Bharat Heavy Electricals Limited

(High Pressure Boiler Plant**)**
Tiruchirappalli – 620014, TAMIL NADU, INDIA
An ISO 9001 Company
CAPITAL EQUIPMENT / MATERIALS MANAGEMENT

ENQUIRY	Phone: +91 431 257 79 38 Fax : +91 431 252 07 19 Email : csguna@bheltry.co.in Web : www.bhel.com

	Enquiry Number:	**Enquiry Date:**	**Due date for submission of quotation:**
	2620800002	**21.01.2008**	**20.02.2008**
You are requested to quote the Enquiry number date and due date in all your correspondences. This is only a request for quotation and not an order			

Item	**Description**	**Quantity**	**Delivery (Item required at BHEL on)**
10	Compact Substation – 750 KVA as per the technical specification & commercial conditions applicable (to be downloaded from web site www.bhel.com or http://tenders.gov.in)	3 Set	25.08.2008

BHEL commercial terms & conditions with Price Bid and Bank Guarantee formats along with technical specifications can be downloaded from BHEL web site http://www.bhel.com or from the Government tender website http://tenders.gov.in (public sector units > Bharat Heavy Electricals Limited page) under Enquiry reference "2620800002".

Tenders should reach us before 14:00 hours on the due date Tenders will be opened at 14:30 hours on the due date Tenders would be opened in presence of the tenderers who have submitted their offers and who may like to be present	Yours faithfully, For BHARAT HEAVY ELECTRICALS LIMITED Manager / Capital Equipment / MM

750KVA, 11KV/415V Compact Substation

Specification and Scope of supply:

Design, manufacture and supply of Compact Substation of 11KV/415 Volts, equipped with 750kVA Cast Resin Transformer, 3 way 11kV Ring Main Unit consisting of 2 nos. 630A at 11kV fault making load breaking switch with one no tee-off as Vacuum Circuit Breaker for the primary side controls & with MV 1250A Air Circuit Breaker as secondary side control with MCCBs and Automatic Power Factor Controller 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:** Three way 11kV Non-Extensible Ring Main Unit Compact switchgear consisting of two nos. 630A at 11KV fault making/ load breaking switch and one number Fixed manual vacuum circuit breaker in SF6 insulated enclosure with self- powered relay having over current and earth fault protection. Interconnection between RMU and transformer shall be using suitable size Aluminium unarmored XLPE Cable. Incomer and outgoing LBS of HT Switchgear should be suitable for termination of 2 runs x 3C x 95 sq. mm aluminum armoured XLPE Cable. Qty: 1 set	Vendor to confirm	
1.1	Make and type number of the load break switches, vacuum circuit breaker, protection relay	Vendor to specify	
2.0	**Transformer:** 750 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 with Alarm and trip contact Qty: 1 no	Vendor to confirm	
2.1	Make of the transformer	Vendor to specify	
2.2	Impedance, no-load/ load losses, efficiency, temperature rise above ambient of winding of the transformer	Vendor to specify	
3.0	**MV Switchgear:** 415V indoor MV panel with Aluminum Bus bars, fabricated using 1.5/2 MM CRCA sheet steel, Ingress protection IP4X, complete with internal wiring consisting of following. **Incomer:** 1250 A, 415V, 3P, 50Hz, 50KA, Fixed manual type ACB with Microprocessor based release. **Outgoing:** 4 Nos. 630A, 3P, 36kA fixed Manual MCCB with thermal base release. Qty: 1 set	Vendor to confirm	

3.1	**PF Correction Capacitor:** Automatic Power Factor Correction capacitor rated for 250kVAr (25kVAr x 10 Nos. suitable for 415 system) controlled by an intelligent microprocessor based PF correction relay with 500A, 3P, 36kA MCCB with thermal base release as incomer. Qty: 1 set	Vendor to confirm	
3.2	Make and type number of the ACB and MCCB	Vendor to specify	
3.3	Make and type number of the Capacitor, PF controller, contactor	Vendor to specify	
4.0	**Enclosure:** Outdoor type enclosure having modular construction of Galvanised Sheet Steel. The degree of protection for HT & LT switchgear compartment & transformer compartment of the enclosure shall be minimum IP23. The enclosure exterior shall be painted with polyurethene paint/ powder coated and tropicalised to Indian weather conditions (Colour Light Grey & D.A.Grey). 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. Qty: 1 set	Vendor to specify the actual degree of protection.	
5.0	Interconnection between HT switchgear & Transformer using XLPE cable & Interconnection between Transformer & LT switchgear using copper busbars. Internal earthing connections by GI strips. Qty: 1 set	Vendor to confirm	
6.0	Dimension of the compact substation (approx.)	Vendor to specify	
7.0	1.Packge 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. 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 site if the same is dispatched in disassembled condition. 5. Vendor shall make necessary supervision at site free of cost during the time of commissioning CSS. 6. Required technical data sheet of the transformer, HV/ MV switchgear, relay, capacitor, PF controller, MCCB etc. should be	Vendor to confirm	

	furnished with the offer. 7. The transformer and HV/ MV breakers should be of reputed make acceptable to BHEL.		
8.0	Routine test to be conducted and original test certificate to be submitted	Vendor to confirm	
9.0	**Reference List/ Qualifying Condition**		
9.1	Only those vendors who have supplied and commissioned similar or higher capacity compact substation and working satisfactorily for at least one year after commissioning should quote.	Vendor to confirm	
9.2	Information about the companies where similar equipments have been supplied, certificate about satisfactory performance are to be submitted for qualification of the offer.	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
High Voltage Switches	IEC 60265
Metal Enclosed High Voltage Switchgear	IEC 60298
High Voltage Switchgear	IEC 60694
Low Voltage Switchgear and Control gear	IEC 60439
Power Transformers	IEC 60076

2.0.0 **DESIGN CRITERIA**

2.1.0 Package Sub-station consisting of 3 way 11KV SF6 insulated Switchgear with 630A at 11kV fault making, Load breaking switch with tee-off as 11kV Vacuum Circuit Breaker + 11kV/415V, 750KVA, DYn11 Transformer + LT 415V, 1250A ACB incoming with 4 MCCB Outgoings rated for 630A and 250KVAr (25 KVAr x 10 Nos.) APFC 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:	40 Deg C
Relative Humidity	upto 95%
Altitude of Installation	upto 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 tropicalised to local whether 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 appropriate one 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 3 way 11kV RMU & incomer of the Low Voltage Switchgear by means of Copper 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 shall be tested as per IEC 61330.

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 with Vacuum Circuit Breaker:

3.3.0 **11KV SF6 RMU with VCB:** The requirement of 11kV Ring Main Unit is as under.

3.3.1 SF6 Gas filled Non-extensible Ring Main Units with Vacuum Circuit Breaker comprising of 3 panels as indicated below:

3.3.2 **Panel No.1 & 2**: Isolator panel with one number SF6 insulated load- breaking fault making isolator switch with one cable box.

3.3.3 **Panel No.3:** Vacuum Circuit Breaker complete with operating mechanism, protection system and one number of cable box.

3.3.4 The above Isolators, breaker, 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.

3.3.5 The Vacuum Circuit Breaker is required to control 11kV/415 volts distribution Transformer of rating 750KVA and relay settings shall be selected accordingly.

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

3.3.7 **Ratings**: The busbars shall have continuous rating of 630 Amps. The isolator shall have a continuous rating of 630 Amps, Vacuum Circuit Breaker shall have a continuous rating of 200 Amps. in accordance with relevant IEC standard

3.3.8 **Breaking & Making Capacity**: The isolators shall be capable for breaking rated full load current. Vacuum Circuit Breaker shall be capable of having rupturing capacity of 20kA symmetrical at 11KV.

3.3.9 **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 **Isolator**:

The Isolators offered shall conform to IEC60129. The isolator shall be triple pole, spring assisted, hand operated, non-automatic type with quick break contacts. The operating handle shall have three positions 'ON', 'OFF' and 'EARTH' which shall be clearly marked with suitable arrangement to padlock in any position. A safety arrangement for locking shall be provided by which the isolator operation shall be prevented from 'ON' position to 'EARTH' position or vice versa in a single operation.

3.5.0 **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.

3.5.1 **Vacuum Circuit Breaker**:

The Unit shall consist 630A Tee-off spring assisted three position, three pole Vacuum 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 CB shall be fitted with self-powered relay inside the front cover to avoid any tampering. The relay should be 2 Over Current + 1 Earth Fault, fed by protection CTs mounted in the cable box.

3.5.2 **Cable Box**:

Every isolator shall be provided with suitable and identical cable boxes in front for connecting 3 core, 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 95 sq.mm three core XLPE cable.

3.5.3 **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.
c) Each isolator-operating handle in 'Closed', ' Open', or 'Earth' position.

3.6.0 **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 (isolator)
g)	Short Circuit rating	
	i) Breaking	20 kA rms for Breaker
	ii) Short time withstand for 3 Sec.	201 KA rms
	iii) Rated S/c making	52.5 kA peak for Breaker
h)	Short duration pwer freq.	28 kV
i)	Insulation Level	75 KVpeak
j)	System earthing	Solidly earthed at substation
3.6.2	**Breaker**	
a)	Type	VCB in SF6 tank
b)	Rated voltage	11kV
c)	Breaking current	
	i) Load breaking	21 KArms.
d)	Making current	52.5 KA peak
e)	Rated current	200 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	52.5 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: (If any)**	
a)	Material	Copper
b)	Type	SF6 insulated
c)	Rated Current	630 Amps
d)	Short time rating for 3 Sec.	-

11kV/415V, 750kVA CAST RESIN DRY TYPE TRANSFORMER:

4.0 **Requirement**: 11000/415 Volt Cast Resin Dry Type 750KVA, 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 750KVA CAST RESIN DRY TYPE TRANSFORMERS

Sr. No.	Descriptions	Unit	Specification
1	Service		Continuous
2	Type		Cast Resin Dry Type
3	Rating	KVA	750
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		Four
	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

5.2.0 **Circuit Ways:**

1 No. 1250A, 3 Pole ACB, fixed Type with Over Current, short circuit and Earth Fault Releases (Microprocessor Based)

4 Nos. outgoing, 3 Pole MCCB with releases rated for 630A.

250kVAr (25KVAr x 10 Nos.) Automatic Power factor correction capacitor with 500A, 3P, 36kA MCCB having thermal base release as incomer. Automatic PF control shall be made thro a Intelligent Microprocessor based power factor controller. The capacitors shall be of mixed di electric Super Heavy Duty capacitor rated for 525 Volts with Detuned harmonic suppression filters rated for 14 % of capacitive reactance for individual capacitor controls has to be provided. 63 Amps.Capacitor duty contactors for 25KVAR shall be provided for capacitor switching.

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.