2000KVA, 11KV/415V Compact Substation

Specification and Scope of supply:

Design, manufacture and of Compact Substation of 11KV/415 Volts, equipped with 2000 kVA Cast Resin Transformer, 4 way 11kV Ring Main Unit consisting of 2 nos. 630A at 11kV fault making load breaking switch with **two** no tee-off as **SF6 insulated Vacuum Circuit Breaker** & with 3200A 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:** Four way 11KV Non-Extensible Ring Main Unit Compact switchgear consisting of 630 A two numbers fixed manual fault making / Load break Switches & two 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. Interconnection between RMU and transformer shall be using suitable Aluminum unarmored 1X3CX95 sq.mm or 3X1CX95 Sq.mm XLPE cable. Incomer / outgoing Load break switches shall be suitable for termination of 2run X 3C X 95 Sq.mm aluminum armored XLPE Cable. (HT 11KV Cable end termination kits shall be in vendor scope). Qty: 1 set	Vendor to confirm	
1.1	Make of HT switchgear: ABB/ Siemens/ Areva / Schneider make only.	Vendor to specify	
1.2	Make of relay to be used with VCB: Ashida / ABB / Areva / Siemens / Schneider make only.	Vendor to specify	
1.3	**HT Switchgear : Trf. Feeder Metering** Digital Multifunction Meter with A,V,KW,KWH,PF, Cl-0.5 with RS-485 Port (Conzerv-EM 6400) and 3 Nos 11KV Single core Ring type metering CTs with 150/1 A for each transformer feeder One no 3 phase, HT PT Panel common for the complete RMU with control MCB, 6A, SP-(MDS/L&T/GE/ABB)	Vendor to confirm	
2.0	**Transformer:** 2000 KVA, 11KV / 415V, DYn11, Air Natural cooling Cast Resin Dry Type Transformer with off circuit tap links 5% to -5% @ 2.5% on HT side of transformer with WTI Scanner (make: PECON Electronics model TR 7570) with Alarm and trip contact. Qty: 1 no	Vendor to confirm	
2.1	Make of the transformer. BHEL/ ABB/ Volt Amp/ Siemens/ Areva /OEM 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: (Inside CSS)** 415V indoor LV panel with Aluminum Bus bars, fabricated using CRCA sheet steel, Ingress Protection IP4X, Compartmentalized complete with internal wiring consisting of following. **Incomer/Alternate:** 3200 A, TPN, 415V, 3P, 50Hz, 50KA, Fixed manual type ACB with Microprocessor based O/L, S/C, E/F release. Rated Insulation Voltage U_i = 1000V, Utilization category = B Alternate LT Switchgear should be suitable for termination of 2run X 3 ½ C X 300 Sq.mm aluminum armored Cable. Qty: 2 sets (one for incomer from Transformer and other for Alternate supply)	Vendor to confirm	
3.1	Make of the ACB - L&T – C Power/ Siemens-3WT / GE-Sectronics/ABB/ Schneider /Areva make only.	Vendor to specify the make offered	
3.2	**LV Switchgear : Metering (for Incomer & Alternate)** Digital Multifunction Meter with A, V, KW, KWH, PF, Cl-0.5 with Port (Conzerv-EM 6400) – 2 Nos. LT Metering CT's – 3 Nos, 3200/1A, Cast Resin Type, Cl - 0.5, R, Y, B, ON, OFF LED Indicating Lamps - 5 Nos. (Make-Technic/Vaishno/STS/Rep.) Control MCB, 6A, SP - As required(MDS/L&T/GE/ABB)	Vendor to confirm	
3.3	**LV Switchgear : Outgoing (Inside CSS)** **630 A,TPN** ,415V, 3P, 50Hz, 35KA, Fixed manual type MCCB with **Microprocessor based O/L,S/C & E/F release**. Digital Multifunction Meter with A,V,KW,KWH,PF, Cl-0.5 with Port (Conzerv-EM 6400) for each outgoing feeder Rated Insulation Voltage U_i = 1000V, Utilization category = B LT Metering CT's, Cast Resin Type, 600/1A, Cl-0.5 (Matrix/AE/G&M Make). Control MCB, 6A, 4P-As required(ABB/MDS/L&T/GE) Outgoing MCCBs of LT Switchgear should be suitable for termination of 2runs X 3 ½ C X 300 Sq.mm aluminum armored Cable. Qty - 6 Nos	Vendor to confirm	
4.1	Make of the ACB - L&T – C Power/ Siemens-3WT / GE-Sectronics/ABB/ Schneider /Areva make only.	Vendor to specify the specific make offered	
4.2	**LV Switchgear : Metering (for Incomer & Alternate)** Digital Multifunction Meter with A, V, KW, KWH, PF, Cl-0.5 with Port (Conzerv-EM 6400) – 2 Nos. LT Metering CT's – 3 Nos, 3200/1A, Cast Resin Type, Cl - 0.5, R, Y, B, ON, OFF LED Indicating Lamps - 5 Nos. (Make-Vaishno/STS/Rep.) Control MCB, 6A, SP - As required (MDS/L&T/GE/SCHNEIDER/ABB)	Vendor to confirm	

4.3	**<u>600KVAR APFC Panel (To be mounted outside the CSS)</u>** **Incomer-Directly connected to the 3200A O/G of Main LT Panel** **14 Step Single Phase APFC Relay-1 No.(L&T/Neptune / ABB Make)** **CT for APFC Relay-3200/1A, Cl-1(to be mounted on Trf. secondary side)-1 No.(Matrix/AE/G&M Make**) Timer- 1no.(GIC/Selectron Make) Control MCB, 6A, SP - As required **<u>Outgoing</u>:-** 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-Epcos/Neptune/Matrix/ABB) Control MCB, 6A, SP-As required(MDS/L&T/GE/ABB)	Vendor to confirm and specify make offered	
5.0	**Enclosure:** 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 polyurethene 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	Vendor to specify the actual degree of protection.	
6.0	Interconnection between HT switchgear & Transformer using XLPE cable & Interconnection between Transformer & LT switchgear using Aluminum busbars. Internal earthing connections by GI strips. Qty: 1 set	Vendor to confirm	
6.1	Dimension of the compact substation (approx.)	Vendor to specify	
7.0	1. Package Sub-Station shall be outdoor plinth mounted type. 2. Erection, Commissioning and Civil work for package substation is in the scope of BHEL. However the bidder shall furnish the foundation details.	Vendor to confirm	

	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 shall assemble the Compact substation at factory and no assembly of the same shall be allowed at site. 5. Vendor 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.		
8.0	**Pre-Dispatch Inspection**: Vendor shall offer for pre-dispatch inspection at vendor's works. Only after the equipments are cleared by BHEL in writing, the vendor can dispatch the equipment. Routine tests to be conducted and original test certificates to be submitted at the time of PDI.	Vendor to confirm	
9.0	**Pre- Qualification Requirements**		
9.1	Only those bidders who have supplied and commissioned same or higher capacity compact substation and working satisfactorily for at least two years after commissioning should quote.	Vendor to confirm & provide documentary evidence	
9.2	The bidder should be a HV (RMU) switchgear OEM.	Vendor to confirm & provide documentary evidence	
9.3	Information about the companies where same or higher size equipments have been supplied and certificate about satisfactory performance are to be submitted for qualification of the offer.	Vendor to confirm & provide documentary evidence	
9.4	The bidder should have supplied 100 nos of CSS of rating 1000 KVA or above in last 2 years. Out of which at least 10 nos should have been supplied to Govt / PSUs in last year.	Vendor to confirm & provide documentary evidence	
9.5	Bidder should have capacity to manufacture at least 50 nos CSS of rating 1000 KVA or above annually	Vendor to confirm & provide documentary evidence	
9.6	CSS should be temperature rise tested design of transformer with type test carried out by CPRI/ERDA/VOLTA/KEMA.	Vendor to confirm & provide documentary evidence	
9.7	Bidder should have annual sales of over Rs 15 Crores in last 3 years.	Vendor to confirm & provide documentary evidence	
9.8	At least 4 nos of Performance certificates of CSS of rating 1000 KVA or above, out of which 2 Nos of Performance certificate must be from Govt / PSU organization	Vendor to confirm & provide documentary evidence	
9.9	The Design for Internal arc fault shall be tested for 20KA as per IEC	Vendor to confirm & provide	

	61330/62271-202.	documentary evidence	
9.10	All the pre qualification requirements should be supported by documentary evidence failing which the bids will be out rightly rejected.	Vendor to confirm	
10.0	**Training**		
10.1	Two BHEL persons shall be trained at vendor's principles in the area of design, maintenance, and operation of Compact Substation for a period of 10 working days.	Vendor to confirm	
10.2	Air-fare, boarding & lodging for the trainees shall borne by BHEL.	Vendor to confirm	
10.3	Competent, English speaking experts shall be arranged by the vendor for satisfactory & effective training of BHEL personnel.	Vendor to confirm	
11.0	**Reverse Auction**		
11.1	BHEL reserves the right to finalize the tender through Reverse Auction. Non-acceptance of Reverse Auction, the offer is liable for rejection.	Vendor to confirm	
12.0	**Commissioning Spares**		
12.1	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	
13.0	**Documentation**		
13.1	Certified reports of all the tests carried out at the works shall be furnished in three (3) copies	Vendor to confirm	
13.2	Approved Drawings of CSS during pre-dispatch inspection shall be furnished in three (3) copies	Vendor to confirm	
13.3	O&M Manuals of CSS during pre-dispatch inspection shall be furnished in three (3) copies	Vendor to confirm	
14.0	**Guarantee**		
14.1	As per commercial terms and conditions	Vendor to confirm	
15.0	Bidder is required to select one 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 Incase the Bidder is offering a make other than those indicated, the offer is liable for rejection.	Vendor to confirm	

Annexure 1

Technical Specifications for the Compact Substation

1.0.0 **CODES & STANDARDS**:

1.1.0 All equipment and material shall be designed manufactured and tested in accordance with the latest applicable IEC standards. The 11KV Package Substation Design must be as per IEC 61330.

1.2.0 The Package Sub-station offered shall in general comply with the latest issues including amendments of the following standards.

Title	Standards
High Voltage Low Voltage Pre-Fabricated Substation	IEC:61330/62271-202
High Voltage Switches	IEC 60265
Metal Enclosed High Voltage Switchgear	IEC 60298/62271-200
High Voltage Switchgear	IEC 60694/62271-100
Low Voltage Switchgear and Control gear	IEC 60439/60947
Power Transformers	IEC 60076

2.0.0 **DESIGN CRITERIA**

2.1.0 Package Sub-station consisting of 4 way 11KV SF6 insulated Switchgear with 630A at 11KV vacuum Circuit Breaker + 11kV/415V, 2000KVA, DYn11 Transformer + LT 415V, 3200A ACB incoming with all connection, accessories, fitting & auxiliary equipment in an 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.

2.2.0 The prefabricated-package substation shall be designed for a) Compactness, b) fast installation, c) maintenance free operation, d) 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 continuous 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:

The Package substation shall be suitable for continuous operation under the basic service conditions indicated below

Ambient Temperature:	50 Deg C
Relative Humidity	up to 95%
Altitude of Installation	up to 1000m

The Enclosure of High Voltage switchgear-control gear, Low Voltage switchgear-control gear & Transformer of the package substation shall be designed for use under normal outdoor service condition as mentioned. The enclosure should take minimum space for the installation including the space required for approaching various doors & equipment inside.

3.0.0 **SPECIFICATION:**

3.1.0 The main components of a prefabricated package substation are Transformer, High-voltage switchgear-control gear, Low-voltage switchgear-control gear and corresponding interconnections (cable, flexible bus bars) & 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 IEC standards.

OUTDOOR ENCLOSURE:

3.2.0 **Outdoor enclosure**:

3.2.1 The enclosure shall be made of Sheet Steel tropicalized to local weather conditions.

3.2.2 The metal base shall ensure rigidity for easy transport & installation.

3.2.3 The protection degree of the Enclosure shall be IP54 for LT & HT switchgear compartment & IP23 for Transformer compartment. Proper / adequate ventilation aperture shall be provided for natural ventilation by way of Louvers etc.

3.2.4 The doors shall be provided with proper interlocking arrangement for safety of operator.

3.2.5 The H.V. & L.V. outgoing of the transformer are to be connected to Vacuum Circuit Breaker of 4 way 11kV RMU & incomer of the Low Voltage Switchgear by means of Aluminum Cables / Flexible Busbars.

3.2.6 **Internal Fault**: Failure within the package 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 highest practicable degree of protection to persons shall be provided. The Design for Internal arc fault shall be tested for 20KA as per IEC 61330/62271-202.

3.2.7 **Covers & Doors**: Covers & doors are part of the enclosure. When they are closed, they shall provide the degree of protection specified for the enclosure. Ventilation openings shall be so arranged or shielded that same degree of protection as specified for enclosure is obtained. Additional wire mesh may be used with proper Danger board for safety of the operator. 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 90^0 & be equipped with a device able to maintain them in an open position.

3.2.8 **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 Package 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,

3.2.9 There shall be an arrangement for internal lighting activated by associated switch for HV, Transformer & LV compartments separately.

3.2.10 **Labels**: Labels for warning, manufacturer's operating instructions etc. shall be durable & clearly legible.

3.2.11 Cleaning & Painting:
The paints shall be carefully selected to withstand tropical heat and rain. The paint shall not scale off or crinkle or be removed by abrasion due to normal handling.

11KV SF6 Non-extensible RMU Circuit Breaker:

3.3.0 **11KV SF6 RMU Circuit Breaker:** The requirement of 11kV Ring Main Unit SF6 Gas filled comprising of 4 panels as indicated below is as under.

3.3.1 **Panel No.1 & 4**: Manual operated Load break switch with integral earth switch having full making capacity shall be used for Incoming / outgoing cables.

3.3.2 **Panel No. 2 & 3**: Vacuum Circuit Breaker complete with operating mechanism, protection system and cable box.

3.3.3 The above breakers, Busbars should be mounted inside a robotically welded sealed for life, stainless steel tank. The tank should be filled with SF6 gas at adequate pressure.

3.3.4 The Circuit Breaker is required to control 11kV/415 volts distribution Transformer of rating 2000KVA and relay settings shall be selected accordingly.

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

3.3.6 **Ratings**: The busbars shall have continuous rating of 630 Amps. Circuit Breaker shall have a continuous rating of 630 Amps. in accordance with relevant IEC standard

3.3.7 **Breaking & Making Capacity**: Circuit Breaker shall be capable of having rupturing capacity of 20kA symmetrical at 11KV.

3.3.8 **Busbars**: Switchgear shall be complete with all connections, busbars etc. The continuous rating of copper busbars shall be 630 Amps and they shall be fully encapsulated by SF6 gas inside the steel tank.

3.4.0 **Switchgear:**

The SF6 RMU shall be sealed for life, the enclosure shall meet the "sealed pressure system" criteria in accordance with IEC: 298. There shall be no requirement to 'top up' the SF6 gas. 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.

3.4.1 Isolator (Load Break Switch):

The Isolators offered shall conform to IS: 4710/9920 as amended to date. The isolator shall be ON Load type, triple pole, spring assisted, hand operated, non-automatic type with quick break contacts and fault indication. 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.

3.4.2 Vacuum Circuit Breaker:

The Unit shall consist 630A Tee-off spring assisted three position, three pole circuit 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 CB 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.

The manual operation of the circuit breaker shall not have an effect on the trip spring. This should only be discharged under a fault (electrical) trip condition; the following manual reset operation should recharge the trip spring & reset the CB mechanism in 'main off' position.

Protection Relay: The CBS shall be fitted with self-powered relay inside the front cover to avoid any tampering. The relay should be 3 Over Current + 1 Earth Fault, fed by protection CTs mounted in the cable box.

3.4.3 **Cable Box**:

Every VCB shall be provided with suitable and identical cable boxes in front for connecting 2 runs of 3 core X 95 Sq.mm or 1 run of 1 Core X 500 sq.mm, 11kV cable from vertically below. The cable boxes shall be so located at convenient height to facilitate easy cable jointing work. The height available for cable termination should be minimum 500 mm. The Cable termination shall be done by Heat shrinkable Termination method so adequate clearances shall be maintained between phases for Termination. It shall be possible to terminate 2 runs of 3 Core X 95 sq.mm.

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

a) CB manual operating handle in the "OFF" position.
b) Each feeder Panel operating handle in 'Closed' 'Open" or 'Earth' position.

3.5.0 **Ratings**:

Non-Extensible ring main unit with VCB		
3.6.1	**Switchgear Data**	
a)	Service	Outdoor but inside Enclosure
b)	Type	Metal clad
c)	Number of phases	3
d)	Voltage	11000V
e)	Rated Frequency	50 Hz
f)	Rated Current	630 Amp
g)	Short Circuit rating	
	i) Breaking	20 kA rms
	ii) Short time withstand for 3 Sec.	20 KA rms
	iii) Rated S/c making	50 kA peak
h)	Short duration power freq.	28 kV
i)	Insulation Level	75 KV peak
j)	System Earthing	Solidly earthed at substation
3.6.2	**Breaker**	
a)	Type	Vacuum Breaker
b)	Rated voltage	11kV
c)	Breaking current	
	i) Load breaking	20 KA rms.
d)	Making current	50 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.
3.6.3	**Isolators**	
a)	Type	load breaking and fault making in SF6 tank
b)	Rated current	630 Amps.
c)	Rated breaking capacity	630 amps.
d)	Fault making capacity	50 KA peak
e)	No. of poles	3
f)	Operating mechanism	Operating handle with ON, OFF, Earth positions with arrangement for padlocking in each position.
3.6.4	**Busbars:**	
a)	Material	Copper
b)	Type	SF6 insulated
c)	Rated Current	630 Amps
d)	Short time rating for 3 Sec.	20 kA

11kV/415V, 2000kVA CAST RESIN DRY TYPE TRANSFORMER:

4.0 **Requirement**: 11000/415 Volt Cast Resin Dry Type 2000KVA, AN cooled transformer Suitable for installation at outdoor in Enclosure for Floor mounting.

4.1 **Voltage Ratio:** No load voltage 11000/415 volt within tolerance as stipulated in IS.

4.2 **Rating:** The transformer shall have a continuous rating as specified at any of the specified tapping position and with the maximum temperature Rise specified.

SPECIFICATION FOR 2000KVA CAST RESIN DRY TYPE TRANSFORMERS

Sr. No.	Descriptions	Unit	Specification
1	Service		Continuous
2	Type		Cast Resin Dry Type
3	Rating	KVA	2000
4	Rated frequency	Hz	50
5	Number of Phase		
	HV Side		3

	LV Side		3
6	Rated Voltage		
	HV Side	kV	11
	LV Side	kV	0.415
7	Vector Group		Dyn 11
8	Type of Cooling		AN (Air Natural)
9	Class of Insulations		Class F
10	Method of earthing-LV		Solidly Earthed
11	Duty		Continuous
12	Taps		
	a) Range	%	+ 5% to -5 %
	b) No. of Steps		Five
	c) In steps of		2.5
	d) Tapping provided on HV Side		Taps Provided on HV side
13	Tap Changer Type		By Off Circuit Tap Links
14	Reference Standards		IS 2026/IS 11171
15	Fittings and Accessories		
	a) Off circuit tap links		Yes
	b) 02 Nos. Earthing Terminal		Yes
	c) Rating and Diagram Plate		Yes
	d) Lifting Lugs for Complete Transformer		Yes
	e) Cover Lifting lugs		Yes
	f) Rollers		Yes

5.0 **L.T. Panel**

5.1.0 **System**:

a) **Nominal voltage**: 3 Phase, 415V, 50 Hz
b) **Neutral**: Solidly earthed at substation.
c) **Busbar**: Aluminum for 3200A

5.2.0 **Circuit Ways:**

3200A or higher, 3 Pole ACB, fixed Type with Over Current, short circuit and Earth Fault Releases (Microprocessor Based)

5.3.0 **Earthing**:

5.3.1 Earthing arrangement shall be provided for earthing each cable, PVC cable gland, neutral busbar, chassis and framework of the cubicle with separate earthing terminals at two ends. The main earthing terminals shall be suitably marked. The earthing terminals shall be of adequate size, protected against corrosion, and readily accessible. These shall be identified by means of sign marked in a legible manner on or adjacent to terminals.

5.3.2 Neutral bus bar strip shall be connected to Earthing terminal with help of GI strip of suitable capacity & nut-bolt arrangement.

ROUTINE TEST ON PACKAGE SUBSTATION:

6.0.0 **ROUTINE TESTS FOR THE PACKAGE SUBSTATION COMPLETELY ASSEMBLED:**

6.1.0 **Routine Tests**: The routine tests shall be made on each complete prefabricated substation.

a) Voltage tests on auxiliary circuit.
b) Functional test.
c) Verification of complete wiring.

6.2.0 **Test Certificates:**

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