e-Tender Document for

Supply, Installation & Commissioning of 500 KVA 11/0.4 KV Sub-station including LT Panel & other Misc Items

at

CIPET:SARP- LARPM, Bhubaneswar

TENDER DOCUMENT NO. 04/2019-20

LAST DATE FOR SUBMISSION OF BID: 13.01.2020

SCHOOL FOR ADVANCED RESEARCH IN POLYMERS (SARP) - LARPM
CENTRAL INSTITUTE OF PLASTICS ENGINEERING & TECHNOLOGY
(Department of chemicals & Petrochemicals,
Ministry of Chemicals & Fertilizer, Govt. of India)
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e-TENDER NOTICE (04/2019-20)

CIPET:SARP-LARPM invites bids through e-Tender **UNDER SINGLE STAGE TWO BID SYSTEM IN e-TENDER PORTAL (www.tenderwizard.com/CIPET)** from Registered & Experience Contractor having HT License for **"Supply, Installation & Commissioning of 500 KVA 11/0.4 KV Sub-station including LT Panel & other Misc Items"** at CIPET:SARP-LARPM, Bhubaneswar. Bid offers should be of two parts viz., Technical Bid & Commercial Bid.

Sl. No	Description	EMD in ` (Refundable)	Tender Fees in ` (Non-refundable)
01.	Supply, Installation & Commissioning of 500 KVA 11/0.4 KV Sub-station including LT Panel & other Misc Items at CIPET:SARP-LARPM, Bhubaneswar	65,000.00	2,500.00 + GST @ 18%

Please visit our website for downloading our bid documents, technical specification and other terms & conditions. The last date for submission of the bid is as mentioned below:

Last date of submission of Tender in the portal : 13.01.2020 Time ----- 03:00 PM

The Tender documents can be downloaded from our official website of CIPET:SARP-LARPM (www.cipet.gov.in). The amounts towards Tender fee and EMD should be submitted separately in the form of Demand Draft drawn in any nationalized bank in favour of **"CIPET LARPM, Bhubaneswar A/c/ No. 34640722811"** (State Bank of India) payable at **Bhubaneswar. Bids without Tender fee and EMD will not be accepted.** The undersigned reserves the right to accept/reject any or all Tenders without assigning any reason thereof. No claims whatsoever shall be entertained for the loss/damage suffered by the parties/bidders on account of such rejection.

Officer (PAF), CIPET:SARP-LARPM

1. **Eligible Criteria for Bidders :**

- Average Annual Turn Over during last 3 financial years should be minimum amount of ` 100 lakhs.
- Audited Balance sheet for the last 3 years
- Up-to-date IT Return for the last 3 years, PAN Card & GST Registration Certificate, GSTR -1 & GSTR-3B for last 3 months.
- Valid Bank Solvency Certificate for an amount of ` 35.00 Lakhs.
- The Bidders must have satisfactorily supplied & completed installation of similar types of work at-least 2 nos. in any Govt. Organisations/PSU/Corporate Sector during the last 5 years. The Certificate in support of that from the user must be attached.
- Self declaration on **NO PENDING LITIGATION.**
- The gross annual turnover certificate should be submitted separately & duly certified by the Chartered Accountant. Year in which no turnover is shown would also be considered for working out the average.
- All Bids should be accompanied by the Bid document fee & EMD for the requisite amount without which the financial bid of the bidders shall not be opened & will be out rightly rejected.
- The Bidders must have Office in Odisha with proper evidence for faster & better serviceability.
- The Bidders shall give a list of his relatives working with the CIPET along with their designations and addresses.
- In addition to above the bidder should submit the following documents :
  - ❖ Valid Electrical (HT) License for electrical works
  - ❖ Income Tax Clearance Certificate
  - ❖ EPF
  - ❖ ESI
  - ❖ Existing Labour License
  - ❖ Company / Firm Registration Particulars

GENERAL TERMS & CONDITIONS

- **Earnest Money Deposit :**

  Earnest money deposit shall be ` **65,000/- (Rupees Sixty Five Thousand only)** through Demand Draft drawn in any nationalized bank in favour of **"CIPET LARPM Bhubaneswar A/c No. 34640722811" (State Bank of India) payable at Bhubaneswar.**

- The EMD of the unsuccessful Bidders will be return back after finalization of e-Tender.

- The cost of the tender document of ` **2,500/- (Rupees Two Thousand Five Hundred only) + GST @ 18%** is to be paid by **Demand Draft drawn in any nationalized bank in favour of "CIPET LARPM Bhubaneswar A/c No. 34640722811" (State Bank of India) payable at Bhubaneswar** which is non-refundable.

- **Taxes :** All taxes, duties, packing & forwarding, installation and any other charges other than GST shall be deemed to have been included in the quoted rate.

- **Performance Security :** 10% of the Work Order value shall be submitted by the party towards performance security within 7 days of receipt of Work Order in the form of Demand Draft. 90% towards Performance Security will be refunded after successful supply & installation and the remaining 10% after warranty period is over.

- **Warranty :** All the items should be covered under warranty from the date of installation.

- **Payment :** 90% payment will be made within 15 days after successful supply, installation & commissioning of 500 KVA 11/0.4 KV Sub-station including LT Panel & other Misc Items at CIPET:SARP- LARPM, Bhubaneswar as per our Technical Specifications & subject to fulfillment of other terms & conditions of the e-Tender document & balance 10% shall be released within 3 months from the date of successfully installation & commissioning of the above Sub-station.

- TDS (Tax Deducted at Source) and any other applicable tax shall be deducted as per prevailing rules and regulations of the Government of India, if applicable

- The Bidders are required to have a survey including the site visit before furnishing the e-Tender.

- **Price Escalation :** No escalation on any account shall be payable and price quoted shall be firm till completion of the work under this contract.

- In case of work not completed satisfactory or in case of delay, CIPET-SARP-LARPM, Bhubaneswar reserves the right to forfeit the EMD and charge liquidated damage @0.5% per week, shall be deducted from the final payment, for each week of delay upto maximum of 5%.

- **Jurisdiction / Dispute:** Any action / dispute arise out of or from this work order shall be subject to the jurisdiction of court of law at Bhubaneswar only, irrespective of anything to the contrary mentioned in the tender. Any statutory obligation has to be made by the contractor.

Technical Specification for supply, installation & commissioning of 500 KVA 11/0.4 KV Sub-station including LT Panel & other misc items

1.1 SCOPE OF WORK:

This specification provides for the manufacture, supply, assembly, testing before despatch and delivery at site, erection & commissioning of various equipments, earthing, etc. as detailed in schedule of quantities, drawings and specifications.

The entire work is required to be carried out as per phase program (to be finalized in consultation with Engineer-in-charge) from the date of awarding of contract. The delay in date of commissioning is subject to the liquidated damage as specified in the General conditions of contract.

1.2 HANDLING AND TRANSPORT FACILITIES AT SITE:

The contractor should be responsible for and pay for handling and transport of all parts and materials covered by this contract from makers work to the actual site of erection, including loading and unloading of materials as required. He should make his own arrangements for temporary storage of his materials and equipments before and during erection. No facility of crane etc. shall be available for installation and contractor should make his own arrangements for his purpose.

1.3 GENERAL CONDITIONS:

All works covered by this specification should be carried out in accordance with the "General conditions of the contract" attached here to.

1.4 GUARANTEE:

The performance of all the equipment and the installation should be guaranteed at least to a minimum period of one year for defective materials or workmanship.

1.5 The tenderer must furnish the make of major items as per preferred make of materials given elsewhere.

1.6 The contractor shall have to furnish the completion certificate on completion and commissioning of the works as per enclosed format.

1.7 The contractor has to furnish the required test certificates, test reports in the approved proforma of supply authority and arrange necessary approval from the Supply Company and electrical inspector. No separate charges will be payable by department to this account.

1.8 All holes to be made in wall / ceiling / beam / column or other places shall be done by using drill machine only.

1.9 Description of item in the schedule of quantities is brief and therefore, shall be read in conjunction with the relevant drawings and the specifications and the contractor's rate shall be deemed to be for such complete work unless otherwise specified by the contractor while tendering. In case any difference or discrepancy between the description in the schedule of quantities and the specifications, the schedule of quantities shall take precedence. In case any difference or discrepancy between the

description in the schedule of quantities and the drawings, the description in schedule of quantities shall take precedence. In case of any difference or discrepancy between drawing and specifications, the specifications shall take precedence.

1.10 APPROVALS OF ELECTRICAL INSPECTIONS ETC.:

The contractor shall submit the required application, drawings etc. to the corporation, Electrical inspector, Factory inspectors & any other authorities and obtain their approved licenses and / or sanctions to the drawings. The final completion certification shall be obtained by the contractor from the corporation, electrical inspector, factory inspector and / or any other authority to enable the owner to commission the electrical equipment for its utilisation. Also the electrical contractor shall submit the required work completion test report to electric supply authority and obtain the power supply to enable the owner / department to commission the electrical equipment for complete utilisation. The contractor shall be responsible for all fees etc. and the employer will not be liable to refund any such payments to the contractor. CIPET:SARP-LARPM will bear the deposits to be paid to supply company if required to be paid to the various authorities. The work shall not be deemed to have been completed until the above approvals / certificate etc. have been obtained by the contractor.

1.11 The specifications given below pertain to the Electrification work to be carried out in the proposed **CIPET:SARP-LARPM at Bhubaneswar.**

The entire scope of work is as per the Bill Of Quantities provided in the tender document.

PROJECT DATA:

Owner	:	CIPET:SARP-LARPM
Elevation	:	118 ft or 35 mtr above MSL
Ambient Temp.	:	42 Degree C Maximum
	:	10 Degree C Minimum
humidity:-	:	92%
Avg. Rainfall	:	180 mm

The design ambient temperature for Electrical Equipment shall be considered as 50 Degree Centigrade.

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OIL FILLED TRANSFORMERS

1.1 SCOPE :

This Specification is intended for the design, manufacture, assembly, testing, inspection, performance guarantee and delivery to site, installation and commissioning of 11/0.433 KV oil filled outdoor type Transformers complete assembly with accessories mounted and wired up for installation and operation at various Substations. The Bidder shall furnish all the guaranteed technical particulars as listed in the specification.

This Specification shall be read in conjunction with **Schedule of Quantities (SOQ)**.

1.2 STANDARDS & CODES :

Except where modified by these Specifications, all materials and equipments shall conform to the requirements of the following standards (latest editions).

i.	Transformer	: IS 2026
ii.	Bushings	: IS 2099
iii.	Transformer oil	: IS 335
iv.	Current transformer	: IS 2705
v.	Fittings and accessories for power transformers	: IS 3639
vi.	Climate proofing	: IS 3202
vii.	Loading of oil immersed transformers	: IS 6600
viii.	Degree of protection for control gear	: IS 2147
ix.	Routine tests	: IS 2026
x.	Tolerance for load and no load losses	: IS 2026
xi.	Buchholz relay	: IS 3637
xii.	Electrical insulation classified by thermal stability	: IS 1271
xiii.	Specification for on load tap changers	: IS 8468-77
xiv.	Dimension for porcelain transformer bushings	: IS 3347

1.3 CONSTRUCTIONAL FEATURES :

1.3.1 General :

All materials used shall be as per the specifications and in accordance with the specified Indian Standard and shall be new.

Similar parts, particularly removable ones, shall be interchangeable.

Screws, studs, nuts and bolts shall be as per Indian Standards.

The design and manufacture of all electrical & mechanical equipments shall be such that they can be transported and installed without any damage and give satisfactory operation under specified site conditions.

Nuts, bolts, pins used inside the transformers and tap changer compartments shall be locked.

Exposed parts shall not leave pockets where water can collect.

Internal design of transformer shall ensure that air is not trapped in any location. When such air pockets cannot be avoided, they shall be connected to pipe between Buchholz relay and tank. Suitable air release vents shall be provided.

Facility shall be provided for lubrication of bearings and mechanisms. Mechanisms shall be constructed of non corrodible materials.

Materials. In contact with oil shall be such as not to contribute to the formation of acid in oil. All bolts and nuts shall be galvanized or cadmium coated.

1.3.2 Core :

The magnetic circuit shall be of . Core Type' construction. The core shall be built out of high grade, non-ageing low loss and high permeability, cold rolled grain oriented silicon steel laminations.

After being sheared, the laminations shall be treated to remove all burrs.

The finally assembled core shall be free from distortion. It shall be rigidly clamped to ensure adequate mechanical strength and to prevent vibrations during operations.

The core clamping structure shall be so designed to minimize eddy current loss.

The core shall be provided with lugs suitable for lifting the complete core and coil assembly.

The core and coil assembly shall be so fixed in the tank that shifting will not occur during transport or short-circuit.

All steel sections used for supporting the core shall be thoroughly sand blasted after cutting, drilling & welding.

Core and winding assembly shall be mounted on the bottom of the tank. It shall not be supported from tank cover.

Frame core clamps and core bolts shall be electrically insulated from the core. Class-F insulation shall be used for this purpose.

1.3.3 Internal Earthing:

All internal metal parts of the transformer, with the exception of individual laminations, core bolts and their individual clamping plates shall be earthed. Core clamps and core bolts shall be insulated from the core by Class-F insulation unless other Class insulation is approved by the purchaser.

The top clamping structure shall be connected to the tank by a tinned copper strip. The bottom clamping structure shall be earthed by one or more of the following methods.

a) By connection through vertical tie-rods to the top structure.
b) By direct metal to metal contact with the tank base.
c) By a connection to the top structure on the same side of the core as the main earth connection to the tank.

The magnetic circuit shall be connected to the clamping structure at one point only, through a link placed in an accessible position beneath an inspection opening on the tank cover. The link shall be on the same side of the core as the main earth connection above.

When the magnetic circuit is sub-divided by oil ducts or insulated barriers above 0.25mm. thick, tinned copper strip bridging pieces shall be inserted to maintain electrical continuity between circuits.

Coil clamping rings of material at earth potential shall be connected to the adjacent core clamping structure on the same side as the main earth connection in 3.3.2 above.

1.3.4 Windings :

The coil and winding assembly shall be carried out in a dust free and humidity controlled atmosphere.

Windings shall be subjected to a shrinking and seasoning process, so that no further shrinkage occurs during service. Adjustable devices shall be provided for taking up possible shrinkage in service. HV winding shall be preferably continuous disc type and LV shall be spiral/helical type.

Coils shall be supported at frequent intervals by means of wedge type insulation spacers permanently secured in place and arranged to ensure proper oil circulation. To ensure permanent tightness of winding assembly the insulation spacers shall be dried and compressed at high pressure before use.

Windings shall not contain sharp bends which might damage the insulation or produce high dielectric stresses. No strip conductor wound on edge shall have width exceeding six times the thickness.

Materials used in the insulation and assembly of the windings shall be insoluble, non-catalytic and chemically inactive in the hot transformer oil and shall not be softened, unless otherwise affected under the operating conditions.

All threaded connections shall be locked. Leads from the windings to the terminal board and bushings shall be rigidly supported to prevent injury from vibration. Guide tubes shall be used where practicable.

Windings and connections shall be braced to withstand shocks during transport or short circuit.

The conductors shall be transposed at sufficient intervals in order to minimise eddy currents & equalise the current and temperature distribution along the winding.

Winding conductor shall be of high conductivity annealed copper only.

Preferably, there shall not be any joint in the copper conductor used for making the coil. Joint shall not be there within drum and joints shall be provided only when essential.

All current carrying bolted connections shall be silver plated to a minimum thickness of 5 microns.

Measures shall be taken to distribute the lightning and switching surges uniformly along the winding.

Unless otherwise specified, uniform insulation to earth shall be provided for windings which are required to withstand highest system voltage. Winding insulation materials shall be Class-A.

Coil clamping rings shall be of steel or of a suitable insulating material built from flat lamination.

Permanent current carrying joints in the windings and loads shall be welded or brazed. Clamping bolts for current carrying parts inside oil shall be made of oil resistant material which shall not be affected by acidity in the oil. Steel bolts, if used, shall be suitably treated.

Terminals of all windings including neutral shall be brought out of the tank through bushings for external connections on the sides only and not from the top cover of the tank.

Pre-compressed press boards shall be used during coiling of the winding assembly.

1.3.5 Tank:

The tank shall be made from good commercial grade low carbon steel. All seams, flanges, lifting lugs and other permanent parts attached to the tanks shall be welded, All joints which may have to be opened from time to time in the course of operation shall be of a design to permit them to be easily made oil tight in re-assembly. The tank should be free from distortion.

Tank shall be designed to permit lifting, by crane or jacks of the complete

transformer assembly filled with oil. Suitable jacking pads and lifting arrangements should be provided outside the tank.

Tank together with radiators, coolers, conservator, bushings, vessel and other fittings shall be designed to withstand without permanent distortion the following conditions:

a) Full vacuum of 760 mm of Hg. for filling with oil by vacuum.

b) Mechanical shocks during transport.

Suitable guides shall be provided in the tank for positioning the core and coil assembly.

Adequate space shall be provided at the bottom of the tank for collection of sediment.

The transformer top shall be provided with a detachable cover with a bolted flanged gasket joint . Suitable lifting lugs shall be provided for removing the cover.

The material used for gasket shall be cork-neoprene or approved equivalent. Gasket joints for tank and manhole cover bushings and other bolted attachments shall be so designed that the gasket will not be exposed to the weather. Mechanical stops to prevent crushing shall be provided for compressible gaskets.

The transformer tank and its fitting shall be designed to withstand the pressure which will be encountered in normal operation and during abnormal conditions such as short circuit etc.

An inspection hole with matching cover shall be provided on the tank cover to facilitate inspection.

Tank top cover shall be provided with suitable slope to avoid stagnation of rain water.

Equalising pipe shall be provided between tank and oil filled disconnecting chamber with isolating valves.

Core and coil assembly shall be dried out under vacuum and oil in the transformer tank shall also be filled under vacuum condition.

Two nos. earthing studs shall be provided on base channel at diametrically opposite ends to terminate 2 nos. 50 X 6 mm copper strips.

Detachable cable boxes shall be provided on sides & on opposite faces of the tank and not on the front side of transformer movement. Location of conservator, marshalling box shall be such that MOG, plain oil level gauge, tap indicator, WTI, OTI are easily visible from the front gate side.

Degree of protection of transformer shall be IP-65.

1.3.6 Base :

The transformer base shall be provided with flat bi-directional rollers for 11/0.433 KV transformers.

1.3.7 Oil :

Transformer and associated oil filled equipments shall be supplied with first filling of oil plus 10% extra in non- returnable drums, The oil shall be EHV grade oil and shall conform to IS 335. No inhibitors shall be used in the oil. The make of oil shall be subject to purchaser's approval.

1.3.8 Cable Boxes and Disconnection Chambers:

When connection is by cable (please refer specific requirements) disconnection chamber shall be provided for disconnecting and moving away the transformer without unsealing the cable, leaving the cable box or chamber behind on purchaser's external supports. The cable box and disconnecting chamber shall be air insulated fabricated out of sheet steel of adequate thickness and shall be of the phase segregated type. The fault withstand capacity of the cable box and disconnecting chambers shall be as per data sheet. The cable box shall have standard facilities and body earth terminals.

The HV terminals shall be brought out from the top of the tank and LV terminals shall be brought out from the side of tank. A cover for preventing water entry shall be provided on top of LV boxes. Necessary bracket with flanges shall be welded for supporting the cable from bottom.

1.3.9 Radiators & Accessories:

Unless otherwise approved, tank mounted radiators shall be of the detachable type with bolted flanged connections. The following accessories shall be provided for each radiator. Radiator sheet shall be 1.25 mm (18 gauge) thick.

a) Shut off valves (butterfly type) and blanking plates on transformer tank at each point of connection.

b) Top and bottom shut off valves and blanking plates on each radiator.

c) Lifting lugs.

d) Top oil filling hole with cap.

e) Air release vent at top.

f) Oil drain plug at bottom

Special care shall be taken to ensure that all flanged joints of the radiator are absolutely leak proof. Valves shall also be leak proof. Make of the radiators shall be subject to purchaser's approval. Radiators shall be cleaned by shot blasting and provided epoxy painting.

1.3.10 Tap Changing Gear

The transformer shall be equipped with OFF load Tap Changing Gear for 11/0.433 KV Transformers.

1.3.11 Painting:

The interior of all transformers tanks and other oil filled chambers and internal structural steel work shall be cleaned of all scale and dust by shot blasting unless otherwise approved. These surfaces shall be painted with not less than two coats of heat resistant oil insoluble and insulating varnish.

Steel surface exposed to the weather shall be thoroughly cleaned by shot blasting and applied a primary coat of zinc chromate. The second coat shall be weather resistant nature, preferably of distinct colour from the primer and finish coats. The final coat shall be of glossy, oil and weather resisting non-fading paint **epoxy based shade 631 as per IS-5.** If felt necessary additional coat of enamel based paint may be given to entire assembly including radiators, conservators etc.

All exposed bolts, nuts and washer shall be of galvanised steel unless otherwise approved.

Metal parts not accessible for painting shall be made of corrosion resistant material, machine finished and bright surface shall be coated with suitable compound & wrapped.

Interior surface of mechanism chambers and kiosks shall receive three coats of paint, proper cleaning. The final coat shall be of light coloured anti-condensation paint

1.3.12 Marshalling Box :

The marshalling box shall be rugged and of welded construction fabricated out of sheet steel having thickness of 2 mm. or more, provided with water tight hinged doors with padlock arrangement, neoprene gasket all around door to make enclosure water and dust proof (IP-55). The sheet metal treatment shall be similar to external surface of the tank.

The marshalling box shall be mounted on the tank. Necessary angles with holes shall be accordingly welded on the tank for bolting the marshalling box on the tank. Location of marshalling box shall be such that WTI/OTI is easily visible from the front.

1.4 FITTINGS AND ACCESSORIES:

List of fittings and accessories:

All oil immersed transformers shall be provided but need not be limited to the following fittings and accessories:

1.4.1 Inspection cover.
1.4.2 Rating plate.
1.4.3 Terminal marking plate
1.4.4 Two earthing terminals.
1.4.5 Lifting lugs.
1.4.6 Drain valve with plug or cover plate.
1.4.7 Top filter valve and bottom filter valve.
1.4.8 Oil sampling valve.
1.4.9 De-hydrating breather.

1.4.10 Oil filling hole and cap.
1.4.11 Conservator.
1.4.12 Conservator drain valve with plug.
1.4.13 Air release device.
1.4.14 Plain oil level gauge with low level marking.
1.4.15 Marshalling Box.
1.4.16 Radiators with valves.

1.5 Dial type thermometer:

All transformer shall be provided with a 150 mm. dia, dial type thermometer for top oil temperature indication. The thermometer shall have adjustable, electrically independent ungrounded alarm and trip contacts maximum reading pointer & resetting device. This shall be housed in marshalling box.

1.6 Winding Temperature Indication:

Winding temperature indicator of 150 mm. dia. with adjustable ungrounded electrically independent alarm and trip contacts shall be provided. The winding temperature indicator shall be responsive to and shall indicate the hot spot temperature of the winding. Temperature detecting equipment shall consist of a heating coil, a resistance coil and a current transformer all wired and mounted inside the transformer tank.

1.7 Gas and oil actuated relay (Buchholz relay):

A double float type Buchholz relay with isolating valves on both sides and as per IS: 3637 shall be provided on each transformer. All gas evolved in the transformer shall collect in this relay. The relay shall be provided with a test cock suitable for a flexible pipe connection for checking its operation. A copper tube shall be connected from the gas collector to a valve located about 1.25 M above ground level to facilitate sampling with the transformer in service. The device shall be provided with two electrically independent ungrounded contacts, one for alarm on gas accumulation and the other for tripping on sudden rise of pressure.

1.8 Location of Fitings/Terminals :

The relative positions of fittings and terminals shall be approved by the purchaser.

1.9 Under Carriage :

The transformer shall be equipped with four sets of bi- directional flanged wheels/plain type rollers. The wheels shall be provided with proper locking arrangement to facilitate the locking of transformer in its final position to prevent accidental movement of the unit.

1.10 Ladder :

Suitable ladder shall be provided, if required.

1.11 TESTS:

The transformer shall be demonstrated capable of performing satisfactorily up to supplier's maximum guarantee. The transformer shall be offered for inspection and testing at manufacturer's works. During the inspection the firm shall offer transformer for all routine, acceptance and type tests as indicated below in 6.3. All the routine and type tests are indicated below, including repeated tests and inspection that may necessary owing to the failure to meet the tests specified, shall be made at supplier's expense. If transformer fails to pass the tests specified, purchaser shall have option to reject the unit. Additional tests shall be made to locate the failure and after reconstruction, testing shall be repeated to prove that the rebuilt transformer meets the specifications in all respects. All tests are to be carried out as per CESU norms and standard procedures.

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SPECIFIC REQUIREMENTS OF 500 KVA 11/0.433 KV TRANSFORMERS

1. General :

i) Application	Step-down Power transformer
ii) Quantity required	3 Nos.
iii) Type	Oil immersed Core type (2 winding)
iv) Installation	Outdoor

2. Rating

i) Rated output	**500 KVA**
ii) No. of phase & frequency	3 Phase & 50 Hz.
iii) Cooling	ONAN
iv) No load voltage	11 KV/ 0.433 kV
v) Vector group	Dyn 11
vi) Percentage Impedance	As per IS.
vii) Short circuit duration	2 Sec.
viii) Degree of protection	IP-65

3. Neutral Earthing:

i) Transformer LV neutral Solidly earthed

4. Insulation Withstand

i) Impulse Cl-1.2/50 µ.s. wave		75 KV (peak)
ii) one (1) minute Power frequency		
(dry & wet)	HV	28 KV (rms)
	LV	3 KV (rms)

5. Temperature Rise

i). Reference ambient	50^0C (max.)
ii). Oil by thermometer	50^0C
iii) Winding by resistance	55^0 C

6. Tap Changing Gear

i)	Type	OFF load, full capacity
ii)	Taps provided on	11 KV winding
iii)	Tapping range	+5% to -5%
iv)	Steps	2.5%
v)	Tap change control	Manual local

7. Bushing Voltage Class:

i)	HV	12 KV
ii)	LV	1.1 KV
iii)	HV Neutral	NA
iv)	LV Neutral	1.1 KV

1.1 KV GRADE LT POWER & CONTROL CABLES

1.1 SCOPE :

This specification establishes the requirements of design, manufacture, testing at manufacturer's works and delivery to site and installation, testing at site & commissioning of 1.1 KV grade LT PVC/XLPE insulated, galvanized round wire/flat strip armoured Aluminium /copper conductor cables.

1.2 STANDARDS AND CODES :

Unless otherwise specifically mentioned in the document, the design, manufacture, testing and performance of all cables shall conform with latest edition of the following standards & codes:

IS : 7098 (Part-I)	:	Cross linked polyethylene insulated PVC sheathed cable for working voltage and including 1100 Volts.
IS : 1554 (Part-I)	:	PVC insulated (heavy duty) electric cables for working voltage upto and including 1100V.
IS : 3961 (Part-II)	:	Recommended current ratings for cables.
IS : 3975	:	Mild steel wires, strips and tapes for armouring of cables
IS : 4905	:	Methods for random sampling
IS : 5831	:	PVC insulation and sheath of electrical cables.
IS : 8130	:	Conductors for insulated electrical cables and flexible cords.
IS : 10418	:	Specification for drums for electric cables.
IS : 10810	:	Method of tests for cables.
ASTM-D-2843	:	Standard test method for density of smoke from the burning or decomposition of plastics.
ASTM-D-2863	:	Standard method for measuring the minimum oxygen concentration to support E3 candle like construction plastics.
IEC-754 (Part-I)	:	Test on gases evolved during combustion of electric cables.
SS:4241475	:	Flammability testing of cables.

1.3 Technical parameters:

i)	Power system details	:	415 V +/-10%, 3 phase, 4 wire solidly earthed.
ii)	Frequency	:	50 Hz.
iii)	Size of cable, conductor & quantity	:	As per S.O.Q.
iv)	Core identification	:	Colour scheme as per IS 1554 (part I) /88 or latest
v)	Conductor	:	Stranded circular/sector shape core Aluminium/Copper conductor
vi)	Rated voltage	:	1100 Volts
vii)	Insulation	:	PVC material type A/XLPE
viii)	Maximum conductor temperature at rated current.		70 degree C/90 degree C
ix)	Maximum conductor temperature during short circuit under hot condition		160 degree C/250 degree C
x)	Inner sheath		Extruded PVC inner sheath
xi)	Filler material		If used shall be compatible with other materials of cable construction
xii)	Armouring		Single layer galvanized steel round wire/ flat strip armoured.
xiii)	Overall serving (outer sheath)		Anti rodent and anti termite extruded black FRLS grade PVC sheath (Type ST-2)

xiv) Cable shall be embossed / printed on the outer sheath at every 1 m. length as under :1.1 kV, PVCA/XLPE, conductor material, No. of core and size of cable, sequential marking for the metered length of cable, make and year of manufacturing

1.4 Installation of LT cables in ground :

Installation of 1.1 KV grade, copper/ Aluminium conductor PVCA/XLPE cables shall be laid at a depth of 900mm below ground level including excavation in all type of soil/concrete, road cutting/footpath cutting, temporary reinstatement, back filling, levelling, dewatering, consolidation, removal of excess earth within the radius of 500 m, sand bedding, cables covered on top & sides by baked bricks conforming to IS: 1077, sand cushioning all around, making good to the original finish, providing brass

cable number tag including supply of bricks, sand, cable tags etc. complete as per instructions of EIC.

1.5 Installation of LT cables on MS support/trenches/sleeves/wall/slab/ beam etc.:

Installation of 1.1 KV grade, copper/Aluminium conductor PVCA/XLPE cables as per specification indicated in clause no 6.1 on MS Support/trenches/sleeves/wall/Slab/ beam/pre fabricated Trays in cable trench including all necessary accessories for installation such as G.I. saddle / clamps/supports, screw, nuts and bolts etc.

1.6 End termination of LT and Control cables:

End jointing of 1.1 KV grade, Aluminium / copper conductor PVCA/XLPE power / control cables with supply & installation of all jointing materials including supply of compression type glands, crimping type long barrel heavy duty copper lugs, insulation tape etc. of sizes as detailed in schedule of quantities (SOQ). Cable gland shall be suitably earthed. Earthing clamp should be included in the cost.

1.7 TESTS :

1.7.1 Shop Tests :

The cables shall be subjected to shop tests & witnessed by department engineer in accordance with relevant standards to prove the design and general qualities of the cables as below:

1.7.1.1 Routine tests on each drum of cables.

1.7.1.2 Acceptance tests on drums chosen at random for acceptance of the lot.

1.7.1.3 Type tests Certificates shall be submitted for particular size & design of cable .

1.8 Site Tests :

The cables after installation at site shall be subjected to HV test & Megger test as per instruction of EIC.

1.9 DEVIATION :

No deviation with respect to specification requirements is acceptable. Deviation if any, shall be clearly spelt out by the Bidder referring clause No.

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LT SWITCHGEAR PANEL

1.1 SCOPE :

This specification covers the technical requirements of design, manufacture, testing at manufacturer's works, supply, installation, testing and commissioning of MV Switchgears.

1.2 TECHNICAL PARAMETERS:

A.	**System Details**		
i)	System Voltage	:	415V +/- 10% 3 phase 4 wire solidly grounded network
ii)	Frequency	:	50Hz +/- 3%
iii)	Control Supply	:	230 Volts AC +/- 10% (tapped from phase & neutral) and 110V DC +/- 10%
B.	**CIRCUIT BREAKERS**		
1	Standard Applicable (Isolation function with the test for line/ load inter-changeability)	:	IS : 13947 (Part –I to Part –IV)
2	Rate insulation voltage (Ui)	:	1000 Volts
2.1	One minute dry withstand test voltage	:	2500 Volts
2.2	Service (Ics) Breaking capacity at 415V, 50Hz	:	As per SOQ
2.3	Making capacity	:	Min 84 KA peak
3	Momentary short time current rating (rms) for 1 sec. (Icw)	:	As per SOQ
4	Rating of circuit breaker	:	As per bill of material
5	Type and material of inter phase barriers wherever required	:	FRP/SMC/Poly Carbonate
6	Type of tripping mechanism	:	i. Direct /Shunt trip (Electrical) ii. Manual (mechanical)
7	Normal voltage of tripping coils	:	110 V DC +10% - 15%

8	Voltage for spring charging motor (for stored energy mechanism)	:	230 V AC +10% - 15%
9	Breaker operations	:	Electrically operated with draw out type.
10	Electrical Closing and tripping	:	By spring return sequence locking type ODS switch
11	Operating duty	:	0-3 min. – CO - 3Min. – CO
12	Features of circuit breaker	:	Trip free and anti pumping
13	Method of closing	:	Electrically operated spring charged (normal), mechanical (emergency).
14	Communication capability	:	All ACB's shall be BMS compatible with RS 232/ RS 485 port
C	**SWITCHGEAR CUBICLES:**		
1	Design voltage of switchgear bus	:	415 Volts
2	Clearances (Except Component terminals). a) Between phases b) Between live parts and earth	: : :	 25mm 19mm
3	Degree of protection	:	IP 42
4	Power frequency withstand voltage for complete cubicle	:	2.5KV
5	Method of circuit grounding	:	Solid/flexible copper
6	Space heater details a) Voltage b) Ratings c) Numbers d) Type of controls	: : : : :	 230 V 100W (min) / Adequate capacity one per Shipping section Thermostat with MCB.
7	Bus bars		
7.1	Material	:	Tinned Copper
7.2	Continuous rating of main bus bars	:	**As Per SLD**
7.3	Continuous rating of feeder bus	:	**As Per SLD**

	bars		
8	Temperature rise of the bus bar over the specified ambient (40 degree C)	:	As per IS.
9	One minute power frequency withstand voltage	:	2.5 KV
10	Ground Bus		
10.1	Material	:	Tinned Copper
10.2	Cross Section	:	Min.300 sq.mm
11	C.T. Mountings	:	At rear side of the panel
12	Control wire size		
12.1	CT circuit	:	2.5 sq.mm. copper
12.2	Other than CT circuit	:	1.5 sq.mm. copper
13	Painting Procedure	:	With 7 tank sheet treatment and powder coating.
14	Cable entry	:	Bottom
15	Cable compartment door	:	To be provided with hinged doors and knobs
16	Feeder compartment	:	To be provided with hinged doors and knobs
17	Design of switchgear	:	Incomer and bus coupler shall be single tier, outgoing in two tier
18	Quantity	:	**As Per SLD**

1.3 GENERAL :

The switchgear shall be designed, manufactured and equipped with accessories in accordance with this specification and applicable standards indicated above. The switchgear shall be of indoor, metal clad, air break with a draw out construction for AIR CIRCUIT BREAKERS.

1.4 CONSTRUCTION FEATURES:

1.4.1 SWITCHGEAR CUBICLES:

The sheet steel used in the fabrication of the switchgear housing shall be cold rolled thick & leveled and finished smooth in such a manner that the complete structure

shall be rigid, self supporting. All the steel panels enclosing a switchgear unit, hinged doors, partitions and removable panels shall be provided with stiffeners to minimize flexing and vibration. Cut outs shall be turned in shape and devoid of sharp edges.

Access to the circuit breaker operating

mechanism shall be through compartment doors provided with hinges and key type locks, so arranged as not to expose any live parts or circuits. All compartment doors shall be so constructed that they will not seize in the event of fir within the switchgear.

Instruments shall be mounted on hinged type front doors. All doors shall have neoprene gaskets wherever required. Panels shall be supported by strong hinges of concealed type and braced in such a manner as to ensure freedom from sagging, bending and general distortion of panel or hinged parts. Cable compartment shall also have hinged doors. Main bus bar, circuit breakers, outgoing feeder housing and cable compartment, shall be generally compartmentalized so that during maintenance the same should not be easily accessible from other compartment. Please note that self-threading screws shall not be used for panel fabrication.

All inter panel/compartments openings for wiring buses or for any other purposes shall be used with PVC bushes. The different materials used in the making of switchgear units, such as bus insulation, bus supports etc. shall not support combustion. All cable entries for outgoing feeders shall be from the bottom through gland plates assembled at the bottom.

The integrated base frame of the switchgear panel shall be designed in such a way that it shall be very strong enough for manual shifting of the panels at site.

INTERLOCKS :

1.5.1 MECHANICAL:

The following general mechanical interlocks shall be provided to ensure safety of personnel as well as to prevent damage. It shall not be possible to engage or disengage unless the breaker is in the open position. It shall also not be possible to operate the breaker unless it is in the fully latched in position, fully drawn-out position or test position. Provision shall be made for automatic closing of shutters to prevent accidental contact with main stationary contact or other live parts, when the breaker is drawn out. When the breaker is inserted back into its cubicle it shall automatically raise the shutters allowing the breaker to continue its travel unit it finally engages the main stationary contacts. Suitable guides, slides and stops for proper positioning of the truck or trolley with the breaker shall be provided to ensure easy removal, replacement and positioning of the breaker. Locking devices shall be provided on each circuit breaker for securely locking it in the 'Isolated' and 'Test' positions.

1.5.2 AC auxiliary & indication supply:

230Volts, 50 Hz. Single phase AC control supply shall be derived from incomer cable side from one phase & neutral of both incomer with a automatic selection scheme to changeover the control supply from one incomer to other in case of failure of power to one incomer.

The circuit breakers shall be operated by a motor operated spring charging mechanism. Each mechanism shall be so designed as to enable one continuous sequence of circuit breaker opening, closing & opening operation on failure of power supply to the motor. The operation of the circuit breakers shall be independent of the motor, which shall be used solely for the charging the spring. The rating of the motor shall be such that it does not require more than 30 seconds for fully charging the closing spring. Charging of the spring shall occur automatically whenever it is discharged. The closing action of the circuit breaker shall charge the opening spring to keep it ready for tripping. Provision should be available for manually charging the spring.

Spring charging motors shall be suitable for operation from the available AC control voltage, unless otherwise specified and shall operate satisfactorily between 85% and 110% of the rated voltage. The anti pumping features shall be achieved electrically. All circuit breakers shall be trip free in TEST and SERVICE positions.

The closing coils and tripping coils and other auxiliary devices shall operate satisfactorily at all voltage between 85% and 110% of the rated voltage.

The auxiliary switches for the circuit breaker shall have multistage electrically separate, reversible, rotary/sliding type contact. Mechanical indication for 'open' / 'closed' positions of the breakers shall be provided.

It shall be preferred that components like spring charging motor, closing coil, tripping coil and auxiliary contacts shall be approachable from the front for the maintenance / replacement without withdrawing the breaker from the guide rail.

LED type Red, green, amber (for incomers only) and white lamps shall be used to indicate breaker 'close', 'open' , trip circuit healthy (for incomers only) and 'auto trip' respectively.

Interlocks shall be provided for the following functions:

a) The incomer breaker shall trip in case the door of the cable chamber of incomer breaker is opened.
b) Prevent the circuit breakers being moved to or from the SERVICE/TEST position when it is in closed position.
c) Prevent manual closing of breaker unless it is in the 'SERVICE', 'Test' or 'Isolated' position.
d) Integral key lock shall be provided to lock position of breaker during maintenance.
e) Safety interlock shall be provided such that the door of the cassette can not be opened till the breaker is racked out to the isolated position.
f) Breaker operation counter shall be provided.

Following LED indications on each breaker shall be provided:

a) Mechanical – Close / open, spring charged / discharged, service position/test position/ isolated position.
b) Electrical – ON, OFF, auto trip for all feeders and additional trip circuit healthy for incomers.

1.6 CONTACTS:

The main contacts of the circuit breaker shall be silver faced and shall have sufficient area so that there is no excessive temperature rise which may cause pitting or welding during the course of normal operations. The contacts shall be replaceable.

1.7 BUS BARS:

The main bus bars and vertical bus bars shall be with heat shrinkable PVC sleeved. Shrouds shall be provided for bus bar joints. Bus bars shall be high conductivity mechanically strong Tinned Copper.

GROUND BUS:

The ground bus shall be tinned copper, continuous throughout the switchgear cubicles and shall be bolted on each cubicle frame by means of hexagonal headed bolts and spring washers.

Grounding terminals shall be provided at each end of the ground bus for connection to purchaser's grounding cables. Continuity with enclosure should be provided. The non-current carrying metal parts of equipment within each switchgear shall be permanently grounded through the ground bus which shall be easily accessible from both ends for connections to the station ground system.

1.8 WIRING AND TERMINAL BLOCKS:

All the internal wiring shall be carried out with stranded copper conductors, PVC insulated 1100/650 V grade of the following sizes :-

Control	-	1.5 sq. mm.
Earth	-	2.5 sq. mm.
CT	-	4 sq. mm.
16A	-	2.5 sq. mm.
25A	-	6 sq. mm.
32A	-	10 sq. mm.
63A	-	25 sq. mm.
100A	-	25 x 3 sq. mm. copper strip

Each terminal block shall be one piece moulded, barrier type, 650 volt grade, complete with washers, heads, studs with two nuts and identification strips and shall have adequate continuous current rating. For tap-offs, adjacent terminals with shorting strips shall be used. **10% Spare terminal blocks shall be provided.** Wire identification on marking strip shall correspond to the designation of the wiring diagrams. All wire terminals on the equipment shall also be marked with designation corresponding to those of the wiring diagram.

Wires shall be provided with numbered ferrules at both ends shall bear the same numbers. All auxiliary contacts whether spare or otherwise shall be wired and

brought out to the terminal blocks. Wiring between components within switchgear cubicle shall be done through the terminal block only. Direct connection shall not be permitted. Current transformer secondary leads shall be brought on to the terminal of the terminal blocks where facility for short circuiting and grounding of CT secondary shall be provided. The terminals shall be similar to type CDTTS of M/s.Connectwell make with shorting and earthing facility.

All wiring shall be enclosed in plastic channels and neatly bunched and closed in metering chamber, Wiring between terminals of various devices shall be 'point to point' (no wire splitting or tee connections) with wires neatly trucked along the back of the panels, adequately supported to prevent sagging or damage due to vibration in transit and operation. Double pole M.C.B. should be provided for control supply to each of the panels.

1.9 CABLE ENTRY :

Cable entry for all feeders shall be from top/bottom. Cables end base of adequate size to be provided wherever required.

Removable 3 mm. thick sheet steel gland plates with appropriate size of knockouts for cables shall be provided. Holes for appropriate size of cable glands shall be made at site.

Double Compression type brass plated cable glands shall be provided.

1.10 INSPECTION AND TESTING :

To be carried out in presence of Department representatives :

1.11 Inspection :

The inspection shall consist of following, but shall not be limited to the same -

i) Appearance and construction.

ii) Dimensions, mounting details etc.

iii) Feeder arrangement and feeder details.

iv) Door alignment, gaskets etc.

v) Alignment of switch drive and handle.

1.12 Tests :

The following tests shall be carried out –

i) Insulation resistance :

The insulation resistance shall be measured between phases, between phase and neutral and between phase and earth. The insulation resistance shall be measured with 1000Volts megger, both before and after high voltage power frequency test. The insulation resistance shall not be less than three megaohm in any case.

ii) High voltage power frequency test :

This test shall be carried out by applying a voltage of 2.5KV for one minute.

a) between all three phases and earth.
b) between the phases.
c) between phases and neutral.

iii) Routine test as per IS & Heat run test (type test) shall be carried out on the panel.

If the result of inspection and tests are not satisfactory, the defects shall be rectified and tests shall be repeated to entire satisfaction of engineer-in-charge/consultant without any extra charge to employer. The inspection and tests result shall be submitted in quadruplicate for engineer-in-charge/consultant's approval.

The tests shall be carried out as one panel of each different rating. The selection of the panel on which heat run test shall be carried out shall be decided by Engineer-in-charge.

Test certificate for all type test conducted on similar type complete switchgear assembly, relay and energy meter shall be submitted.

1.13 DRAWINGS :

The following shall be submitted for engineer-in-charge/consultant's approval before taking up the fabrication.

a) Complete assembly drawings of the switchgear showing plan, elevation and typical sectional view.
b) Foundation plan showing locations of channel sills, foundation bolts and anchors, floor plans and openings.
c) Complete terminal block details, showing ferrule numbers wire destinations.

The following shall be submitted on delivery of panels:

a) 4 Nos. of installation and operation manual
b) 4 Nos. of all approved drawings.
c) 6 Nos. of operating handle.
d) Reproducible drawing on Compact Disc.

1.14 PAINTING :

All steel work shall undergo a process of degreasing, pickling in acid bath, phosphatising & shall be subjected to seven tank process and then Powder coated with approved shade RAL 7032.

1.15 LABELS :

Engraved PVC/black anodised labels shall be provided on all the components.

AUTOMATIC POWER FACTOR CONTROL PANEL (APFC) WITH CAPACITOR BANK

1.1 SCOPE :

This specification covers supply, installation and testing of automatic power factor control panel (APFC) along with 415 Volts shunt capacitor bank. Associated minor civil works are included in the scope of this contract.

1.2 STANDARDS :

The design, manufacture and testing of automatic power factor control panel with shunt capacitor bank shall comply with the latest issue of the following standard:-

IS - 2834 : Specification for capacitor for power system.

1.3 CONSTRUCTIONAL DATA FOR APFC :

Sheet steel enclosed, free standing, APFC panel, suitable for top entry of cables, shall house the incoming MCCB, contactor, power factor correction capacitor, power factor measuring and controlling equipments, relays and associated control circuitry. The sheet steel enclosure shall be of minimum 14 SWG thick CRCA sheet.

By selection of 'mode selector switch (MSS)' in the panel it shall be possible to operate APFC either in 'auto mode' or full 'manual mode'.

For 'auto mode', 10/8 step power factor (PF) control relay unit to be provided in APFC incomer portion. This relay shall have following features :

Power factor indication, digital to indicate actual system power factor.

Power factor setting dial calibrated from about 0.85 lag to 0.85 lead.

Dead band feature (adjustable) to prevent hunting.

Under current blocking, to switch OFF all capacitors one by one and shutting down of relay, when load current is below 20% with appropriate indication available on the relay.

Low PF and high PF indication.

When the power factor falls below the setting, the capacitor bank shall be switched ON, in sequence at intervals of 4 to 8 seconds minimum and when the power factor rises above the setting, capacitor banks are switched OFF in sequence.

The sequence of switching ON and OFF shall be as follows :

Switching ON : Bank 1, 2, 3.....8, 9, 10

Switching OFF : Bank 1, 2, 3..... 8, 9, 10

The relay shall provide feature to provide an adjustable delay of about 0-120 seconds from changeover from 'capacitor OFF' signal to 'capacitor ON' signal, to

ensure the capacitor are fully discharged before they are switched in, to prevent dangerous transient over voltages.

The relay shall provide 'LED' indications, to indicate to the operator the full status of relay like auto-manual, load signal healthy and above the minimum operating threshhold, low and high power factor, lest mode, indication for the bank switched ON and any other 'LED' necessary for operator convenience and safe/proper operation.

The relay shall be flush mounting type on the APFC door and shall have conveniently removable transparent glass or acrylic cover, also avoiding inadvertent/unauthorised tampering of relay controls, once set.

If mode selector switch is kept in 'manual' mode it shall be possible to switch the capacitor banks ON and OFF in any sequence, through push buttons provided for each bank. Each bank shall also be provided with ON indication lamp. In the 'manual' mode the following features shall be present :

Between switching ON operation of banks there shall be time delay of about 70 seconds.

Similar time delay shall be present from bank switching OFF to bank switching ON to ensure full discharged capacitor condition, to prevent dangerous system disturbances.

The time delays as above shall be adjustable from 0-120 seconds.

A common indication lamp, 'ready for manual switching', dependent on the timer shall indicate to the operator the readiness of the bank for switching-ON.

The manual operation of APFC shall be available as described even in the case of failure of power control control relay.

An emergency, stay put type mushroom-head push button 'emergency OFF' shall be available to de-energise all the contactors and also switch-OFF the incoming MCCB both in auto and manual position of mode selector switch.

The control voltage of APFC shall be 240 Volts A.C/110V D.C.

HRC fuses shall be used in the control circuits for protection and isolation.

1.4. SAFETY ANNUNCIATION FEATURES OF APFC :

The APFC shall have the following :-

- Two tonne hooter
- Fault indication lamp
- APFC out of circuit indication lamp
- All located at the top portion of the panel.

If MCCB is kept OFF or trips during its operation, the hooter should come ON along with lamp and continue to operate till accept push button, present on the APFC, is pressed to cancel the audio/visual alarm.

However the APFC out of circuit lamp will continue to flash till the MCCB is closed and APFC is put in operation, drawing attention of operators to the situation.

The flashing feature is to be derived by adjustable cyclic timer - electronic type or electronic automation type AID CS-X, 0.6 seconds to 60 seconds set at 2 seconds.

Audio/visual annunciation facility with an electronic hooter and two lamps shall be provided as part of central control console. Necessary terminals in the APFC shall be foreseen for this purpose.

The RAP will be sheet metal fabricated wall mounting panel suitable for bottom entry of cables and is interconnected with APFC.

1.5. CONSTRUCTIONAL DATA FOR CAPACITOR BANK :

The capacitor banks shall be provided with suitable capacity as per S.O.Q.

Each capacitor unit shall be a three phase unit suitable for delta connections.

Each capacitor unit shall consist of capacitor elements connected in parallel. Each unit shall be protected by internal fuse.

The capacitor unit shall be housed on a leak proof bank.

The capacitor shall be MPP type or as per manufacturers standard material and then dried both under high degree of vacuum.

The capacitor unit shall be provided with the discharge resistors to reduce the phase voltage to 50 Volts within one minute.

Each capacitor unit shall be provided with 2 nos. earthing terminals.

The capacitor unit shall be banked together. They shall have common base frame and a cover shall be provided to prevent the accidental contact with the terminals.

Adequate space shall be provided for connecting each capacitor unit.

Each capacitor unit shall be provided with a rating plate.

The capacitor unit shall be suitable for indoor application.

Electromechanical relays used shall not be plug in type.

1.6 INSPECTION :

Inspection shall consist of the following, but shall not be limited to the same -

Appearance and construction.

Dimensions, mounting details.

Leakage container and at the bushing.

1.7 TESTS :

The following routing tests shall be carried out as per IS-2834.

- Test for output and capacitance.
- Voltage test between terminal and container (for capacitor unit).
- Voltage test between terminal and earth (for capacitor bank).
- Insulation resistance test.
- Test for efficiency of discharge device.

If the results of the inspection and tests are not satisfactory, the defects shall be rectified and tests shall be repeated to the entire satisfaction of department without extra charges whatsoever.

The inspection & test results shall be submitted in quadruplicate for Department's approval.

1.8 DRAWINGS:

The following shall be submitted in quadruplicate for E-I-C's approval :-

Guaranteed technical particulars for capacitors.

Dimension drawings and foundation details.

Test certificate for type tests.

1.9 PAINTING :

All steel work shall undergo a process of degreasing, pickling in acid bath, phosphatising & shall be subjected to seven tank process and then Powder coated with approved shade RAL 7032

1.10 ERECTION :

Capacitor banks shall be installed in inside the APFC panel (Automatic Power Factor Correction) in such a way that there is a adequate dissipation by radiation and convention of the heat produced by the capacitor losses. The oil leakage shall be checked and insulation resistance shall be measured. The test for the effectiveness of the discharge device shall also be carried out.

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EARTHING

1.1 SCOPE :

The scope of work under this section covers the earthing of various panels, distribution boards and utilisation equipments.

1.2 STANDARDS :

The following standards and rules shall be applicable -

IS – 3043 (latest) : Codes of practice for earthing.

Indian Electricity Act 1910 and rules issued there under.

1.3 PLATE ELECTRODES :

Plate type earth electrodes shall be provided at the location shown on drawing. The plate size shall be 600 mm. x 600 mm. x 3.15 mm. tinned copper plate / 600 mm. x 600 mm. x 6.3 mm. G.I. plate or as specified in bill of quantities. The minimum depth, type of electrode, soil treatment shall be in accordance with IS-3043 (latest) complete with masonry watering pipe, GI cover etc. The number of earthing stations shall be as shown on the drawing and as directed consultant.

1.4 EQUIPMENT EARTHING :

Three phase motors and other three phase apparatus shall have two distinct earth connection of size equal to 50% of the connecting cables.

For 1HP motor and 1HP apparatus, the single earth connection shall be provided.

For all light fittings and fans, a single earth connection with 1.5 sq. mm. copper shall be provided.

1.5 EARTH CONTINUITY CONDUCTOR :

Metalic conduit shall not be accepted as an earth continuity conductor. A separate copper earth continuity conductor of size of 50% of phase conductor or 14 SWG copper wire whichever is more shall be provided.

The earth continuity conductor shall be clamped to the conduit at one meter intervals using approved copper earth clamps. Binding wire is not accepted as a substitute for earth clamps.

1.6 SIZE OF COPPER STRIPS/WIRES FOR EARTHING :

Earthing of cable boxes shall be carried out as under :-

Sr.No.	Size of cable	Size of tinned copper strips/wires
1.	a) 10 sq. mm. 4 core b) 16 sq. mm. 4 core c) 25 sq. mm. 3.5 core d) 35 sq. mm. 3.5 core	2 nos. of 8 SWG tinned copper or 2 nos. of 4 SWG G.I.
2.	a) 50 sq. mm. 3.5 core b) 70 sq. mm. 3.5 core c) 95 sq. mm. 3.5 core	2 nos. of 4 SWG tinned copper or equivalent G.I. wire
3.	a) 120 sq. mm. 3.5 core b) 150 sq. mm. 3.5 core c) 185 sq. mm. 3.5 core	2 nos. of 25 x 3 mm. tinned copper or 2 nos. of 50 x 3 mm./25 x 6 mm G.I.
4.	a) 225 sq. mm. 3.5 core b) 300 sq. mm. 3.5 core c) 400 sq. mm. 3.5 core d) 500 sq. mm. 3.5 core	2 nos. of 25 x 6 mm. tinned copper or 2 nos. of 25 x 12 mm./50 x 6 mm G.I.

Earthing of following equipments shall be done with two number copper strips of size specified in schedule from ring main earthing tapped at different places.

1. H. T. switchgears
2. L. T. switchgears and panels
3. Transformers.

1.7 GROUNDING EQUIPMENTS :

Ground wire/strip shall either terminate on ground lugs provided on the equipments or shall be fastened to the foundation bolt and the frame of equipment.

All conduits shall be grounded with approved proper size of earthing wire/strips as requested.

Ground wires terminating at every equipment shall have certain flexibility in its connection to the equipment.

Suitable size of sleeves required in the wall, column etc. taking earth strips across them shall be provided by the contractor during the civil construction. After laying the earth strip, the sleeve shall be properly sealed.

1.8 ERECTION :

Joints :

The joint of earthing conductor shall be brazed, bolted or welded. Welded surfaces shall be painted with red oxide and then aluminium painted.

Termination :

Where the diameter of the bolt at the joints exceeds one quarter of the width of the earth continuity, the connection shall be made with a wider piece sandwiched between two conductors.

1.9 Supply And Installation Of Earthing System :

All medium voltage equipment shall be earthed by two separate and distinct earth connection using tinned copper/GI earth wire/strip of specified gauge.

All conduits run for lighting & receptacle system shall be provided with continuous earth wire of 14 SWG tinned copper run along the conduit and connected to all lighting/power receptacles of 5A and 15A. Three phase, 60 Amps receptacles and associated conduit run will be earthed by 2 nos of 8 SWG tinned copper conductors or equivalent G.I. Wires/strips.

Earthing conductors, tinned copper/G.I. Earthing clamp and all other accessories required for earthing the lighting and receptacle system, conduit accessories and equipment as per drawings and specifications shall be supplied and installed by the contractor. Earth wires shall be protected against mechanical damage and possibility of corrosion particularly at the point of connection to the earthing terminals of panels and fitting.

All joints shall be made on tinned surfaces in case of copper earth system jointing earth wire shall be done only at junction boxes and equipment earthing terminals. The jointing on earth wires shall be done with approved type of connection & no twisted joint will be allowed.

The whole metallic conduit system shall be electrically continuous through out and shall be permanently and efficiently connected to earth. When earth wire runs along the conduit the earth wire shall be clamped to the conduits securely on either side of the joint to ensure electrical continuity in the conduit system.

All non-current carrying metal parts of panels, lighting fixtures, junction boxes etc. shall be efficiently connected to earth.

1.10 SITE TEST :

The following earth resistance values shall be measured with an approved earth megger and recorded.

i) Each earthing station

ii) Earthing system as a whole

iii) Earth continuity conductors

1.11 MODE OF MEASUREMENT :

Providing an earthing station complete with excavation electrode watering pipe, soil treatment, chamber etc. shall be treated as one unit of measurement.

The following items of work shall be measured and paid at unit rate covering the cost of the earth wires/strips, clamps, labour etc :-

- Main equipment earthing grid and connection to earthing station.
- Connection to power panels, distribution boards etc.

The cost of earthing the following items shall become part of the cost of the item itself and no separate payment for earthing shall be made :-

- Light fittings -form part of installation of light fitting.
- Conduit / PVC casing & capping - should form part of the wiring of cabling.
- Cable glands earthing

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PREFERRED MAKES OF MATERIAL

Sr. No.	Description	Preferred makes
1.	Oil filled Transformer	ABB/ Voltamp / Kirloskar Electric/ EIC Approved
2.	LT Cable	Universal / KEI / Polycab / Finolex
3.	Cable glands	Braco / Comet
4.	Cable Socket (Lugs)	Dowells
5.	Terminal Strip / Connector	Connectwell / Elmex
6.	LT Panel	Technocraft / S K Engineers / Utkal Electrical / Equivalent CPRI Certified
7.	Air Circuit breakers	Schneider / Siemens / ABB
8.	MCCB	Schneider / Siemens / ABB / Legrand
9.	Switch Disconnector Fuse / Switch Disconnector / HRC fuses	Schneider / Siemens / ABB
10.	MCB / MCB type isolator / ELCB / Timers / DB's	Legrand / ABB / Schneider / Siemens
11.	Power / Control Air break Contactors	Schneider / Siemens / ABB
12.	Numerical / Static / Electromagnetic Relays	Areva / ABB / Siemens
13.	APFC Relay	Epcos / Beluke / Meher
14.	CT / PT	Kappa / AE / Pragati
15.	Digital Panel meters	Conzerv / AE / Rishab
16.	Annunciation Panel	Minilec
17.	Indication Lamps (LED Heavy duty type)	Siemens / Technik / Schneider
18.	Push Buttons	Siemens / Technik / Schneider
19.	Selector Switches	Kaycee / Siemens / Salzer
20.	Capacitors	Universal / Epcos / Meher
21.	Fire Extinguishers	Minimax / Ceasefire

NOTE :

1. In case, for any material, different makes as listed above, from that mentioned in the Schedule of Quantities, then the make mentioned in the Schedule of Quantities will only prevail and the Contractor will have to supply only that make mentioned in Schedule of Quantities.

2. If any make stated above, does not comply with the Technical Specifications given in the tender then such a make cannot be supplied at this project.

3. For items not covered in the above list, the sample shall be got approved by competent authority of department, prior to use.

Signature of Tenderer

Seal & Date

CERTIFICATE OF COMPLETION AND GUARANTEE

Electrical installation at: _____

Details to be indicated after completion of work.

Tests

i) Insulation resistance tests on individual equipments & completed & interconnected system.

ii) Earthing resistance of each earth station and interconnected system.

iii) Test results of all equipments.

1 **CERTIFICATES**:

I certify that the installation detailed above has been inspected and tested and that to the best of my knowledge and belief it complies with the latest edition of the Indian Electricity Rules and the relevant I.S. code of practices at the date of contract for the work except as stated below.

2 Details of departures (if any) from the above.

3 6 Sets of completion drawings & test reports and original tracings with CD showing the installation of as actually executed are enclosed duly certified.

4 The installation is guaranteed for a period of twelve months from the date of taking over by the Department against defective materials and workmanship. During the period of guarantee such defects in materials and workmanship will be rectified or replaced free of cost to the Department. The completion certificate for a particular system will be issued by the Department only on its satisfactory commissioning and the guarantee period for that system will start only from the date of the said certificate.

Signature of Contractor

Date:-

Schedule of Quantities supply, installation & commissioning of 500 KVA 11/0.4 KV Sub-station including LT Panel & other misc items at CIPET:SARP-LARPM, Bhubaneswar					
SL. NO.	**DESCRIPTION OF ITEM**	**UNIT**	**QTY**	**RATE (RS.)**	**AMOUNT (`)**
The scope of below mentioned works includes load application, load sanction, drawing/scheme approval from local Authority i.e CESU and Electrical Inspectorate along with energization of the sub-station.					
1	Supplying , installation, testing and commissioning of 11KV DP Structure with 2nos 9 mtr long 150x150mm RS joist pole with X arm bracings of 75X 40mm MS Channels , clamps , insulators, Lightning Arrestors, AB switch , Earthing Switch , HG Fuse , Guy Sets , Earthng , Danger Boards , Painting , accessories , fittings, hardwares etc. as required with Trivector Meter complete with C.T & P.T along with T.P Box .	Set	1		0.00
2	Supplying installation testing and commissioning of 500 KVA 11KV/.433 KV, 3 Phase, 50Hz, Dyn 11, oilcooled ONAN type, copper wound transformer with Off load tap changing arrangement on HV side in steps of +/- 2.5%, +/- 5% & - 7.5%, having cable termination bush on HT side and Terminal Box on LT side complete with buchholtz relay, all accessories i/c first filling of filtered dehydrated oil and confirming to IS 2026 & as per specification attached complete in all respects as required (to be installed indoor). The total loss at 100% loading shall not exceed 5500 Watt. The scope includes approval from local Authority and Electrical Inspectorate.	Set	1		0.00
3	Supplying installation testing and commissioning of extendable, compartmentalised, front operated , back openable, LT cubicle panel having ingress protection of IP 54, suitable for operation on 415 Volt 3 phase 50 c/s power supply fabricated out of 2 mm thick CRCA sheet steel and base channel of MS section not less than 100mmX50mmX5mm, gland plate of 3 mm thick cleaned and treated in 7 tank process and powder coated with approved shade with 4 nos Electrolytic copper busbar suitable to withstand 25 MVA fault lavel complete with supplying & installation of following equipment including interconnection, control wiring etc as required. (All MCCBs shall have Icu = Ics, All MCCBs shall have microprocessor based release having breaking capacity of35 KA. All MCCBs shall have motorised rotary handle and RS 485 port compartible for PLC) The scope includes approval from local Authority and Electrical Inspectorate.				

	Outdoor Sub Station Panel				
3.1	800A Four pole MCCB (50kA) as incomer and Bus bar connection on outgoing side. R,Y,B Phase Indication lamp with control MCB -1 set **(for 500 KVA Transformer)**	Set	1		0.00
3.2	**MAIN LT Cum PCC Panel**	Set	1		0.00
	Incoming :				
	800A, 4P EDO ACB (50KA) with microprocessor based release/relay having variable range of overcurrent, short circuit and earth fault protection with time lag facility for each of the fault for achieving discrimination with ON ,OFF & TRIP Indication and Trip push button, castel key interlock -1 No as Transformer Incomers with Battery Charger.				
	400A, 4P EDO ACB (50KA) with microprocessor based release/relay having variable range of overcurrent, short circuit and earth fault protection with time lag facility for each of the fault for achieving discrimination with ON ,OFF & TRIP Indication and Trip push button, castel key interlock -1 No as D.G Incomers with Battery charger.				
	R,Y,B Phase Indication lamp with control MCB -2 sets.				
	0-800A Digital Ammeter , 100/5A Class-1.0, 15VA CTs-2 Sets.				
	0-500V Digital Voltmeter with control MCB -2 sets.				
	Outgoing :				
	400A 4P MCCB (36KA) with ON , OFF & TRIP Indication -4 sets				
	250A 4P MCCB (36KA) with ON , OFF & TRIP Indication -4 sets				
	63A 4P MCCB (25KA) with ON , OFF & TRIP Indication -4 sets				
3.3	**APFC Panel** of 105 KVAR with 3 Phase Intelligent Power factor correction relay with inbuilt metering features like: 8 Steps Relay, Total Current, Voltage , Power Factor ,Current of each bank and 1 No. Off delay timer for manual operation	Set	1		0.00
	Incoming :				
	250 A, TP ,36 KA, MCCB of capacitor duty with inbuilt Micro Processor based releases.with 1Nos 800/5 CT, Control relay- 1 Set.				
	R,Y,B Phase Indication lamp with fuse-1 set.				
	0-500V Digital Voltmeter with control MCB -1 set.				
	Outgoing :				

	25KVAR Capacitor bank, MPP (Heavy duty) with 7% detuned reactor with 1 No. TP, MCCB of capacitor duty 35KA for 25KVAR Bank along with:-3P capacitor duty contactor with 2 NO + 2 NC auxiliary contacts for 25KVAR capacitor ,A/M Selector switch ,Illuminated ON/OFF Push buttons -1 Set .				
	15KVAR Capacitor bank, MPP (Heavy duty) with 7% detuned reactor with 1 No. TP, MCCB of capacitor duty 35KA for 15KVAR Bank along with:-3P capacitor duty contactor with 2 NO + 2 NC auxiliary contacts for 15KVAR capacitor ,A/M Selector switch ,Illuminated ON/OFF Push buttons -4 Set .				
	10KVAR Capacitor bank, MPP (Heavy duty) with 7% detuned reactor with 1 No. TP, MCCB of capacitor duty 35KA for 10KVAR Bank along with:-3P capacitor duty contactor with 2 NO + 2 NC auxiliary contacts for 10KVAR capacitor ,A/M Selector switch ,Illuminated ON/OFF Push buttons -1 Set .				
	5KVAR Capacitor bank, MPP (Heavy duty) with 7% detuned reactor with 1 No. TP, MCCB of capacitor duty 35KA for 5KVAR Bank along with:-3P capacitor duty contactor with 2 NO + 2 NC auxiliary contacts for 10KVAR capacitor ,A/M Selector switch ,Illuminated ON/OFF Push buttons -2 Sets .				
4	Supplying of armoured, Aluminium conductor XLPE power cable of 1.1 KV grade confirming to IS 7098(Part II) amended upto date as per the following size: -				
4.1	3.5 C X 300 sq.mm	Mtr	90.00		0.00
4.2	3.5 C X 240 sq.mm	Mtr	40.00		0.00
4.3	Laying of one number PVC insulated and PVC sheathed / XLPE power cable of 1.1 kV grade of following size direct in ground including excavation, sand cushioning, protective covering and refilling the trench etc. as required.				
	Above 185 sq. mm and upto 400 sq. mm	Mtr	25.00		0.00
4.4	Laying of one number PVC insulated and PVC sheathed / XLPE power cable of 1.1 kV grade of following size in the existing masonry open duct as required.				
	Above 185 sq. mm and upto 400 sq. mm	Mtr	105.00		0.00
4.5	Supplying and making end termination with brass compression gland and aluminium lugs for following size of PVC insulated and PVC sheathed / XLPE aluminium conductor cable of 1.1 kV grade as required.				
4.5.1	3½ X 300 sq. mm (70mm)	Each	2.00		0.00
4.5.2	3½ X 240 sq. mm (62mm)	Each	2.00		0.00

4.6	Excavation for cable trenches in soft soil, depth upto 1.2 m including dressing of sides lift upto 1.5 m, including getting out the excavated soil, refilling with sand and or good soil after laying of cable/ pipe etc. in layers of 20 cm, ramming, watering and disposal of surplus excavated soil as directed, within a lead of 50 meter.	Cum	25		0.00
4.7	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.	Cum	25		0.00
4.8	Providing 15mm thick cement plaster of mix 1:4 (1 cement : 4 fine sand) at all levels.	sqm	45		0.00
5.1	Earthing with G.I. earth pipe 4.5 meter long, 40 mm dia including accessories, and providing masonry enclosure with cover plate having locking arrangement and watering pipe etc. with charcoal/ coke and salt as required.	Each	5		0.00
5.2	Earthing with copper earth plate 600 mm X 600 mm X 3 mm thick including accessories, and providing masonry enclosure with cover plate having locking arrangement and watering pipe of 2.7 meter long etc. with charcoal/ coke and salt as required.	Set	2		0.00
5.3	Providing and fixing earth bus of 50 mm X 5 mm copper strip on surface for connections etc. as required.	Mtr	5		0.00
5.4	Providing and fixing 25 mm X 5 mm copper strip on surface or in recess for connections etc. as required.	Mtr	18		0.00
5.5	Supplying and laying 25 mm X 5 mm copper strip at 0.50 meter below ground as strip earth electrode, including connection/ terminating with nut, bolt, spring, washer etc. as required. (Jointing shall be done by overlapping and with 2 sets of brass nut bolt & spring washer spaced at 50 mm)	Mtr	12		0.00
5.6	Providing and fixing 25 mm X 5 mm G.I. strip in 40 mm dia G.I. pipe from earth electrode including connection with G.I. nut, bolt, spring, washer excavation and re-filling etc. as required.	Mtr	100		0.00
5.7	Providing and fixing 25 mm X 5 mm G.I. strip on surface or in recess for connections etc. as required.	Mtr	150		0.00
6	Supplying and fixing of non-skid rubber mat 16mm thick and 900mm width as required including cutting to required lengths of approved make with Test Certificates for L.T. panels.	Mtr.	20		0.00
7	Supplying and fixing of fire bucket painted red and duly filled with sand conforming to IS: 2546-1974.	Each	12		0.00
8	Supplying and fixing of MS stand suitable for supporting two buckets (Pedestal type)	Set	2		0.00

9	Supplying and fixing of MS stand suitable for supporting four buckets (Pedestal type)	Each	2		0.00
10	Supplying and fixing of shock restoration chart written in English and Hindi duly framed in as required.	Each	4		0.00
11	Supplying and fixing of carbon dioxide fire extinguisher type 4 kgs. Capacity of approved make with wall mounting bracket as required conforming to IS: 2878/1976 (Push type).	Each	4		0.00
12	Supplying and fixing of first aid box as approved complete with standard kit as prescribed by Indian Red Cross.	Each	1		0.00
13	Supply and fixing of H.T. Danger notice plate of 250x200mm made of mild steel at least 2mm thick and vitreous enameled white on both side with inscription in signal red colour on front side as required.	Each	4		0.00
14	Providing and fixing M.V. danger notice plate of 200 mm X 150 mm, made of mild steel, at least 2 mm thick, and vitreous enameled white on both sides, and with inscription in single red colour on front side as required.	Each	4		0.00
				GRAND TOTAL :	**0.00**