I/c excavation, sand cushioning & protective covering and refilling the trench etc. as required	Mtr	50		
6.	Laying of 1 No. XLPE insulated power cable of grade exceeding 1.1 KV of size not exceeding 3.5C X 240Sqmm in the existing masonry open duct/tray as required.	Mtr	500		
7.	Supplying and making end termination with brass compression gland and Al. lugs for XLPE Al. conductor cable of 1.1 KV grade as required. a. 3.5Cx240Sq. mm	Set	20		
8.	Supplying and making straight through joint with cast resin compound I/c ferrule and other jointing material for XLPE Al. Conductor cable of 1.1 KV grade as required. a. 3.5Cx240Sq. mm	Each	UR		
9.	Supplying and making indoor cable end termination with heat shrinkable jointing kit complete with all accessories I/c lugs suitable for following sizes of 3core XLPE Al. Conductor cable of 11KV grade as required. a). 150Sq.m b). 185Sq.m	Each Each	4 1		
10.	Supplying and making straight through cable jointing with heat shrinkable jointing kit complete with all accessories I/c ferrules suitable for the following size of 3 core XLPE Al. conductor cable of 11 KV grade as required. a. 150Sq.m b. 185Sq.m	Each Each	UR UR		
11.	Providing and fixing 8mm thick M.S. chequered plate (including cutting to required size as instructed) over the cable trench with 8mm dia lifting hooks on both sides by making small holes in chequered plates . Chequered plates will rest over the M. S. angles fixed over the walls of trench. Note: lifting hooks and M.S.angles will be paid in kg in separate structure steel item no. 20	Sq. Mtrs	50		
12.	Providing and laying Cement concrete 1:2:4 (1 cement : 2 coarse : 4 aggregate 20mm nominal size) below electrical panels and cable trenches including	Cu. Mtr	8		

	shuttering, compaction and curing as per standard specifications.				
13.	Excavation upto 1foot below PCC of electrical panel and filling the same with brick ballast and coarse sand including watering and compation.	Cu. Mtr	10		
14.	Excavation of the cable trenches in hard rock not exceeding 1.0 meter in width, and lift upto 1.0 meter, including getting out the excavated soil and disposal of excavated soil as directed within a lead of 250 meter.	Mtrs	40		
15.	Excavation of the cable trenches in hard rock not exceeding 1.5 meter in width, and lift upto 1.0 meter, including getting out the excavated soil and disposal of excavated soil as directed within a lead of 250 meter.	Mtrs	5		
16.	Providing brick work (in width 225 mm or more) with F.P.S. bricks of class designation 7.5 in cement mortar 1:4 (1 cement : 4 coarse sand) at all levels.	Cu. Mtr	25		
17.	Providing 15 mm thick cement plaster of mix 1:4 (1 cement : 4 fine sand) at all levels.	Cu. Mtr	160		
18.	Supplying of fine Jumna Sand and filling in the existing substation trench/Open masonry duct as required	Cu. Mtr	25		
19.	Supplying and installing following size of perforated Hot Dipped Galvanised Iron cable tray (galvanisation thickness not less than 50 microns) with perforation not more than 17.5%, in convenient sections, joined with connectors, suspended from the ceiling with G.I. suspenders including G.I. bolts & nuts, etc. as required. 450 mm width X 62.5 mm depth X 2.0 mm thickness	Mtr	30		
20.	Supplying and installing following size of perforated Hot Dipped Galvanised Iron cable tray "Bends" (galvanisation thickness not less than 50 microns) with perforation not more than 17.5%, in convenient sections, joined with connectors, suspended from the ceiling with G.I. suspenders including G.I. bolts & nuts, etc. as required. 450 mm width X 62.5 mm depth X 2.0 mm thickness	Nos			
21.	Supplying and installing following size of perforated Hot Dipped Galvanised Iron cable tray "Tee" (galvanisation thickness not less than 50 microns) with perforation not more than 17.5%, in convenient sections, joined with connectors, suspended from the ceiling with G.I. suspenders including G.I. bolts & nuts, etc. as required. 450 mm width X 62.5 mm depth X 2.0 mm thickness	Nos			
22.	Supply of MS angle, C-channel/ pipe etc. as required for supports, frames etc.	kg	1000		
23.	Fabrication and installation of supports from of MS angle, C-channel/ pipe and MS plates in any length and shape including primer and two coats of enamel paint of approved shade etc. as required.	kg	1000		

	Total of Sub Head II				
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Sub Head – III: Earthing

24.	Earthing with chemical earth pits by using 75X3000 mm Cu. earth electrode i/c back filling compound, accessories and providing masonry enclosure with cover plate having locking arrangement as per specifications. –SITC	Sets	6		
25.	Earthing with chemical earth pits by using 75X3000 mm GI. earth electrode i/c back filling compound, accessories and providing masonry enclosure with cover plate having locking arrangement as per specifications. –SITC	Sets	6		
26.	Providing, laying and fixing following dia G.I. pipe (medium class) in ground complete with G.I. fittings including trenching (75 cm deep) and re-filling etc. as required a). 80mm dia	Mtr	300		
27.	Providing and fixing earth bus of 50mm x 5mm GI strip on surface for connection etc. as required.	Mtr	20		
28.	Providing and fixing earth bus of 50mm x 6mm Copper strip on surface for connection etc. as required.	Mtr	40		
29.	Providing and fixing 75 mm x 6 mm copper strip on surface or in recess from earth electrode to all the substation components etc. as required.	Mtr	UR		
30.	Providing and fixing /securing, insulated with heat shrink sleeve, 75 mm x 3.0 mm copper strip (single roll in length minimum 25 mtrs) as required.	Mtr	200		
31.	Exothermic welding/ brazing Cu. strip to electrode/Cu. Strip.	Nos.	20		
32.	Riveting sweating & soldering of copper strip with another copper strip or any other metallic object as required.	Nos.	20		
	Total of Sub Head III				

Sub Head – IV: Safety Equipment

33.	Providing & fixing danger plates made of mild steel at least 2mm thick & vitreous enameled white on both sides & with inscriptions in signal red colour on front side as read. a. High Voltage- size 250mm x 200mm b. Medium Voltage – size 200mm x 150mm	Each Each	UR UR		
34.	Providing and fixing carbon dioxide (CO2) type fire extinguishers conforming to IS 2878-1976 and cylinders fully charged of following capacity. (a) 4.5KG	Each	UR		
35.	Providing and fixing of foam fire extinguishers, Portable type 9 lit capacity hanged on wall with bracket complete as required	Each	UR		
36.	Providing of set of 4 Nos. 9.5 Litre capacity GI bucket painted in post office red colour with prior coat of red oxide paint and written with white paint 'FIRE' and mounted on MS angle iron frame with bracket of appropriate size & capacity I/c filling sand etc.	Set	1		
37.	Fixing of Safety charts, shock treatment charts, HT, MV danger plates, first aid boxes as per CPWD specifications (Part-IV)	Set	1		
	Total of Sub Head IV				

(Signature of Bidder):

(NAME):

(SEAL)