

TECHNICAL SPECIFICATION FOR 11/ 0.433KV HIGH VOLTAGE/ LOW VOLTAGE COMPACT PRE-FABRICATED PACKAGED SUBSTATION

1.0 SCOPE

The specification covers design, manufacture, Testing, Inspection, Packing, Transportation and supply of 11/0.433 kV Packaged Substation with all safety accessories, tools and tackles. The substation shall be designed, manufactured and tested as per IEC-62271. The substation shall be tested for internal arc test.

Test methods of Pre-fabricated sub-station which are cable connected to be operated from inside or outside for alternating current of primary rated voltage 10KV to 13KV and for a transformer of maximum power 1000KVA for service frequencies. The Pre-Fabricated sub-station can be situated at ground level or partially or completely below ground level.

2.0 SYSTEM DETAILS

KPTCL Power is fed to Grid Substations at 66/11KV from the 220/66 and where it is stepped down to the primary distribution voltage of 11kV. BESCO distribute the power at 11 KV to consumers.

3.0 A. BILL OF QUANTITY

Each offer of Packaged Substations shall consist of

- a. 11 KV compact RMU Unit(1OD+2 VL-SF6/VCB type) --- 1 No.
- b. 11 / 0.433 KV, Distribution transformer --- 1 No
- c. Bus bar connection between LT terminal
of transformer to ACB and to MCCB --- 1 set
- d. Enclosure for entire sub station
- e. Exhaust fan for Transformer Compartment
- f. Provision for ETV Meter with CT & wiring
- g. MCCB/ACB details:

Sl.No	Transformer	No. of MCCB	Capacity of MCCB 4 pole 50KA, TM Based	Incomer for LT
1	100kVA Al. Winding	2	100A	250A MCCB, 50kA, 4 pole Fixed Type Micro Processor based
2	250kVA Al. Winding	3	250A	400A MCCB, 50kA, 4 pole Fixed Type Micro Processor based
3	500kVA Al. Winding	4	250A	800A ACB, 50kA, 4 pole Fixed Type Micro Processor based
4	800kVA Cu winding	6	250A	1250A ACB, 50kA Fixed Type 4 pole Micro Processor based
5	1000kVA Cu winding	6	2 x 400A 4 x 250A	1600A ACB, 50kA Fixed Type 4 pole Micro Processor based

B. SPARE

The bidder has to specify the list of recommended spare per packaged substation for a period of 2 years.

4.0 SITE CONDITION

The equipment covered under this specification is for **outdoor installation** and should be suitable for use at the sites in BESCOM jurisdiction for the prevailing climatic conditions.

a) TEMPERATURE: The reference ambient temperature is to be taken as 43.3°C as per IS 9676.

i) Maximum ambient air temp----- 50°C

ii) Maximum daily average ambient temp----- 40°C

b) RELATIVE HUMIDITY

i) Maximum ----- 100%

ii) Minimum ----- 10%

c) Average Annual rainfall ----- 750mm

d) Average no of rainy days/annum----- 50

e) Average no of thunderstorm days/annum----- 40

f) Altitude ----- Not exceeding 300 m

g) Rainy months ----- June to Oct

h) Wind pressure ----- 195kg/m² up to 30m elevation as per IS 875/75.

The atmosphere is heavily polluted, laden with mild acid and dust in suspension during the dry months and is subjected to fog in cold months. Heavy lightening occurs in the area during rainy months.

All equipments shall be designed to withstand seismic forces, corresponding to an acceleration of 0.1g.

5.0 DRAWINGS AND DOCUMENTS

Vendor shall furnish with the detail, as per “VENDOR DATA REQUIREMENT”, attached with the specification.

6.0 Manufacturers should submit item wise price bids as given below:

1. 11 kV compact RMU (SF6/VCB Type)
2. 100,250,500,800,1000kVA Transformer, Dyn11
3. Details of ACB & MCCB as per para 3.0
4. Insulated copper bus bar for LT connection between transformer secondary, ACB & MCCB.
5. Entire Enclosure
6. Commissioning at site
7. Packaged substation with oil cooled Transformer

7.0 INSTRUCTIONS TO BIDDERS

- 7.1 All equipment and material shall be designed manufactured and tested in accordance with the latest applicable Indian Standard, IEC standard and CBIP manuals.
- 7.2 The electrical installation shall met the requirement of Indian Electricity Rules as amended up to date relevant IS code of practice and Indian electricity act. In addition other rules of regulations applicable to the work shall be followed.
- 7.3 The high tension Switchgear, distribution transformer, LT Switchgear & its accessories offered shall in general comply to the following specification attached.
 - A. Specification for 11kV Non extensible compact RMU
 - B. Specification for Distribution Transformer
 - C. Specification for LT system
 - D. Specification for enclosure for package substation.

A. SPECIFICATION FOR 11 kV Non-Extensible Compact RMU

1.0 CODES AND STANDARDS

1.1 The equipment shall comply with the requirements of latest revision of following standards issued by BIS (Bureau of Indian Standards), unless otherwise specified.

IS 694:	PVC insulated cables for working voltages up to and including 1100V.
IS 722:	Integrating meters.
IS 1248:	Electrical indicating instruments.
IS 2071:	Methods of high voltage testing.
IS 2544:	Porcelain post insulators for systems with nominal voltage greater than 1000V.
IS 2705:	Current Transformer.
IS 3156:	Voltage Transformer.
IS 3231:	Electrical relays for power system protection.
IS 3427:	Metal enclosed Switchgear and Control gear for voltages above 1000V but not exceeding 11000V.
IS 3618:	Phosphate treatment of iron and steel for protection against corrosion.
IS 5082:	Material for data for aluminium bus bars.
IS 5578:	Guide for marking of insulated conductors.
IS 6005:	Code of practice of phosphating of iron and steel.
IS 9046:	AC conductors of voltage above 1000V up to and including 11000V.
IS 9920:	Switches and Switch isolators for voltages above 1000V.
IEC: 1330:	Specification for High Voltage Pre-
1995 IS: 14786/2000	Fabricated Sub-Station.
IEC:50 (441):1984	International Electro Technical
IS:1885 (Part 17)	Vocabulary (IEU) chapter 441 Switch gear, Control gear & fuses.
IEC: 298:1990:IS: 3427	AC metal enclosed Switch gear and Control gear for rated voltages above 1 KV and up to and including 52KV.
IEC: 364-4-441: 1992	Electrical installation of building.
Part 4	protection for safety, chapter 41 protection against electrical shock.
IEC:439-1:1992:IS:8623	Low voltage Switch gear and Control gear
(Part I)	assemblies Part-I, type tested and partially type tested assemblies.
IEC:466:1987:	AC Insulator-enclosed Switch gear and
IS:14659	Control gear for rated voltages above 1 KV and up to and including 38KV.
IEC:529:1989:	Degree of protection provided by
IS:12063	enclosures (IP code).

IEC:664-1,1992:	Insulators co-ordination for equipments with low voltage system Part-I, principles and tests.
IEC:694,1980:	Common clauses for high voltage Switch gear and Control gear standards.
IEC:947-1,1988	Low voltage Switch gear and Control gear
IS:13947 (Part I)	Part-I, general rules.
IEC:1180-1,1992	High voltage test Techniques for low voltage equipment Part – I, definition test and procedure requirement.
ISO:1052:1982	Steels for general engineering purposes.
ISO:1210:1992	Plastics determination of the burning behavior of horizontal and electrical Specimen in contact with small flame or ignition source.
IEC:694:IS:12729	Common clauses for high voltage Switch gear and Control gear standards.
IEC:298:IS:3427	AC metal enclosed Switch gear and Control gear for rated voltage above 1 KV and up to and including 52KV.
IEC:129	AC Switches and Earthing Switches.
IEC:265:IS:9920	Switches and dis-connectors (All parts)
IEC:801	Monitoring and Control.
IS:13118	High voltage AC circuit breakers.
IS/BS:5463	High voltage Switches.
IS/BS:5227	Metal enclosed AC Switch gear.
IEC:376	For SF6 Gas used for the filling of RMU.
IS 9921:	AC dis-connectors (isolators) and earthing Switches for voltage above 1000V.
IS 11353:	Guide for uniform system of marking and identification of conductors and apparatus terminals.
IS 12661:	HV motor starters.
IS 12729:	General requirements for Switchgear and Control gear for voltages exceeding 1000V.
IS 13118:	General requirements for circuit breakers for voltages above 1000V.
IS 13703:	Low voltage fuses.

1.2 In case of imported equipment standards of the country of origin shall be applicable if these standards are equivalent or stringent than the applicable Indian standards.

1.3 The equipment shall also conform to the provisions of Indian electricity rules and other statutory regulations currently in force in the country.

2.0 DESIGN CRITERIA

- 2.1** The 11KV Non-Extensible, Non-metering Switchgear shall be installed at Outdoor substation location along the ring main 11KV feeder system in BESCOM supply area. 11KV wing isolator Controls incoming/Outgoing feeder cables of the 11KV distribution system. Tee-off Vacuum/ SF6 Circuit Breaker shall be used to Control and isolate the 11KV/433V distribution transformer / HT Consumers connected through 11KV grade underground cable at distribution center.
- 2.2** 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.
- 2.3** 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.
- 2.4** The equipment offered shall be suitable for continuous satisfactory operation as per site condition specified else where.

3.0 SPECIFIC REQUIREMENT

- 3.1** The requirement of 11KV, 20KA SF6/VCB insulated Non-Extensible SF6 insulated Ring Main Unit is as under.
- a) Non-Extensible compact ring main unit suitable for Indoor/Outdoor installation shall consist of the following.
- i. Two numbers of 11KV, **630 Amps**, continuously rated fault making, load breaking Switches. These units shall be triple pole, SF6 Insulated, quick break type with spring charge stored energy mechanism for operation. It shall have arrangement for terminating up to 400sq.mm incoming and outgoing 11KV, 3C XLPE HT UG cables.
 - ii. One Tee-Off unit with 11kV, **200 Amps** Vacuum / SF6 Circuit Beaker (for Controlling transformer), load breaking and fault breaking type fitted with three 200 Amps continuously rated SF6 insulated busbar along with CT with combination for protection of transformer. It shall have arrangement for terminating up to 240sqmm 11KV, 3C XLPE HT UG cables.
 - iii. Providing **Right angled reusable boot** for terminations (3x3 nos.)

3.2 SYSTEM :

3.2.1 The system network is 11000 Volts, 3 phase 3 wires 50 cycles with neutral solidly grounded. The voltage and frequency are subject to variation as per statutory limits governed by Indian Electricity Rules 1956 with latest amendments in force.

a. GENERAL FINISH :

The equipment should be totally enclosed, metal clad, vermin and dust proof suitable for tropical climate use as detailed above. The body of the RMU Unit should be of **metalised cast resin tank /stainless steel** and should be **rust free**.

b. PAINTING:

The surface of all metallic parts shall be thoroughly cleaned, scrapped and degreased preferably by shot blasting or any other treatment. The exterior surface shall be given two coats of rust resisting red oxide primer conforming to IS 2074:1992 and final two coats of weather resisting battleship grey enamel paint. The paint shall withstand the operating conditions described above and equipment shall not show any sign of the rust formation.

c. RATING:

The busbar shall have continuous rating of **630 Amps**. The isolator should have continuous rating of 630 Amps and Vacuum / SF6 circuit breaker shall have a continuous rating of 200 Amps.

All connection including band joints for busbars etc shall be of ample cross section to cater the rated load current continuously and shall be suitable for short time rating of **20KA for 3 seconds**.

4.0 BREAKING AND MAKING CAPACITY :

- i. The Vacuum / SF6 circuit breaker shall be capable of having rupturing capacity of **350 MVA** symmetrical at 11000 Volts three phase. Symmetrical breaking capacity shall be **20 KA** and the making capacity of **50 KA** at 11000 Volts. The isolators shall be capable for breaking rated full load current and shall have fault making capacity of **50 KA peak**. In case of asymmetrical breaking capacity, DC component shall be indicated by bidder in the offer.

4.1 TYPE OF EQUIPMENT :

4.1.1 The equipment shall be compact, totally enclosed in as self contained self supporting, gas tight compartment, mounted on base frame or channels. The assembly shall be equipped with common power busbars, load break Switches and SF6/vacuum circuit breaker as specified in specific requirement as above. All medium voltage parts should be totally enclosed in an SF6 environment.

4.1.2 **BUSBARS:** The busbar shall be SF6 insulated type. The cross sectional area of the copper busbar and jointing accessories shall be stated in the tender.

(a) Isolator:

The isolators offered shall conform to IEC-265 IS-9920 (all parts) as amended to date. The isolator shall be SF6 insulated, triple pole, spring assisted hand operated type with quick break contacts. The isolator shall be contained in sealed SF6 enclosure made of stainless steel. SF6 gas pressure gauge shall be provided for pressure indication purpose.

- a) The operating handle shall have the 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.
- b) Integral cable test terminals for test plug with clear identification mark and with interlocked cover shall be provided. The interlocks shall be so arranged that, the cable test terminals will be accessible only in the “EARTH” position of the isolator.
- c) To facilitate testing of cables, it shall be possible to bring the isolator to OFF position while the test plugs are kept inserted, but operation to ON position shall be prevented so long the cable testing is in progress.
- d) The isolator shall be capable of breaking full load current and a fault making of 50 KA peak.
- e) Isolators: Isolators are to be operated manually.

(b) Vacuum / SF6 Circuit Breaker

4.2 The tee-off unit shall consist of 11KV, **200 Amps** VCB/ SF6 (for Controlling transformer), load breaking and fault breaking type fitted with three 200 Amps continuously rated SF6 gas insulated busbars and arrangement for cable to the primary side of the transformer.

4.3 The Tee-off circuit breaker shall be suitable for manual closing and opening.

4.4 The operating mechanism shall be direct hand operated trip free with a mechanically operated indicator, positively coupled to the operating mechanism to indicate whether the breaker is in the closed or in the open position.

4.5 Off load isolator shall have three positions i.e. ON, OFF & EARTH.

4.6 Voltage Indication: There should be arrangement to check whether the cable connecting to the isolator is live or not.

4.7 The tee-off unit shall be provided with accessories for tripping such as CT operated series trip coils for over current and earth fault protection.

- 4.8** Breaker shall be provided with a **shunt trip** coil suitable for **230VAC** supply.
- 4.9** Current Transformer: The Ratio of the CTs shall be suitable for Controlling transformer as specified in purchase enquiry. The VA burden of the CTs shall be sufficient to supply the energy required by the relay for normal operation and tripping of the circuit breaker.
- 4.10** Protection System: The protection system should be provided with the provision of suitable self-powered relays having scheme for both over current & earth fault. It must provide immediate protection and can detect faults instructing the circuit breaker to trip in less than 40ms.
- i. The protection system is a **self-powered relay which requires no external power source or batteries**.
 - ii. It must have improved operation and Control with the Relay settings clearly displayed on the front of the panel..
 - iii. It should have the provision for the trip test on circuit breaker. The 'trip inhibit' facility allows the Relay to be tested without tripping the circuit breaker. Secondary injection can also be carried out using conventional test equipments.

The free standing metal housing shall be designed to withstand internal pressure and external mechanical loads without distortion. Where required the SF6 gas insulated Switchgear housing shall have an over pressure relief device vented to the rear side of the equipment. An operating mimic diagram shall be provided on the front side of RMU. Each unit shall be provided with lifting facility of proven design for easy handling.

Isolator / Breaker ON-OFF, Earth, (230VAC space heater, thermostat Controlled) with heater ON/OFF indication & 'SF6 gas pressure low' indication etc. shall be provided.

Handle operated 'spring charged' mechanical operation shall be provided.

Local Control of Switch / isolator shall be possible.

Local operation selector Switch shall be provided.

SF6 Insulation: Switchgear housing shall be completely gas tight. In the power compartment, provision shall be made for filling up the gas at site.

A manometer should be provided to indicate the healthy state of SF6 gas pressure inside the tank. SF6 gas pressure inside the tank shall not be more than 1 bar at 20 Deg Centigrade.

5.0 OPERATION AND INTERLOCKING :

- 4.1 All operations shall be from front of the equipment via spring assisted mechanism. The Ring Main Unit and SF6/VCB for Tee-off should be provided with a series trip coil for tripping. It shall be possible to operate the Switches and circuit breaker manually and spring assisted mechanism shall ensure speed of operation of Switches.
- 4.2 Operation handle shall be considered as part of the unit and should be provided with each RMU.
- 4.3 Load break Switches and earthing Switches shall be fully interlocked to ensure that operation is carried out in correct sequence. Movement of operating handle against interlock shall not by any means originate, store or activate the energy mechanisms. Padlocking facility shall be provided for operation of load Switch and earthing Switch. Safety of operation shall be ensured by interlocks.
- 4.4 Simultaneously closing of the main Switch and earth Switch. This interlock shall be integral part of the operating mechanism. Also separate operating shafts shall be provided for operation of earthing Switch and main Switch for the same purpose.
- 4.5 The fully interlocked integral test facilities are to be provided underneath the units, so that access to the test terminals is achieved only by removal of a cover.
- 4.6 The SF6 insulated isolators and SF6/VCB breaker operating mechanisms shall be totally enclosed and self lubricating type. The manually operated handle shall be mounted in front of the isolators and so designed that the operation is complete by one movement without any undue strain on the operator.
- 4.7 All mechanical interlock shall be robust so as not to give any way during normal operation.
- 4.8 The tripping of breaker unit should be provided with push button.

6.0 SECONDARY WIRING:

- 5.1 The secondary wiring supplied for the equipment shall consist of non-deteriorating fire proof superior grade stranded copper PVC wires suitably colored and fitted with numbered ferrules at both ends. The cross section of the wires shall be 4 mm² for CT and 2.5 mm² for others. Following color codes shall be used for wiring.

C.T.: Red, Yellow, Blue, Black,
D.C. Circuit: Grey, Earth: Green,
A.C. Circuit: Black.

- 5.2 Wiring shall be terminated with ring type ferrules with ferrule numbers marked at both ends of wiring. CT wiring shall be marked with additional distinct Red tags on both ends. All secondary wiring shall be terminated by using reputed make terminal blocks.

7.0 EARTHING ARRANGEMENT:

- a) It shall be easily possible to test the cables including the Tee-off (in case of RMU) by a simple earthing arrangement. In case of breaker, the earthing shall be preferably accomplished through the circuit breaker and the tripping arrangements made inoperative if required.
 - b) Equipment earthing of copper strips of adequate size shall be provided.
 - c) A set of earthing and a set of three phase test bushings shall form an integral part of RMU and shall be all enclosed within an interlocked cover to prevent incorrect operation. The access of the test bushing shall be fully interlocked.
- 6.1 A mechanical 'ON/OFF' indicator shall be provided on SF6 insulated isolators and SF6/ VCB breaker to indicate whether Switch is ON or OFF.
- 6.2 SF6 insulated Switches shall be fitted with correct sequence device having "ON/OFF" and re-set and test position and shall have provision for padlocking **operating handle**.

7.0 CABLE BOXES

- 7.1 The isolators and SF6/VCB shall be provided with suitable and identical cable boxes for connection 3 core, 11KV XLPE cables of size up to 400 Sqmm approaching vertical from below. The cable boxes shall be so located at convenient height to facilitate easy cable jointing work.
- 7.2 The access for the isolator cable box shall be from side and the access for the Tee-Off SF6 / VCB cable box shall be from rear side and distanced of bottom level of wiping gland from ground shall be maintained at 310 mm (minimum).
- 7.3 The cable boxes shall be with detachable front cover for ease of termination & shall be interlocked with Switch position (i.e. when isolator is in Earth / OFF position).
- 7.4 The design of the cable box shall be such that any type of jointing methods such as heat shrinkable/push on type/cold shrinkable type termination's can be adopted.
- 8.0 Earthing: All ring main units shall have a special earth bar with a sectional area of not less than 100Sqmm run along the whole of metal enclosed Switch structure, each end being connected to the main earthing system where metal cases are used on instruments these shall be connected to this bar by conductors of not less than 16 mm² section.

- 8.1 All foundation bolts, nuts and washers necessary for installation shall be supplied by the manufacturer.
- 8.2 Removable eye bolts shall be provided to facilitate the handling of the RMU/tee-off unit/ SF6 isolators.
- 8.3 Labels: All RMUs shall be clearly labeled as required indicating where necessary their purpose and “ON” and “OFF” lettered on brass, ivory, enamel iron or other suitable materials.
- 8.3 Name plate.
Each RMU and its associated equipments shall be provided with a nameplate legible and indelibly marked with at least the following information.
- (a) Name of manufacturer
 - (b) Type, design and serial number
 - (c) Rated voltage and current
 - (d) Rated frequency
 - (e) Rated symmetrical breaking capacity
 - (f) Rated making capacity
 - (g) Rated short time current and its duration
 - (h) Purchase Order number and date
 - (i) Month and Year of supply
 - (j) Rated lighting impulse withstand voltage
 - (k) D.C. component of current.
 - (l) DTs Structure name, 11000Volts Dangers etc.

NOTE:

- i) The word rated need not appear on the name plate. Recognized abbreviations may be used to express the above particulars.
- ii) Whether the circuit breaker is fitted with closing/tripping devices necessitating an auxiliary supply shall be stated either on the circuit breaker name plate or any other acceptable position.

9.0 CORONA DISCHARGE:

The equipment shall be so designed that corona discharge would occur under conditions mentioned earlier in this specification.

10. RATINGS AND REQUIREMENT

	Non-Metering SF6 Insulated Ring Main Unit with SF6/VCB Breaker	
10.01	Switchgear Data	
a)	Service	Indoor
b)	Type	Metal clad
c)	Number of phases	3
d)	Voltage	11000V
e)	Rated Frequency	50 Hz
f)	Rated Current	630 Amps
g)	Short Circuit rating	
	Breaking Short time 3S	20 KA rms
h)	Insulation Level	75 KV peak
i)	System earthing	Solidly earthed at substation
10.02	Vacuum / SF6 Circuit Breaker	
a)	Type	SF6 / VCB encapsulated in SF6 Environment
b)	Rated Voltage	11kV
c)	Breaking Current	20 KA
d)	Making Current	50 KA peak
e)	Rupturing Capacity	350 MVA
f)	Rated Current	200 Amps
g)	No. of Poles	3
h)	Operating mechanism	Trip free & free handle type with mechanically operated indicator
10.03	Isolators	
a)	Type	SF6 insulated load breaking and fault making
b)	Duty cycle	-
c)	Rated current	630 Amps.
d)	Rated breaking capacity	630 Amps.
e)	Fault making capacity	50 kA peak
f)	Rupturing Capacity	350 MVA
g)	No. of poles	3
h)	Operating mechanism	Operating handle with ON, OFF, Earth positions with arrangement for padlocking in each position.
i)	SF6 tank	Tank with substantial stainless steel construction with SF6 pressure Gauge for indicator and filling arrangement.
j)	Interlocks	Suitable interlocks for: 1. Cable test terminals on the orifices will be accessible only in "Earth" position.

		2. Test plugs can be inserted and withdrawn only in the “Earth” position. 3. To prevent operation from “ON” position to “Earth” position or vice versa in a Single operation. 4. To bring isolator to “OFF” position with test plugs inserted but to prevent operation to “ON” position with test plugs inserted or test terminals kept open.
k)	Operation safety	Safety against explosion and fire hazards etc.
10.04	Busbars:	
a)	Material	Copper
b)	Type	SF6 insulated
c)	Rated Current	630 Amps
d)	Short time rating for 3 Sec.	20 kA
10.05	Cable Boxes	Vacuum / SF6 circuit breaker shall be provided with identical cable boxes for connecting 1 No. 11kV 3C, 70 to 300 mm ² XLPE/PILC cable
10.06	Current Transformer	
a)	C.T. Ratio	Shall be as furnished in Purchase order.
b)	Over current factor	To correspond to rupturing capacity of Switchgear.
c)	Class of Accuracy	5 P 20
d)	Rated Burden	2.5 VA
10.07	Configuration	3 function RMU loop in /loop out and tee off CB
10.08	Protection	
	a) Three phase over current and earth fault relay.	Self-Powered Relay

11.0 TESTS

11.1 Each type of H.V. Switchgear shall be completely assembled, wired, adjusted and tested at the factory as per the relevant standards and during manufacture and on completion.

11.2 ROUTINE TEST

The tests shall be carried out in accordance with IEC 60298 include but not necessarily limited to the following:

- i. Withstand voltage at Power Frequency for all current carrying parts including wiring
- ii. Measurement of resistance of the main circuit
- iii. Gas Leakage test
- iv. Withstand voltage on auxiliary circuits
- v. Operation of functional locks, interlocks, signaling devices and auxiliary devices
- vi. Suitability and correct operation of protections, Control instruments and electrical connections of the circuit breaker operating mechanism (PRIMARY & SECONDARY INJECTION)
- vii. Verification of wiring
- viii. Visual Inspection

Routine test shall be carried out on all equipment such as circuit breakers, current transformers, relays, meter etc. as per relevant standards.

11.3 TYPE TEST

The following tests shall be performed on a typical section of the bus assembly of each type of Switchgear. Units shall be type tested in accordance with IEC Standards 60056, 60129, 60265, 60298, 60529 and 60694.

- a) Impulse test with breaker inside the cubicle
- b) Temperature rise test with breaker inside the cubicle
- c) Short Circuit test with breaker inside the breaker
- d) Dielectric Tests
- e) Test of apparatus i.e. circuit breaker and earthing Switch
- f) Arc Fault test

The cost of such tests, if any, shall be quoted separately.

11.4 TEST WITNESS

All tests shall be performed in presence of owner's representatives, if so desired by the Owner. The Contractor shall give at least fifteen (10) days advance notice of the date when tests are to be carried out.

12.0 TEST CERTIFICATES

- 12.1 Certified reports of all the tests carried out at the works shall be furnished in three (3) copies for approval of the Owner.
- 12.2 The equipment shall be dispatched from works only after receipt of Owner's written approval of the test reports.
- 12.3 Type test certificate on any equipment, if so desired by the Owner, shall be furnished; otherwise the equipment shall have to be type tested, free of charge, to prove the design.

13.0 DRAWING APPROVAL

The bidder has to take the approval for the various drawings of the RMU unit including the protection scheme. The bidder has to provide us all relay characteristics.

13 MANUAL

The bidder has to provide the complete manual for the operation of the breaker.

B. SPECIFICATION FOR DISTRIBUTION TRANSFORMER

The bidder has to quote for the following types of distribution transformers. The transformer should be of

- I. **Star2 Rated, oil cooled, 11/0.433kV, 3Phase, 50Cycle, Distribution Transformer of rating 25/63/100/250/500 Aluminium Wound & 800/1000kVA copper wound.**

C.SPECIFICATION FOR LT SYSTEM

LT compartment shall be suitable to house following equipment,
Bus bar connection from transformer to LT ACB & MCCB

Sl.No	Transformer	No. of MCCB	Capacity of MCCB 4 Pole 50KA, TM Based	Incomer for LT
1	100kVA Al. Winding EEL-2	2	100A	250A MCCB, 50kA, 4 pole Fixed Type Micro Processor based
2	250kVA Al. Winding EEL-2	3	250A	400A MCCB, 50kA, 4 pole Fixed Type Micro Processor based
3	500kVA Al. Winding EEL-2	4	250A	800A ACB, 50kA, 4 pole Fixed Type Micro Processor based
4	800kVA Cu winding EEL-2	6	250A	1250A ACB, 50kA Fixed Type 4 pole Micro Processor based
5	1000kVA Cu winding EEL-2	6	2 x 400A 4 x 250A	1600A ACB, 50kA Fixed Type 4 pole Micro Processor based

Trivector meter(Provision- meter to be fixed by BESCOM)

CT for metering wiring for Trivector meter

CT for measuring the Current and voltage connection MFM

Cable glands for outgoing feeders

The design should comply with the following standards.

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

EQUIPMENT SPECIFICATION

1. Air circuit breaker (ACB)

These shall be fixed type with manually operated mechanism microprocessor based. The short circuit mechanism and breaking capacity as shall be supported by test certificate. The test certificates should be from CPRI / ERDA/any Govt. approved recognized test house / laboratory.

The circuit breaker shall be fitted with CT operated thermal overload and short circuit releases devices for current rating 800/1250/1600Amps.

- a) Overload releases should be settable from 50% to 100% of the rated current I_n .
- b) Ambient temperature compensated type and there should not be de-rating of ACB current carrying capacity at 40°C. The testing of ACB for the temperature rise shall be carried out by the manufacturer as per the prevailing, IS / IEC or any other international standards.
- c) ACB shall be provided with overload and short circuit release. Short circuit release should have settable value of 15kA to 25kA with a adjustable times having setting range of 40 – 460 m seconds, to have a proper co-ordination with short circuit release of outgoing MCCBs.
 - 1) 3 phase, 4 wire, neutral earthed having link arrangement.
 - 2) Rated current thermal current- 250/400/800/1250/1600Amps
 - 3) Service voltage - 415 volts
 - 4) No. of break / pole one
 - 5) Frequency - 50 c / s
 - 6) Rated insulation voltage - 1000 volts
 - 7) Rated short circuit breaking capacity
Rated services S/C breaking capacity I_{cs} (rms) – 50kA
Rated ultimate S/C breaking capacity I_{cu} (rms) – 50kA
 - 8) Break Time - less than 40ms
 - 9) S/C making capacity 1cm (peak) - 143kA
 - 10) Rated short time withstand current : I_{cw} 50kA for 1 sec.
 - 11) Suitable for outdoor installation.
 - 12) It shall conform to IS 13947/ pt.2 / 1993, IEC 60947-2&3 with latest amendment, if any.
 - 13) Performance category : Utilization category – B with operation cycle O – t – Co – t – Co.

- 14) The status of open and close shall be clearly visible.
- 15) The trip indication separated for overload and individual phase wise trip indication for short circuit to be provided.
- 16) The ACB shall have the provision to lock the operating mechanism in off position.
- 17) The operating mechanism should be form front and the compartment should have the degree of protection IP – 54.
- 18) Separator shall be provided between all phases inside. ACB enclosed to prevent travel of arc during short circuit.
- 19) The CTs mounted for thermal overload release shall have secondary winding inaccessible including tripping mechanism of O/L and magnetic releases to avoid tampering CTs should also have provision of separators.
- 20) Two nos. earthing bolts for propose of earthing of ACB may also be provided & suitable for G.I stay wire of size 7/ 10 SWG.
- 21) The bus bar size shall be confirming to relevant IS and the neutral bus bar shall be of same wire of size as phase bus bar and should be suitable for connecting neutral.
- 22) The ACB shall be tested in accordance with the provision of IS:13947– Part I or relevant IEC.

2. Moulded case circuit breaker (MCCB)

L.T. section with one MCCB/ACB as incoming and following outgoing MCCB feeders and with enclosure made of electronically Galvanized sheet (min 2 mm Thickness) with powder coated finish, Cu bus bar with LT Metering facility . IEC 60947-2.

Sl. No	Transformer	No. of MCCB	Capacity of MCCB 4 pole 50KA, TM Based	Incomer for LT
1	100kVA Al. Winding	2	100A	250A MCCB, 50kA, 4 pole Fixed Type Micro Processor based
2	250kVA Al. Winding	3	250A	400A MCCB, 50kA, 4 pole Fixed Type Micro Processor based
3	500kVA Al. Winding	4	250A	800A ACB, 50kA, 4 pole Fixed Type Micro Processor based
4	800kVA Cu winding	6	250A	1250A ACB, 50kA Fixed Type 4 pole Micro Processor based
5	1000kVA Cu winding	6	2 x 400A 4 x 250A	1600A ACB, 50kA Fixed Type 4 pole Micro Processor based

The MCCB should be suitable for connecting LT 3 ½ C x 400sqmm XLPE cable. Connection between transformer LT terminal to ACB and MCCB shall be through copper bus bars.

3. Interconnecting bus bar

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

Both horizontal and vertical bus bars, bus joints and supports shall be capable of withstanding dynamic and thermal stresses of the specified short circuit currents for 1 second. Only zinc passivated or cadmium plated high tensile strength steel bolts, nuts and washers shall be used for all bus bar, joints and supports. The short circuit capacity of the neutral bus bars shall be in line with IS: 13947.

The hot spot temperature of bus bars including joints at design ambient temperature shall not exceed 95°C for normal operating conditions.

The current rating of the bus bars shall be 250/400/800/1250/1600A for design ambient temperature at site conditions and for being inside the cubicle at fully loaded condition. The vendor shall suitably de-rate the nominal rating to suit the above condition.

All bus bars shall be insulated with heat shrink PVC sleeves of 1100V grade, red yellow and blue color shall be used for phase bus bars and black color shall be used for neutral bus bars. Removable type shrouds shall be provided for joints.

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

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

4. Tri-vector meter and CTs

Suitable cut out shall be provided on LT compartment for installing Tri-Vector meter (Tri-Vector meter and its details shall be provided by BESCOM). CT's 04 Nos. & potential connection for metering shall be provided in the LT compartment. The details are as under.

CT's with accessories: CT's of rating as specified below are to be provided, mounted on the Transformer L.T busbar.

Sl. No	Particulars	Requirement
1	100/250/500/800/1000kVA	250/5A,400/5A,800/5A,1250/51600/5Amps
2	Class of Accuracy	0.5
3	Burden	15 VA
4	Type	Resin Cast, Suitable for Outdoor use

The Secondary Terminals of the CT's shall be individually wired, using 2.5 sq mm flexible copper wires (with color coding, and ferrules at both ends) up to a Terminal block. Terminal Block shall be located, at a suitable height. The three phase voltages also are to be tapped from the L.T busbar and wired up to the terminal block. The C.T secondary shall be covered with sealable covers.

5. Auxiliary supply

3phase with neutral, 440V AC supply shall be tapped from main bus bar after the ACB for supply to exhaust fan, lighting of the substation and Control supply for RMU etc. Necessary protection in incomer and outgoing shall be provided.

D.SPECIFICATION FOR ENCLOSURE FOR PACKAGE SUBSTATION

The package substation shall have the following features.

1. Enclosure for the package substation shall be made of electronically galvanized sheets and MS sheets are not accepted.
2. Separate compartment for 11 kV Compact RMU, Distribution Transformer & LT Switchgear
3. Door of the HT and LT compartment shall be designed such as complete door is divided into minimum two fold / parts vertically for minimum space requirement while opening.
4. Painting shall be tested for radiation test.
2. The painting specification and color shade of the enclosure shall be approved by the BESCO.
3. There should be proper earthing arrangement for the entire substation i.e. 11 kV Compact RMU, Distribution Transformer & LT Switchgears along with the enclosures.
4. Design of Transformer Compartment shall be such to accommodate oil type 100/250/500/800/1000KVA transformers, and it shall be possible to interchange any of these transformer.
5. Barrier shall be provided between MCCB.
6. Non-metallic phase separator shall be provided between the three phases connected to MCCB.
7. Layout of package substation shall have approval of Chief Electrical Inspector. It is the responsibility of bidders to make changes as per the

- requirement of Chief Electrical Inspector, without any time and cost implication to the purchaser.
8. Suitable cut out shall be provided on LT compartment for installing Tri-Vector meter (Tri-Vector meter and its details shall be provided by purchaser).
 9. CT's & potential connection for metering shall be provided in the LT compartment.
 10. The Packaged Substation should have adequate arrangements of ventilation and should be inclusive of all safety accessories like voltage detection rod, fire extinguishers, gloves etc. Adequate illumination is to be provided for Packaged Substation. There should be provision for providing enclosure around the entire Packaged Substation. There should be barrier for RMU section, Transformer section and LT Switchgear section for safety purpose. There should be easy access to all these three compartments independently.
 11. The Packaged Substation should have ample arrangement to meet the requirements of protection of all electrical equipments. The clearances between live parts and minimum clearances to earth have to be maintained to the respective standards. The size of the substation should be compact to meet the traffic and road requirements.
 12. The bidder has to specify the total weight of the Packaged Substation.

RELAY CO-ORDINATION

Bidder shall ensure proper relay co-ordination between 11 kV RMU & LT ACB & LT MCCB and shall provide calculation in support of the same.

DIMENSION

The approximate base dimension for packaged substation shall be around **2 Mtr x 3 Mtr**. However depending upon the design of the bidder, the same may be reviewed.

GUARANTEED TECHNICAL PARTICULARS FOR 11KV Non-Extensible Compact RMU

The bidder should fill up Technical particulars of 11 kV panel in the following format)
Name of the Bidder:

Sr. No.	Description	RMU
1.0	SWITCHGEAR ASSEMBLY	
1.1	Make	
1.2	Type	
1.3	Reference Standard	
1.4	Voltage (Normal/Max.) kV	
1.5	Phase (Nos.)	
1.6	Frequency (Hz)	
1.7	Short Circuit Rating	
	a) Breaking Symmetrical (kA)	
	b) Breaking Asymmetrical (kA)	
	c) Short time for 1 Sec.	
	d) Short time for 3 sec.	
1.8	Insulation Level	
	a) Impulse Withstand (kVpeak)	
	b) 1 minute 50 Hz. Voltage Withstand (kVrms)	
1.9	Metal Clad Construction	Yes/ No
1.10	Degree of protection :	
1.11	Switchgear completely wire and tested at factory :	Yes/ No
2.0	CONSTRUCTION	
2.1	Overall Dimensions	
a.	Breaker	
	i) Length (mm)	
	ii) Breadth (mm)	
	iii) Height (mm)	
b.	Isolator	
	a)Length (mm)	
	2) breadth (mm)	
	3) Height (mm)	
c.	Total Non-Extensible 3 Panel RMU	
	1) Length (mm)	
	2) Breadth (mm)	
	3) Height (mm)	
2.2	Weight	
	a) Breaker (kg)	
	b) Isolator (kg)	
	c) Non-Extensible 3 panel RMU (kg)	

3.0	Bus Bar	
3.1	Make	
3.2	Material & Grade	
3.3	Reference Standard	
3.4	a) Cross Sectional area (m m ²)	
	b) Size (m m ²)	
3.5	Continuous Current	
	a) Standard	
	b) At site conditions and within cubicle	
3.6	Maximum temperature rise over ambient (c)	
3.7.	Short time current for 3 Sec. (KArms)	
3.8	Minimum clearance from bare bus bar connection	
	a) Phase to phase (mm)	
	b) Phase to earth (mm)	
3.9	Bus Bar provided with	
	a) Insulation Sleeve	
	b) Phase barriers	
	c) Cast Resin shrouds for joints	
3.10	Bus bar connection	
	a) Silver Plated	
	b) Made with anti oxide grease	
3.11	Bus bar support spacing (mm)	
3.12	Bus support insulators	
	a) Make	
	b) Type	
	c) Reference Standard	
	d) Voltage Class (kV)	
	e) Minimum creepage distance (mm)	
	f) Cantilever strength Kg/mm ²	
	g) Net Weight (kG)	
4.0	SF6 / VCB CIRCUIT BREAKER	
4.1.	Make	
4.2.	Type	
4.3.	Reference Standard	
4.4.	Rated Voltage	
4.5	Rated Frequency	
4.6	No. of Poles	
4.7	Rated Current	
	a) Normal (Standard) Amps	
	b) Derated (Site) Amps	
4.8	Maximum temperature rise over ambient °C	
4.9	Rated operating Duty	
4.10	Rupturing capacity at rated voltage (MVA)	
4.11	Breaking capacity at rated voltage & operating duty	

	a) Symmetrical (kArms)	
	b) Asymmetrical (kArms)	
4.12	Rated making Current (kA _{peak})	
4.13	a) Short time current for 1 sec. (kArms)	
	b) Short time current for 3 Sec. (kArms)	
4.14	Transient Recovery Voltage	
	a) Rate of rise (kV/ms)	
	b) Peak Voltage (kV)	
4.15	Insulation Level	
	a) Impulse voltage withstand on 1/50 full wave	
	b) 1 minute 50 Hz. Voltage withstand	
4.16	Maximum over voltage factor when Switching off	
	a) Un loaded transformer	
	b) Loaded transformer	
	c) Un loaded cables	
	d) Capacitors	
4.17	Opening time maximum No load condition (ms)	
4.18	Opening and closing time under SF ₆ gas loss or vacuum loss condition (ms)	
4.19	At 100% Breaking capacity	
	a) Opening time-Max. (ms)	
	b) Arcing time-Max (ms)	
	c) Total break time (ms)	
4.20	At 60% breaking capacity	
	a) Opening time-Max. (ms)	
	b) Arcing time-Max. (ms)	
	c) Total break time (ms)	
4.21	At 30% breaking capacity (ms)	
	a) Opening time-Max. (ms)	
	b) Arcing time-Max. (ms)	
	c) Total break time (ms)	
4.22	At 10% breaking capacity (ms)	
	a) Opening time-Max. (ms)	
	b) Arcing time-Max. (ms)	
	c) Total break time	
4.23	a) Make time (Max) (ms)	
	b) Total closing time (ms)	
4.24	Number of breaks per pole	
4.25	Total length of breaks per pole (mm)	
4.26	Total length of contact travel (mm)	
4.27	Speed of break (100% short circuit current)	
	Rate of contact travel	
	a) At tripping M/sec.	
	b) At closing M/sec.	
	No. of breaker operations permissible without requiring	

	inspection, replacement of contacts and other main parts.	
	a) At 100% rated current	
	b) At 100% rated breaking current	
	Type of contacts	
	a) Main	
	b) Arcing	
	Material of contact	
	a) Main	
	b) Arcing	
	c) Whether contacts silver plated	
	d) Thickness of silver plating	
	Contact pressure at No load (Kg)	
	Type of arc Control device provided	
	Operating mechanism-closing	
	a) Type	
	b) No. of breaker operations stored	
	c) Trip free or fixed trip	
	d) Anti pumping features provided	
	e) Earthing for operating mechanism and metal part furnished	
	f) Earth terminal size and material	
	Operating mechanism-tripping	
	a) Type	
	b) No. of breaker operations stored	
	c) Trip free or fixed trip (V)	
	d) Anti pumping features provided (%)	
	e) Earthing for operating mechanism and metal part furnished	
	f) Earth terminal size and material	
	1Spring Charging mechanism 2Make 3Type 4Size 5rating	
	Breaker suitable for capacity Switching Operating duty 4Max. rating of capacitor bank that can be safely Controlled	
	Tripping Coil	
	a) Voltage	
	b) Permissible voltage variation (%)	
	c) Tripping Current at rated Voltage (A)	
	d) Power at rated voltage (W)	
	e) 2-Over current trip with 1- earth fault furnished as specified.	

	Breaker/Accessories Accessories such as Control Switch indication lamps etc. furnished as specified: (Please attach separate sheet giving details of all accessories, inter locks and safety shutters)	
	a) Mechanical Safety Interlock	
	b) Automatic Safety Interlock	
	c) Operational Interlock	
	d) Emergency manual trip	
	e) Operation counter	
	f) Charge/discharge indicator	
	g) Manual spring charging facility	
	Impact load foundation design (to include dead load plus impact value on opening at maximum interrupting rating) (Kg	
5.0	Isolators	
5.1	Make	
5.2	Type	
5.3	Reference Standard	
5.4	Rated Voltage (KV)	
5.5	Rated Frequency Hz	
5.6	No. of Poles (No)	
5.7	Rated Current Normal (Standard) Derated (Site) Amp	
5.8	Maximum temperature rise over ambient °C	
5.9	Rated Operation duty	
5.10	Rupturing Capacity at rated voltage MVA	
5.11	Rated making current KA Peak	
5.12	Short time current a) for 1 Sec KA RMS b) for 3 Sec KA RMS	
5.13	Impulse voltage withstand on 1/50 full wave b) 1 minute 50 Hz voltage withstand	
5.14	Maximum over voltage factor when Switching off a) Loaded feeder cable	
5.15	Minimum SF6 Gas pressure required	
5.16	No. of isolator operation permissible without requiring inspection, replacement of contacts and other main parts At 100% rated current At 100% rated breaking current	
5.17	Isolator provided with the following Mechanical safety Mechanical ON, OFF , CABLE EARTH indicators Operation counter Manual spring charging facility	

5.18	Impact load for foundation design (To include dead load plus impact values on opening at maximum interrupting rating) Kg	
6.0	CURRENT TRANSFORMER	
6.1	Make	
6.2	Type & voltage level	
6.3	Reference standard	
6.4	C.T. ratio as specified	
6.5	Rated frequency	
6.6	Short circuit withstand Short time current for 3 Sec. KA RMS ii) Short time current for 5 Sec. KA RMS iii. Dynamic current kA peak	
6.7	Class of insulation	
6.8	Temperature rise over ambient ° C	
6.9	Basic insulation level	
6.10	For tripping CT Ratio Class of accuracy Rated burden VA Knee point voltage V Excitation current at $V_k/2$ Amps Rated saturating current Amp Over current rating Continuous % over load (%)	
7.0	Secondary Wiring	
7.1	Type and insulation	
7.2	Voltage grade	
7.3	Conductor material	
7.4	Conductor size (minimum) and insulation wiring	
7.5	Wires identified at both ends with markers	
7.6	Wiring and other accessories provided as per specification.	
8.0	CABLE TERMINATIONS	
8.1	Circuit Breaker Type Material Dimensions Size Height of cable box from ground level Arrangement for supplying bus end cable box furnished for extensible ring main unit Arrangement for mounting an extra cable box on each equipment furnished	
8.2	Isolator Type	

	Material Dimensions Size Height of cable box from ground level	
9.0	Name Plate	
9.1	Material	
9.2	Thickness	
9.3	Size for	
	a) Breaker cubicle	
	b) Instruments/devices	
10.0	Painting	
10.1	Finish of Breaker Inside outside	
10.2	Finish of Isolator Inside outside	
11.0	No. of Accessories Furnished	
	a) Earthing Equipment	
	b) Test Plug	
12.0	TESTS	
12.1	Reference Standard	
12.2	Routine tests to be performed on Switchgear	
12.3	Type Tests quoted	
13.0	Drawing/Data	
13.1	General arrangement for Panel Board	
13.2	Foundation plan	
13.3	SF6/VCB tripping & material schematic	
13.4	Bill of material	
13.5	SF6/VCB LT Panel Wiring Diagram	

**GUARANTEED TECHNICAL PARTICULARS FOR DISTRIBUTION
TRANSFORMERS**

SCHEDULE 'A' (To be furnished by the manufacturer)

Sl No.	Description	
1.	Make	

2.	Name of Manufacture	
3.	Place of Manufacture	
4.	Voltage Ratio.	
5.	Rating in kVA.	
6.	Core Material used and Grade.	
	a). Flux density.	
	b). Over fluxing without saturation (Curve to be furnished by the manufacture in support of his claim).	
7.	Maximum temperature rise of:	
	a. windings by resistance method	
	b. Oil by thermometer	
8.	Magnetising (no-load) current at:	
	a. 90%	
	b. 100%	
	c. 110%	
9.	Core loss in watts	
	a. Normal voltage	
	b. Maximum voltage.	
10.	Resistance of windings at 20°C (with 5% tolerance)	
	a. HV Windings (ohms).	
	b. LV Windings (ohms).	
11.	Full load losses (watt) at 75°C	
12.	Total Losses at 100% load at 75°C	
13.	Total Losses at 50% load at 75°C	
14.	Current density used for : (Amper/sqmm)	
	a. HV Winding	
	b. LV Winding	
15.	Clearances : mm	
	a. Core and LV	
	b. LV&HV	
	c. HV Phase to Phase	
	d. End insulation clearance to earth	
	e. Any point of winding to tank	
16.	Efficiency at 75°C	
	a. Unity P.F. and	
	b. 0.8 P.F.	
	1. 125% load	
	2. 100% load	
	3. 75% load	
	4. 50% load	
	5. 25% load	
17.	Regulation at:	
	a. Unity P.F. and	

	b. 0.8 P.F. at 75°C	
18.	% Impedance at 75°C	
19.	Flash Test:	
	(i) HV 28kV/50HZ for 1 minute	
	(ii) LV 3kV/50Hz for 1 minute	
20.	Over potential test (Double voltage and Double frequency for 1 minute)	
21.	Impulse test in peak kVA.	
22.	Mass of : (kg)	
	a. Core lamination (minimum)	
	b. Windings (minimum)	
	c. Tank and fittings	
	d. Oil	
	e. Oil quantity (minimum) (litre)	
	f. Total weight	
23.	Oil Data:	
	1. Qunatity for first filling (minimum) (litre)	
	2. Grade of oil used	
	3. Maker's name	
	4. BDV at the time of filling (kV)	
24.	Transformer:	
	1. Overall length x breadth x height (mm x mm x mm)	
	2. Tank length x breadth x height	
	3. Thickness of plates for	
	a. Side plate (min)	
	b. Top and bottom plate (min)	
	4. Conservator dimensions	
25.	Radiation:	
	1. Heat dissipation by tank walls excluding top and bottom	
	2. Heat dissipation by cooling tube	
	3. Diameter and thickness of cooling tube	
	4. whether calculation sheet for selecting cooling area to ensure that the transformer is capable of giving continuous rated output without exceeding temperature rise is enclosed	
26.	Inter layer insulation provided in design for:	
	1. top and bottom layer	
	2. In between all layer	
	3. Details of end insulation	
	4. Whether wedges are provided at 50% turns of the HV coil	
27.	Insulation materials provided	
	a. For conductors	

	1. HV	
	2. LV	
	b. For core	
28.	Material and size of the wire used	
	1. HV Dia (mm) SWG	
	2. LV a) Strip size	
	b) No. of conductors in parallel	
	c) Total area of cross section (sq.mm)	
29.	Whether the name plate gives all particulars as required in tender	
30.	Particulars of bushings HV/LV	
	1. Maker's name	
	2. Type IS:	
	3. Rating as per IS	
	4. Dry power frequency voltage withstand test	
	5. Wet power frequency voltage withstand test	
31.	Type of insulation used in	
	a. HV windings	
	b. LV windings	
32.	Type of insulation used on	
	a. Core bolts	
	b. core bolt washers	
	c. Core laminations	
33.	whether conservator is provided	
34.	whether breather is provided	
35.	Approximate overall dimensions	
	a. height	
	b. Breadth	
	c. Length	
36.	Weight of insulated conductor	
	a. HV	
	b. LV	
37.	a. Weight of core	
	b. Tolerance	
38.	a. weight of complete Transformer for transport	
39.	Period for which this design of transformer has been in commercial use	
40.	Reactance of windings at 75 ° C/ph a.HV b. LV	
41.	Resistance of rated current and frequency a. HV b.LV	
42.	Bushing characteristics Normal power frequency with voltage stand voltage (kV)	

2.	Core (Magnetic circuit)	
	a. Top yoke (single sheet) Thickness mm	
	b. Channel liner	
	c. Core wrapper	
	d. Core clamping	
	e. Core dimensions	
	i. height (window)	
	ii. Core diameter	
	iii. Limb centre	
	f. No load current (% of FL current)	
	g. No load loss in watts	
	h. Core material	
	i. Core fixing bolt Ø mm	
	j. Tie rod insulation mm paper	
3.	Winding (Electrical circuit)	
	a. Conductor material	
	b. Conductor insulation	
	i. HV winding	
	ii. LV winding	
	c. Conductor size	
	i. HV winding mm ²	
	ii. LV winding mm ²	
4.	Phase barrier board (press board)	
	a. Spacer between HV & LV coils	
	b. Coil end insulation mm	
	c. coil packing screw	
	d. HV jumper & delta formation	
	e. LV jumper mm	
	f. HV termination (bushing)	
	g. LV termination (bushing)	
	h. Spacers	
	i. Load loss at 50% and 100% load in watts	
	j. Percentage of impedance 75° C	
	k. Neutral current at full load in %	
5.	a. Coil packing	
	b. Tapping lead Cu mm	
	c. Neutral current	
	d. Breather (Silica gel)	

Note:

The following shall be specifically confirmed:

1. Whether the offer conforms to the limits of impedance mentioned in the specification

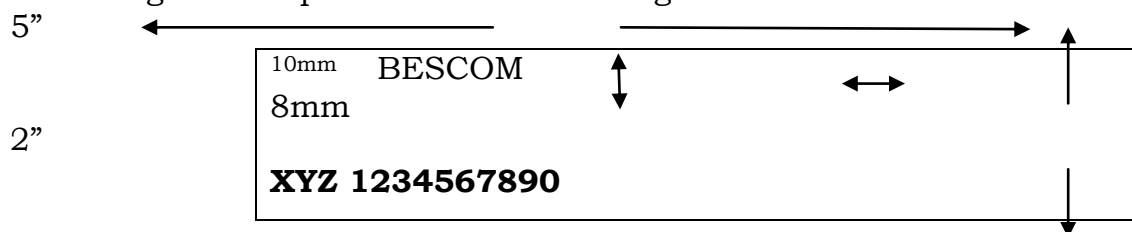
2. Whether the offer conforms to the limits of temperature rise mentioned in the specification
3. Whether the losses of the transformers offered are within the limits specified
4. Whether the transformers offered is already type tested for the design and test reports enclosed.

Signature & Seal of the Tenderer

Annexure-A

Welding of Unique ID Number plate (Stainless Steel) on the Distribution Transformer Tank for Distribution Transformer Tracking System(DTTS).

The Design for SS plates to be welded as given below.



Transformer Name Plate Dimensions

- Length = 5"
- Width = 2"
- Thickness= 1mm
- Material = Stainless Steel (SS)
- Unique ID code= a) First three letters (initials of Manufacturer as approved/to be approved by BESCO) followed by 10 digit serial no.
- Unique ID code with BESCO shall be punched on stainless steel plate and the same shall be welded on transformer tank. The unique ID code with initials of manufacturer & 10 digit code shall be punched on the top cover, on the transformer tank and also shall be embossed /engraved on the rating plate.
- The punched Unique ID code& BESCO initials on stainless plate shall be painted with Black color & shall be visible from the ground.

NOTE:

TERMINAL MARKING PLATE AND RATING PLATES SHALL BE PROVIDED IN ACCORDANCE WITH IS 1180 IN ADDITION TO UNIQUE ID STAINLESS STEEL PLATE MENTIONED ABOVE:

The transformer shall be provided with an anodized aluminium/stainless steel plate securely fixed on the outer body showing the relative physical position of the terminal and their markings. This shall be in accordance with IS: 1180(Part1):2014. The transformers shall be provided with rating plate furnishing the information as specified in 1180(Part1):2014.

The month and year of delivery shall be indicated on the rating plate. The rating plate shall be embossed / engraved type but not painted. The serial No. of transformer shall follow the code Nos. as detailed in annexure B. These shall be punch marked on the transformer tank and also on the top cover.

Annexure B

Procedure for assigning Unique ID code to Distribution Transformers:

Alpha Numeric code	Numeric 1	Numeric 2	Numeric 3&4	Numeric 5&6	Numeric 7,8,9&10
3 digit code assigned to manufacturer by BESCOM	Star Rating	capacity	Year of manufacture	Month of manufacture	Sl.No of the Transformer as assigned by the manufacturer
Example: Sl.No :XYZ 1315063456					
XYZ	1	3	15	06	3456

Unique ID code: XYZ 1315063456. XYZ denotes First three letters (initials of Manufacturer as approved/to be approved by BESCOM) 3 star rated 63kVA distribution Transformer manufactured in the month of June during the year 2015 with Sl.No.3456.

a) Alphanumeric codes (3 Digits)

Alphanumeric code(3 digit)	Name of the Company	Remarks
XYZ	---	3 digit alpha numeric code assigned to manufacturer by BESCOM

b) Details of the 10 Digit code.

Digit	Digit codes	Description of the Digit Code
1 st Digit	0,1, 2 or 3	0- Conventional(Un starred)
		1 – BEE-3 Star
		2- BEE-4 Star
		3- BEE-5 Star
2 nd Digit	1 to 9	1- 15 KVA Capacity
		2-25 KVA Capacity
		3- 63 KVA Capacity
		4- 100 KVA Capacity
		5- 250 KVA Capacity

		6- 300 KVA Capacity
		7 - 500 KVA Capacity
		8- 750 KVA Capacity
		9 -990/1000 KVA Capacity
3rd & 4th Digit	15 or 16 etc.,	Year of Manufacture that is 2015 or 2016 etc
5th & 6 th Digit	01 to 12	Month of Manufacturing
		01-Jan, 02-Feb,03-March etc., up to 12-Dec
7th to 10 th Digit	0001 to 9999	Sl. No. of the transformer