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**OVERSTRAND MUNICIPALITY: ELECTRICITY DEPARTMENT**

**TENDER SC 1012/2010**

**GENERAL SPECIFICATION FOR COASTAL MINIATURE SUBSTATIONS**

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## GENERAL SPECIFICATIONS FOR COASTAL MINIATURE SUBSTATIONS

### 1. GENERAL

The miniature substations shall be in accordance with the requirements of the following standard Specifications: . Unit to comply with latest internal arc testing procedure as per SANS/IEC 62271-200 and 202.

|          |                                 |
|----------|---------------------------------|
| S.A.N.S. | 1029 - Miniature substations    |
| S.A.N.S. | 1030 - Miniature substations    |
| S.A.N.S. | 780 - Distribution transformers |
| S.A.N.S. | 555 - Transformer oil           |
| S.A.N.S. | 833 - Bushings                  |
| S.A.N.S. | 763 - Galvanising               |
| S.A.N.S. | 1091 - Paint colour             |
| B.S.     | 3938 - Current transformers     |
| B.S.     | 89 - Ammeters                   |
| B.S.     | 638 - Welding cables            |

### 2. CONSTRUCTIONAL DETAILS

The miniature substation shall be of the three or four compartment type viz:

MV compartment

Transformer compartment

LV switchgear compartment and Street lighting compartment

The compartments shall be so bolted together as to form a rigid solid unit and shall be so designed to facilitate removal of the transformer without undue disturbance both internally and externally.

The substations shall be so constructed that bolts and nuts shall not project on the external surface. The entire miniature substation shall be specifically designed to counteract deliberate damage to the interior or exterior components.

Metalwork including cooling fins shall be manufactured of 3CR12 corrosion free steel, cut, folded and welded as required. All welds shall be thoroughly ground to form smooth surfaces. The roof shall be of 3CR12 steel, common to all compartments and shall be designed in a pyramid formation so as not to retain water and also designed in such a manner as to prevent creepage of water into the interior of the substation.

Each substation shall be complete with a substantial channel section base which shall be internally bolted to the framework. This base shall be hot dipped galvanized to SANS 763, and shall in addition be coated with black epoxy tar paint. The base shall not be larger than 3 500mm by 1 000mm and will conform to these dimensions as near as is practicable. The base shall adequately support the

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transformer tank base. No metal other than this base shall be in contact with the minisub supporting plinth.

### **3. FINISH**

The protection against corrosion shall be in accordance with clause 3.23 of SANS 780, except that an epoxy-resin base primer is required, and a total dry film thickness of at least 100 micrometers.

Notwithstanding the requirements of SANS 1029, the colour of the final paint coating on all external surfaces shall be an acceptable match to the specified colour.

### **4. MARKING**

The roof flange shall, opposite the front MV compartment door, bear a permanently embossed imprint as indicated in the detail specification.

### **5. MV SWITCHGEAR**

The MV compartment shall be equipped with a 11 kV non-extensible type ring main unit comprising two incoming switches and a circuit breaker T-off with self powered IDMT protection relay with flagged indication for tripping

SF6 or Vacuum insulated type switchgear may be offered.

The ring main unit shall comprise 2 load break fault make isolating switches rated for 630A minimum and 1 x circuit breaker rated for 200A Amp minimum.

The ring main shall be capable of being EARTH, in which position all cores of the incoming cables shall be earthed through an earthing device.

Incoming cable test facilities are to be provided. The test terminals shall not be accessible whilst the switch is in the on position.

All switches shall have independent manual operating mechanisms with the necessary interlocks to ensure correct and safe operation, complete with operating handles etc., as required.

Padlocking facilities to lock any switch in the ON or OFF position, are to be provided.

Cable termination facilities shall be of the heatshrink type, incorporating cable clamping facilities for MV cables as specified.

The unit shall meet the requirements of the following standards:

Metal Enclosed switchgear: IEC 60298  
General Purpose switches: IEC 60265  
Disconnectors and earthing switches: IEC 60129  
Switch Fuse Combination: IEC 60420

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Common clauses: IEC 60694  
Pressure of SF6 gas: 1.4 bar at 20 °C  
Cable bushings: DIN 47636  
Degree of protection: - SF6 tank: IP 67 - Front cover: IP 2X - Cable cover : IP 3X  
Earth bar (external): 120 mm<sup>2</sup> Cu - Bolt dimension: M10  
Thickness of Stainless Steel Tank: 3.0 mm

### **Electrical data**

Rated voltage: 12kV  
Short time withstand current (3 sec) : 20 kArms  
Breaking capacity for circuit breaker: 20 kArms  
Impulse withstand voltage : To earth and between phases: 95 kV  
Insulation level: - Power frequency 1 min: 28 kV  
Rated current for busbars: 630 A  
Rated current for isolator : 630 A, circuit breaker: 200A  
Cable test bushings with interlocked cover  
Cable support bars  
Manometer  
Operating handle long type  
Stored energy mech. for man.operation,  
Phase voltage indication and phasing test sockets.

Test certificates issued by a recognised testing authority shall be made available upon request.

The entire unit shall be corrosion-protected for coastal conditions.

Comprehensive manuals are to be provided, which clearly describe the installation, operation and maintenance of the unit.

## **6. TRANSFORMER**

Each miniature substation shall be equipped with an oil-immersed, three phase, sealed, low loss transformer meeting the requirements as specified.

In addition to the standard fittings for minimum transformers as laid down in SANS 780 table 1, each transformer shall be equipped with the following:

An off-circuit, padlockable, snap-action tapswitch, with positive indicating facilities.

Drain valve with plug.

Oil gauge

Lifting lugs

Filling hole which will be properly sealed to ensure no ingress of dirt or moisture.

Earthing terminal

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The MV terminals shall be equipped with epoxy resin bushings and the MV tails shall be terminated by means of 11 kV rated heatshrink terminations and RICS boots.

The four LV terminals shall be of the bare stem bushing type of adequate rating, connected to the LV busbars.

The transformer is to be thoroughly dried out and tested at the manufacturer's works before delivery, the windings being submerged in oil, eliminating any need for further drying out and rendering the transformer ready for immediate service at full rated load.

The transformers shall carry SANS mark and be tested in accordance with SANS 780. Certified copies of test certificates shall be forwarded to the Employer as soon as possible after the tests have been carried out.

## **7. LV COMPARTMENT**

The LV bushings of the transformer shall be connected to the LV busbars, by way of four single core copper conductor PVC insulated cables, the neutral conductor being of the same cross-section as the phase conductors.

An earth bar which is integrally connected with the earth terminal of the transformer and high voltage switchgear shall be supplied and fitted in the LV compartment. The earth bar shall be large enough to enable 5 off 70mm<sup>2</sup> earth cables terminated with lugs, to be bolted thereon.

All equipment shall be installed flush on a steel front panel with cut outs to prevent access to live terminals. Front panels shall be removable for maintenance purposes.

The following circuit breakers shall be fitted in the LV compartment:

### **MAIN CIRCUIT BREAKER**

Three pole moulded case circuit breakers with hydraulic magnetic overcurrent elements to SANS 156.

### **LOAD CIRCUIT BREAKERS**

As specified, to SANS 156.

## **8. NOTICES**

At least one skull and cross bones notice with the words **GEVAAR - DANGER** thereon will be mounted on each door of the minibus. The doors providing access to the high and low voltage compartments must be clearly marked on the insides MV/s and LV/s respectively.

## **9. ENGRAVING OF LABEL PLATES AND NUMBERING OF MINIATURE SUBSTATIONS**

The Electrical contractor shall supply engraved trafolite label plates at the incoming and outgoing MV cables in the medium voltage compartment. This label plates shall

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be engraved in 12mm high letters with the number and name of the substation to which the cables are connected as well as with the length of the 11 kV cable to the next miniature substations.

The Electrical Contractor shall supply engraved trafolite label plates at the outgoing cables in the low voltage compartment. It shall be engraved in 12mm high letters with the numbers of the distribution cubicles to which the cables are connected.

The name plate for each miniature substation shall be constructed of 2mm thick anodised aluminium and shall be engraved with 4mm high figures and letters. The letters and figures shall be coloured black. The name plate shall be fastened onto the miniature substation by means of brass bolts and nuts. The position of the name plate on the miniature substation shall be indicated by the Engineer.

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## DETAIL SPECIFICATION FOR THE MINIATURE SUBSTATIONS

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## DETAIL SPECIFICATION FOR COASTAL MINIATURE SUBSTATIONS

### 1. GENERAL

| ITEM | DESCRIPTION                     | DETAILS     |
|------|---------------------------------|-------------|
| 1    | Number of miniature substations | As required |

### 2. CONSTRUCTIONAL DETAILS

| ITEM | DESCRIPTION                                     | DETAILS   |
|------|---|---|
| 1    | Number of compartments in Minisub               | 4   |
| 2    | Type of sheet steel                             | 3CR 12  |
| 3    | Thickness of sheet steel                        | 2mm   |
| 4    | Final paint coating:                            |   |
| 4.1  | Outside   | Avocado: SANS 1091 C12  |
| 4.2  | Inside  | White   |
| 5    | Cable clamping facilities in the MV compartment | For up to 185 mm <sup>2</sup> , 3-core paper insulated Copper cable |
| 6    | Double door LV compartment                      | For LV distribution and streetlights compartment                    |
| 7    | Hinges, Handles, bolts, nuts                    | Stainless steel   |

### 3. DESIGN RATINGS

| ITEM | DESCRIPTION                   | DETAILS  |
|------|-------------------------------|--|
| 1    | Service voltage               | 11 000 kV  |
| 2    | Frequency                     | 50 Hz  |
| 3    | Ring main switches:           |  |
| 3.1  | Continuous current rating     | 630 A  |
| 3.2  | Fault making                  | 350 MVA  |
| 4    | Tee-off circuit breaker:      |  |
| 4.1  | Continuous current rating     | 200 A  |
| 4.2  | Fault making                  | 350 MVA  |
| 4.3  | Self powered protection relay | IDMT NI&VI, overcurrent and earth fault, 200/1 CT's and flagged trip indication on front panel |
| 7    | Impulse withstand voltage     | 95 kV peak   |

### 4. EQUIPMENT IN THE LOW VOLTAGE COMPARTMENT

| ITEM | DESCRIPTION  | DETAILS  |
|------|--|--|
| 1    | Moulded Case 3P Main circuit breaker:<br>Number Required<br>Breaking Capacity, Assymetrical, 415V<br>Rating    | 1<br><br>min 25 kA<br>800 A (500 kVA),<br>1000 A (630 kVA),<br>1250 A (800 kVA)<br>1500 A (1000 kVA) |
| 2    | Supply, installation and<br>connection of 3P MCBs for<br>primary LV feeders<br>Breaking capacity Assymetrical, | min 25 kA  |

| ITEM | DESCRIPTION   | DETAILS  |
|------|---|--|
|      | 415V Hydraulic magnetic   | <p>3 X 250A, 1 X 300A (500 kVA),</p> <p>3 X 300A, 1 X 400A, 1 X 100A (630 kVA),</p> <p>1 X 200A, 1 X 350A, 4 X 400A (800 kVA),</p> <p>Main circuit breaker only (1000 kVA),</p>  |
| 3    | Streetlighting (for photocell control)  | <p>3 x 63 A HRC fuses</p> <p>1 x 32A 3pH contactor AC3</p> <p>1 x 3P and 3x1P, 40A, 5 kA circuit breakers</p> <p>1 x 3 position rotary test switch, ie On/Auto/Off</p> <p>4 x 6 mm<sup>2</sup> terminals (Klippon or eq)</p> <p>1 x 3 Phase kWh meter 20 - 40A Class 2</p> |
| 4    | 16 A 3-pin Industrial switch socket, with 15 Amp lp, 5 kA earth leakage circuit breaker and 63 A HRC fuse protecting same   | 1  |
| 5    | Set of three current transformers, sensing main switch current, class 1, to control ammeters, ratio   | 800:5 or 1000/5 or 1250/5 or 1500/5  |
| 6    | Set of three instantaneous indicating and thermal maximum demand combination ammeters with built-in saturation CT, integrating over 15 minutes, slip-in scale 96 mm type, for operation from 5 A CT secondary, scaled | 0 – 800 A or 0 - 1000 A<br>or 0 - 1250 A or 0 – 1500 A   |
| 7    | One voltmeter, slipon scale 96 mm complete with stanton selection switch to select R-N, Y-B, B-N, B-Y, R-Y, B-R, connected to busbars, scaled   | 0 – 400V   |
| 8    | Busbars   | Predrilled tipped Cu to SANS 784   |
| 9    | LV Cable Terminations   | On unistrut with K clamps  |
| 10   | Panel Heaters in MV and LV compartments   | 80Watt with thermostat   |
| 11   | Enermax meter with modem  |  |

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## 5. TRANSFORMER

| ITEM | DESCRIPTION                  | DETAILS   |
|------|------------------------------|---|
| 1    | Rated power                  | 500 kVA or 630 kVA or 800 kVA or 1000 kVA   |
| 2    | Num of windings              | 2   |
| 3    | Nominal voltages:<br>Primary | 11 500 V  |
| 3.1  | Secondary                    | 420/240 V   |
| 3.2  | Number of phases             | 3   |
| 4    | Frequency                    | 50 Hz   |
| 5    | Nature of load               | Residential   |
| 6    | Tappings                     | Full capacity tappings provided in the MV winding and corresponding to 95%, 97,5%, 100%, 102,5% and 105% of the rated primary voltage |
| 7    |                              |   |
| 8    | Winding connections          | DYN 11  |
| 9    | Cooling                      | ONAN  |
| 10   | Instrumentation              | Oil level glass   |