SERVICES INFRASTRUCTURE

ENERGY & ELECTRICITY
MATERIALS

CITY OF TSHWANE
IGNITING EXCELLENCE

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MINIATURE SUBSTATIONS

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1. SCOPE

This specification covers the CoT minimum requirements for the manufacture, testing and supply of MSS, suitable for use in areas accessible to the public.

MSS shall be manufactured in accordance with the requirements of SANS 1029:2008. Only new MSS will be accepted. Each MSS shall be supplied complete with plinth.

The standard transformer power ratings for MSS shall be:

a) 315 kVA
b) 500 kVA
c) 630 kVA
d) 800 kVA

2 NORMATIVE REFERENCES

SANS 1029:2008 Miniature substations

3 DEFINITIONS AND ABBREVIATIONS

The definitions stated in SANS 1029 apply.

4 CONSTRUCTION REQUIREMENTS

The requirements of SANS 1029 and Schedule A, together with the following apply. The clauses refer to SANS 1029.

4.2 General

After the contract is awarded, a prototype MSS shall be manufactured and approved by the CoT Test Section before full scale production of MSS can commence.

4.3 Construction and dimensions

4.3.1 The MSS shall be in accordance with the type B layout

4.3.5 Doors

The three-point locking mechanism on each compartment door shall have an additional, captive, 10 mm Allen cap screw. The cap screw shall be recessed, i.e., the head shall be flush with the door surface and the screw shall lock the swivel mechanism of the three-point locking device when the mechanism is in the closed position.
NOTE: ‘captive’ implies that the Allen cap screw cannot be removed.

4.3.10 The IAC of the MSS with RMU shall be type AB in accordance with SANS 62271- 202.

4.5 Transformer

4.5.1 Tenderers shall submit prices in Form B for the following:

1) MV and LV transformer windings manufactured from copper;

4.5.2 MV bushings and clearances

The MSS transformer bushings shall not be accommodated in the MV RMU compartment.

4.5.3 The MSS transformer shall display the SABS certification mark for approved performance. A SANAS/IEC accredited equivalent will also be evaluated.

4.8.1.1 **RMU/MV compartment**

4.8.2 b) The RMU shall comply with the requirements of SANS 1784 clause 4.3.5 and Schedule A together with the following:

(i): The RMU shall have integral cable test facilities on SD and CB.

(ii) The RMU shall be supplied complete with unscreened separable connector (USC) comprising of a cable plug with bolted contact.

Note: cable accessories (terminations and joints) shall comply with the requirements of NRS053.

4.8.3 Termination of MV cables: Provision shall be made for the support (clamping) of two incoming (ring) cables in the MV compartment. Two (hexagon) adjustable cable clamps, manufactured from HDPE suitable for clamping cable sizes up to one 150 mm^2 3-core PILC cables.

4.8.4 Internal MV connections and terminations

Please note the following requirements for internal connections.

The connections between the RMU and transformer shall be without phase cross or with phase cross as outlined below (if so specified in the order):

a) The terminal marked A or Red on the ring main unit must be connected to the terminal marked C on the primary side of the MSS transformer and be marked as the red phase.

b) The terminal marked B or White on the main ring unit must be connected to the terminal marked B on the primary side of the MSS transformer and be marked as the white phase.

c) The terminal marked C or Blue on the ring main unit must be connected to the terminal marked A on the primary side of the MSS transformer and be marked as the blue phase.

The low-voltage terminals of the MSS transformer must be connected to the main LV circuit-breaker by means of conductors without phase crossover or as follows:

i)Terminal A - Blue phase
ii)Terminal B - White phase
iii)Terminal C - Red phase
iv)Terminal N - Neutral (black)

4.8.5 Earth fault indicators

An earth fault indicator shall be provided with each MSS. In the event that no integral cable test facility is provided on the tee-off circuit-breaker, an additional earth fault indicator shall be provided for fault indication on the tee-off cable.

4.9 LV compartment

4.9.3.2.3 b) A cable support rail (e.g. uni-strut) shall be provided and fitted for LV cable support.
Provision shall be made for the installation of LV circuit-breakers.

LV equipment

4.9.3.4 (a) & (b) LV Indicating- with thermal maximum demand ammeters shall be provided for all three phases.

4.9.3.4 (d) One voltmeter shall be provided with a selector switch.

4.9.3.4 (f) Provision shall be made for mounting a double row of LV circuit breakers having sufficient space between the rows for accommodating cable terminations. Cover plates shall be provided for both rows.

4.9.3.4 (g) One standardized street lighting compartment, panel and control circuit shall be provided and shall comply with the following:

The street lighting control panel shall be located **adjacent to the MV kiosk** and shall be constructed as follows:

i) Shall be approximately 400mm in width and 200mm deep;
ii) Shall have its own door and padlock which shall open from the front of the MSS;
iii) The SL compartment shall be independent from MV and LV compartment.

The following electrical equipment shall be mounted on this panel:

4) Three 60A single-phase circuit-breakers (Centurion) and one 60A three-phase (Akasia) circuit-breaker, having breaking capacity of 10kA, shall serve as the main streetlight circuit breaker(s) and shall be labeled “MAIN CIRCUIT BREAKER”. These circuit breaker(s) must be connected between the LV busbars via the terminal block to the circuit-breakers and the three-phase contactor.

5) Two 5A single-phase circuit breakers with a breaking capacity of 10kA curve1. The first labeled “CONTROL CIRCUIT” used as a main supply for the control circuit, and the second labeled "BYPASS SWITCH" used for switching the streetlights for testing purposes.

6) One 60A three-phase contactor with a 230 volt coil for the streetlight control unit.

7) Terminal blocks for connecting the LV busbars, circuit breakers and photocell cables must be mounted at the base of the panel and properly shielded. Terminal blocks with a current carrying rating of not less than 145A must be supplied. Provision is to be made for 6 outgoing streetlight cables to a maximum size of 16mm^2. This excludes the photocell control cable.

8) Six 40A 10kA single phase circuit breakers connected between the contactor and the terminal strip by means of 16mm^2 insulated copper conductors.

9) 70 mm^2 neutral and earth bar, connected to the main neutral and earth bar in must be provided near the terminal blocks.

5 TESTS

The requirements of SANS 1029 and Schedule A apply.

INSPECTION AND TESTING OF A MSS" form, Annexure C, must be completed by the manufacturer before testing. CoT Test Section shall conduct routine testing on all MSS.

6 MARKING LABELING AND DOCUMENTATION

The requirements of SANS 1029 and Schedule A apply together with the following:

6.1 Safety notices

The following safety notices shall be provided:
i)The main circuit breaker shall have a trafolite plate engraved with: "Alive", mounted on the supply side.
ii)The LV busbars shall be color-coded in the colors of red, yellow, blue and black by a clearly visible painted-on spot at least 20 mm diameter.
iii)The MV and LV compartment doors shall be labeled with "MV" and "LV", respectively. Note that "MV" and not "HV" shall be used for the MV compartment doors. The labels shall be clearly and indelibly stenciled on both the inside and outside of all the compartment doors.
iv)The LV streetlight compartment door shall be labeled with "STREETLIGHT COMPARTMENT". The labels shall be clearly and indelibly stenciled on outside of the streetlight compartment door.
v)The primary voltage, secondary voltage, 'kVA' rating and vector group shall be marked on the MSS transformer,e.g. "11kV/420V; 500 kVA; Dyn11". The markings shall be black and in characters larger than 50 mm high.
vi)The MSS nameplate, having dimensions of 50X200mm, manufactured from trafolite, shall be located on the inside of the MV compartment door.

6.2.2 Transformer rating plate information:

In addition to the relevant requirements of SANS 780, the following information shall be clearly shown on the transformer rating plate:

a) Manufacturer's name and year of manufacture;

b) Serial number;

c) CoT order number;

d) CoT SAP material number;

e) Mass of the MSS.

6.3 Documentation:

6.3.1 Schedule B (Annexure A) and the Deviation Schedule (Annexure B) must be completed by the tenderer and submitted with the tender.

i) The "Inspection and testing of MSS" form, Annexure C, must be completed by the supplier/manufacturer and forwarded to TS before the MSS is permitted to leave the factory.

ii) Safe-keeping of documentation:
Provision shall be made for the safe-keeping of all relevant documentation (i.e. the installation, operating and maintenance instructions for the ring main unit and all routine test certification) on the inside of the MSS MV compartment door.

6.3.2 Drawings

The requirements of SANS 1029 apply.

7 Transport and delivery

The following requirements apply.

i) The MSS shall be delivered and off-loaded complete with plinth to the CoT SCM stores depot.

Annexure A: Technical schedules A and B

315kVA-800kVA MSS
Schedule A: Purchaser's specific requirements
Schedule B: Particulars of equipment offered

Item	Sub-clause SANS 1029	Description		Schedule A	Schedule B
	General	MSS information: a) manufacturer b) country of origin c) catalogue/type		 XXXXX XXXXX XXXXX	
	4.1.1	Nominal MV voltage	kV	11	XXXXX
	4.1.2	MSS power rating	kVA	315,500,630 800	XXXXX XXXXX
	4.3.1.1	Mini-sub type		Type B	XXXXX
	4.3.1.4	Mini-sub design		Modular	XXXXX
	4.3.4.3	Are roof lifting lugs required?		Yes	XXXXX
	4.3.5.3	Is a lock protection facility required for each door handle		Yes	XXXXX
	4.4.1	Enclosure material		Mild steel	XXXXX
	4.4.2	LV panel material		Mild steel	XXXXX
	4.3.5.3	Is a lock protection facility required?		Yes	XXXXX XXXXX
	4.5.1	Transformer windings required		copper	
	4.6.1	Type of corrosion environment for transformer		Non-corrosive	XXXXX
	4.6.2	Is black epoxy tar paint required?		Yes	XXXXX
	4.6.3	Type of corrosion environment for enclosure		Non-corrosive	XXXXX
	4.6.4	Paint colour		Avocado	XXXXX
	4.8.2 (b)	RMU required in MV compartment; circuit-breaker and two isolating switches		SANS 1784	XXXXX
	4.8.3.1	MV cable termination: option a)		RMU as per above	XXXXX
	4.8.3.4	Size and type of MV cables to be terminated		PILC SWA	XXXXX
	4.8.3.4	Number of cores of MV cables to be terminated		3-core	XXXXX

Signature of tenderer: ……

Annexure A: Technical schedules A and B

315kVA-800kVA MSS
Schedule A: Purchaser's specific requirements
Schedule B: Particulars of equipment offered

Item	Sub-clause SANS 1029	Description	Schedule A	Schedule B
	4.8.3.4	Maximum size of MV cable to be terminated	150/3	XXXXX
	4.8.5	Are earth fault indicators required?	Yes	XXXXX
	4.9.2.3.2	LV/MV earth bar requirements	separate	XXXXX
	4.9.3.4.2(a)	Indicating ammeters (combined indicating and demand ammeter)	required	XXXXX
		a) Quantity	Three	XXXXX
		b) Location	LV panel	XXXXX
		c)Type/manufacturer?	XXXXX	
	4.9.3.4.2(b)	Thermal maximum demand ammeters	required	XXXXX
		a) Quantity	Three	XXXXX
		b) Location	LV panel	XXXXX
		c) Type/manufacturer?	XXXXX	
	4.9.3.4.2(b)	Volt meter	required	XXXXX
		a)Quantity	one	XXXXX
		b) Location	LV panel	XXXXX
		Type/manufacturer?	XXXXX	
	4.9.3.4.2(f)	Main MCCB required	Yes/One	XXXXX
	4.9.3.4.2(f)	Number and rating of each MCCB		XXXXX
		a) quantity required per MSS	One	
		b) Full load rating: 315,500,630,800.	500;800; 1000;1600	XXXXX XXXXX
		c) breaking capacity:		
		315, (Ics=100% Icu)	20;	XXXXX
		500, (Ics=100% Icu)	20;	XXXXX
		630, (Ics=100% Icu)	25;	XXXXX
		800, (Ics=100% Icu)	30	XXXXX
		c)Type/manufacturer?	XXXXX	
	4.9.3.4.2(g)	Standardized street lighting panel	required	XXXXX
		Refer to the main specification		

Signature of tenderer: ……

Annexure A: Technical schedules A and B

315kVA-800kVA MSS
Schedule A: Purchaser's specific requirements
Schedule B: Particulars of equipment offered

Item	Sub-clause SANS 1029	Description	Schedule A	Schedule B
	4.9.3.4.2(g)	Standardized street lighting panel	required	XXXXX
		a) PECU	No	XXXXX\
		b) Contactor capacity rated for three-phase	60A	XXXXX
		c)Number of lighting circuits	Six	XXXXX
		d)Type/manufacturer?	XXXXX	
	4.9.3.5.1	Wire numbering	To be agreed between supplier/ purchaser	XXXXX
	5.5.2	Paint thickness test	required	XXXXX
	6.2.2	Additional notices, nameplates and labels	Refer to main spec	XXXXX
	6.3.1	Documentation to be supplied with tender: kiosk (SANS 62271-202); RMU (SANS 62271-200); transformer (SANS 780)	Test certificates	XXXXX
	6.3.1	Test certificates and SABS permit attached?	XXXXX	
	6.3.2	Drawings to be supplied	Detailed drawings	XXXXX
	6.3.2	Drawings attached?	XXXXX	

Signature of tenderer: ……

Annexure A: Technical schedules A and B

Schedule A: Purchaser's specific requirements
Schedule B: Particulars of equipment offered

Clause 1874	Description	Schedule A	Schedule B
	RMU manufacturer?	XXXXX	
	Make, model and catalogue number?	XXXXX	
4.2.1	Rated voltage kV	12	XXXXX
4.3.1.5	Is an indoor or outdoor unit required?	Outdoor	XXXXX
4.3.2	Extensible or non-extensible unit	Non-extensible	XXXXX
4.3.3.3	Degree of protection of unit offered?	XXXXX	
4.3.4	Required RMU configuration	SD,CB,SD	XXXXX
4.3.5.1	Separate integral cable test facility required for SD	required	XXXXX
4.3.5.1	Separate integral cable test facility required for CD	required	XXXXX
4.3.5.4	Cable test facility offered shall be interlocked with associated earth switch and padlock.	required	XXXXX
4.3.10.2	Specify insulating/interrupting medium of CB?	XXXXX	
4.3.10.3	Specify insulating/interrupting medium of SD?	XXXXX	
4.3.14.1	IAC classification of RMU and kiosk indoor and outdoor?	XXXXX	
4.4.1.3	Rated normal current of a switch disconnector A	630	XXXXX
4.5.2.1	Transformer load to be protected?	Refer scope	XXXXX
4.6.1.3	Rated normal current of the circuit breaker A	200	XXXXX
4.6.2.4	Type of protection tripping of circuit breaker required	10P10	XXXXX
4.6.2.7	Detail of protection relays (Overcurrent and earthfault)	OC/EF	XXXXX

Signature of tenderer: ……

Annexure A: Technical schedules A and B

Schedule A: Purchaser's specific requirements
Schedule B: Particulars of equipment offered

4.6.2.12	EF pickup independent of CT?	XXXXX	
4.7.5	Insulation medium of busbar?	XXXXX	
4.8.2 4.8.6	Cable type Maximum size(s)	PILCSWA /SANS 97 Table 18. 150mm2 copper	XXXXX XXXXX
4.10.6	Detail of SF6 recovery and replenishment?	XXXXX	
4.11.1	Maximum earth fault current kA	2.0	XXXXX
4.12.1	Detail of voltage presence detection system (VPIS)?	XXXXX	
4.13.1	Earth fault indication	Required	XXXXX
4.13.1	Earth fault indication offered?	XXXXX	
4.14.1	Detail of kiosk required	Refer 4.3.10	XXXXX
4.14.6	Padlock facility required on kiosk	Refer 4.14.6	XXXXX
4.15.1	Steel raising base required	Indoor unit	XXXXX
4.15.2	Steel gland plate required	Indoor unit	XXXXX
4.16.4	Recommended tools?	XXXXX	
4.19.9	State type of material offered for the RMU kiosk etc?	XXXXX	
5.1.3	Quantity already installed in South Africa?	XXXXX	
5.1.4	State details of accrediting body and proof of certification?	XXXXX	
6.1	List of recommended spares?	XXXXX	

Signature of tenderer: ……

Annexure B

Deviation schedule

Any deviations offered to this specification shall be listed below with reasons for deviation.		
ITEM		**PROPOSED DEVIATION**

Signature of tenderer:……

Annexure C

CITY OF TSHWANE
"we are the same"

INSPECTION AND TESTING OF A MSS

Date :

Project / Township :

Serial no. : Dept. no. :

Manufacturer : kVA :

ITEM	DESCRIPTION	COMMENTS									
		) / New (N)	ory	y	ection FAT	cal Tests (Test Section)	al Engineering (Store)	ations (Area Office.)	Section SAT	s (Area Office.)	n Control
1.	**GENERAL**										
1.1	Positioned in accordance with the drawing		B								
1.2	A clean area of 2m around MSS?		B								
1.3	Minimum depth of 250mm below ground level (Average gradient 200mm)?		A								
1.3.1	Maximum switching - height is 1500mm with a 300mm base. Step?		A								
1.4	External chromadek electrical symbolic warning signs “No Unauthorized Entry Allowed” in English, Afrikaans and Zulu		A								
1.5	Treatment and Full First Aid Instructions to the inside of MV and LV compartment (Doors open first)		A								
1.6	Paintwork satisfactory?		B								
1.7	Correct - locks on MV doors?		A								
1.8	Current - locks on LV /Streetlight doors? *Refer to work policy		A								
1.9	Do all the doors fit?		A								
1.10	MSS clean inside.		A								
1.11	MSS fixed to the base by means of bolts.		A								
1.12	Roof fixed to the framework by means of bolts.		A								

ITEM	DESCRIPTION	COMMENTS									
		) / New (N)	ory	y	ection FAT	cal Tests (Test Section)	al Engineering (Store	ations (Area Office.)	Section SAT	s (Area Office.)	n Control
1.13	Installed level and parallel to the side of the road.		A								
1.14	50mm Cement floor inside MSS and on top of switching-platform.		A								
1.15	No holes or cracks in the foundation.		A								
1.16	Cable end boxes correct size. Only dry ends.		A								
1.17	SAP number.(if applicable)										
1.18	Test certificate (white plate – Test Section)		A								
1.19	Primary voltage, secondary voltage, kVA rating and vector group (Black characters larger than 50mm high)		A								
1.20	Base channel and sills of doors – removable sections adjacent to MV compartment door(s)		A								
1.21	Door stop, to prevent door from swinging		A								
2.	**11kV COMPARTMENT**										
2.1	Switchgear correctly installed?		A								
2.2	Nameplate behind the door		B								
2.3	11kV (MV) stenciled inside and outside the door		A								
2.4	Identification of cables connected to panels		A								
2.5	Switch lever		A								
2.6	Does the switchgear operate properly		A								
2.7	Fuses (40A) /VIP 35 Protection Relay		B								
2.8	(a) Level of oil in fuse compartment and Inspection-glass if applicable.		A								
2.9	(b) Lid of switchgear fixed properly (if applicable) SF6 Gas pressure indicator level correct.		A								
2.10	Oil in switchgear - oil leaks in applicable.		A								
2.11	Connection to transformer. Thickness, length and type of material.		A								
2.12	Clamps on armouring of cables		A								

ITEM	DESCRIPTION	COMMENTS									
		) / New (N)	ory	y	ection FAT	cal Tests (Test Section)	al Engineering (Store)	ations (Area Office.)	Section SAT	s (Area Office.)	n Control
2.13	Bolts of cable end box tightened properly.		A								
2.14	Pressure and Megger test of Cables and Unit.		A								
2.15	ON/OFF/EARTHED positions indicated on switchgear		A								
2.16	Fuse-switch Protection Relay marked 'TRANSFORMER and kVA rating"		A								
2.17	Cable testing points marked color coded and function properly		A								
2.18	Cable end box, phase color indicated.		A								
2.19	Interconnections between RMU and Transformer		A								
3.	**LT COMPARTMENT**										
3.1	LV stenciled inside and outside the door.		A								
3.2	Phase color of busbar correct (20mm diameter painted)		A								
3.3	Size of conductors correct		A								
3.4	Phase color of conductors		A								
3.5	Phase color on ammeters		A								
3.6	Condition of ammeters + Instantaneous phase-identified, thermal maximum demand		A								
3.7	Main circuit breaker marked "MAIN CIRCUIT BREAKER" on panel.		A								
3.8	Main circuit breaker marked "LIVE" on incomer of Circuit – Breaker.		A								
3.9	Cables made off correctly at cable glands		A								
3.10	Cables marked in accordance with the drawing		A								
3.11	Circuit breakers marked / labeled.		A								
3.12	Crimping cable lugs and bolt holes correct size Correct crimper		A								
3.13	Locknuts or spring washers fitted		A								
3.14	Two (2) crimping cable lugs on a bolt are not permissible, earth connections two (2) crimping cable lugs back-to-back.		A								

ITEM	DESCRIPTION	COMMENTS									
		) / New (N)	ory	y	ection FAT	cal Tests (Test Section)	al Engineering (Store)	ations (Area Office.)	Section SAT	s (Area Office.)	n Control
3.15	All bolts of busbar tightened properly.		A								
3.16	All connections of circuit breakers tightened properly/ Flash-barriers supplied.		A								
3.17	Bolts of current transformers tightened properly.		A								
3.18	Cables tested.		A								
3.19	Neutral separated. Split equal between neutral and earth		A								
3.20	Isolation sleeve between open conductors (arc shield) if clearance is less than 20mm.		B								
3.21	Voltmeter fuses fitted and labeled VOLTMETER.		A								
3.22	Barrier to barricade the LV bushings of Transformer and sticker applied to it depicting an electrical symbolic warning sign “Unauthorized entry”		A								
3.23	Interconnections between Transformer and main Circuit breaker		A								
4.	**STREETLIGHT COMPARTMENT**										
4.1	“STREETLIGHT COMPARTMENT” stenciled on outside of the door		A								
4.2	Streetlight circuit breakers : Control Circuit / Bypass 5A ; 5kA , curve 1 single phase		A								
4.3	Three 60A, 5 kA single phase circuit breakers marked “STREET LIGHTS”		A								
4.4	Oil level of transformer, if applicable.		A								
4.5	Rating plate correct		A								
4.6	Phase colour correct		A								
4.7	Perspex sheet? (If applicable).		A								
4.8	Cables made off correctly with K-Clamp		A								
4.9	Transformer feeders correct size, in accordance with NRS.		A								
4.10	Transformer feeders tightened properly? (If applicable).		A								
4.11	All other bolts and nuts tightened properly?		A								
4.12	Cables tested?		A								
4.13	All streetlight circuit breakers and switch labeled.		A								

ITEM	DESCRIPTION	COMMENTS									
		) / New (N)	ory	y	ection FAT	cal Tests (Test Section)	al Engineering (Store)	ations (Area Office.)	Section SAT	s (Area Office.)	n Control
5.	**ELECTRICAL TESTS**										
5.1	Impedance test.		A								
5.2	Voltage ratio test		A								
5.3	Polarity test		A								
5.4	'Magnetization' test		A								
5.5	Pressure test		A								
5.6	Relay Tested/ Relay.		A								
5.7	Does Main Switch function properly and continuity? Mechanically.		A								
5.8	Fuses installed correctly and continuity? /Relay.		A								
5.9	11kV and L.V. conductor's crossings to be advised with order.		A								
5.10	Does ammeter function properly?		A								
5.11	Does streetlight control contactor function properly		A								
5.12	Current transformer ratios and meter scales.		A								
5.13	Meters wired correctly		A								
5.14	Does the circuit breaker function properly and are they set correctly.		A								
5.15	T3 switch and continuity.		A								
5.15	Tap-position correct?		A								
6.	**EARTHING**										
6.1	11kV earth bar (11kV compartment) to :										
6.1.1	I. 11kV switch,		A								
6.1.2	earth bar (LV side),		A								
6.2	LT earth bar (LT compartment) to :										
6.2.1	cable rack, LT compartment,		A								
6.2.2	neutral, LT compartment,		A								

ITEM	DESCRIPTION	COMMENTS									
		) / New (N)	ory	y	ection FAT	cal Tests (Test Section)	al Engineering (Store)	ations (Area Office.)	Section SAT	s (Area Office.)	n Control
6.2.3	Transformer.		A								
6.2.4	Earth bar, streetlight compartment.		A								
6.3	Earth bar, streetlight compartment to :										
6.3.1	neutral bar, streetlight compartment,		A								
6.3.2	Cable rack, streetlight compartment.		A								
6.4	Braided earth connector between door - kiosk		A								
6.5	Main-earthing (earthing installations 70mm²)		A								
6.6	Connections for earthing by means of locknuts or spring washers.		A								
6.7	Earth connections tightened properly.		A								
6.8	Earth neutral bonding 70mm². Fixed connection between earth and neutral.		A								
6.9	Cable-earthing to main-earthing.		A								
7	**EARTHING IN ACCORDANCE WITH ESS S0016 PAR.5**										
7.1	**11kV Earthing installation, resistance equal to 1ohm or less :**										
7.1.1	Installed		A								
7.1.2	Resistance (reading in ohms)		A								
7.1.3	Earth conductors inside mini-sub correct size.		A								
7.1.4	Earth conductor between 11kV earthing installation and earth bar in 11kV compartment insulated.		A								
7.1.5	11kV Earthing installation to earth bar in 11kV compartment.		A								
7.1.6	Earth bar in 11kV compartment to earth bolt of transformer in 11kV compartment.		A								
7.1.7	Earth bar in 11kV compartment to earth bolt of 11kV switchgear.		A								
7.1.8	Earth bar in 11kV compartment to earth bolt of transformer in streetlight compartment.		A								
7.1.9	Earth bar in 11kV compartment to earth bar in streetlight compartment.		A								

ITEM	DESCRIPTION	COMMENTS									
		) / New (N)	ory	y	ection FAT	cal Tests (Test Section)	al Engineering (Store)	ations (Area Office.)	Section SAT	s (Area Office.)	n Control
7.1.10	Earth bar in streetlight compartment to earth bar in LV compartment.		A								
7.1.11	Earth bar in LV compartment to neutral bar in LV compartment.		A								
7.1.12	Neutral of transformer to earth bar in LV compartment.		A								
7.1.13	Neutral of transformer to neutral bar in LV compartment.		A								
7.1.14	Neutral of transformer to neutral bar in streetlight compartment.		A								
7.1.15	Crimping cable lugs correct size.		A								
7.2	**11kV Earthing installation and separate LV earthing installation.**										
7.2.1	11kV Earthing installed.		A								
7.2.2	11kV Earthing resistance (reading in ohms).		A								
7.2.3	LV Earthing installed.		A								
7.2.4	LV Earthing resistance (reading in ohms).		A								
7.2.5	Earth conductors inside mini-sub correct size.		A								
7.2.6	Earth conductor between 11kV earthing installation and earth bar in 11kV compartment insulated.		A								
7.2.7	Earth conductors between LV earthing installation and earth bar in LV compartment insulated.		A								
7.2.8	11kV Earthing installation to earth bar in 11kV compartment.		A								
7.2.9	Earth bar in 11kV compartment to earth bolt of transformer in 11kV compartment.		A								
7.2.10	Earth bar in 11kV compartment to earth bolt of 11kV switchgear.		A								
7.2.11	Earth bar in 11kV compartment to earth bolt of transformer in streetlight compartment.		A								
7.2.12	Earth bar in 11kV compartment to earth bar in streetlight compartment.		A								
7.2.13	Earth bar in streetlight compartment to earth bar in LV compartment.		A								
7.2.14	LV earthing installation to neutral bar in LV compartment.		A								
7.2.15	Neutral of transformer to neutral bar in LV compartment.		A								

ITEM	DESCRIPTION	COMMENTS									
		) / New (N)	ory	y	ection FAT	cal Tests (Test Section)	al Engineering (Store)	ations (Area Office.)	Section SAT	s (Area Office.)	n Control
7.2.16	Neutral of transformer to neutral bar in streetlight compartment.		A								
7.2.17	Crimping cable lugs correct size.		A								

	INSPECTION BY :	PLACE	DATE
y			
	Signature		
	Name (print)		
ection FAT			
	Signature		
	Name (print)		
Electrical Test Test Section			
	Signature		
	Name (print)		
al eering Store			
	Signature		

	Name (print)		
tions Depot	Signature Name (print)		
ection FAS.	Signature Name (print)		
Depot	Signature Name (print)		
Control	Signature Name (print)		

NOTES:

1. **If an installation is executed by a CONTRACTOR, the SUBS and CABLES columns must be completed by the CONTRACTOR.**

2. **Category A: Must be correct before the equipment can be commissioned.**

3. **Category B: Can stand over, but must be rectified after the equipment have been commissioned.**

Annex D

Form B: Material Group:-Miniature substation (MSS) with copper windings

ITEM	SHORT DESCRIPTION	Price excluding VAT	Units delivered per Month	Delivery period in weeks
1	MSS TB 315KVA			
	SAP item number: 100000000628			
2	MSS TB 500KVA			
	SAP item number: 100000000629			
3	MSS TB 630KVA			
	SAP item number: 100000000630			
4	MSS TB 800KVA			
	SAP item number: 100000000631			

Form B: Material Group:-Miniature substation (MSS) with copper windings

ITEM	SHORT DESCRIPTION	Price excluding VAT	Units delivered per Month	Delivery period in weeks
1	MSS TB 315KVA			
	SAP item number: 100000000628			
2	MSS TB 500KVA			
	SAP item number: 100000000629			
3	MSS TB 630KVA			
	SAP item number: 100000000630			
4	MSS TB 800KVA			
	SAP item number: 100000000631			
5	Recover MSS and install new MSS and plinth, supply and install terminations, connect MSS earth and transport recovered MSS to store. SAP service number: 3007551			