



TITLE: SPECIFICATION FOR 11 kV TYPE B MINIATURE SUBSTATIONS WITH RATINGS NOT EXCEEDING 1000 KVA	REFERENCE	REV
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FOREWORD

This specification was prepared by the following Work Group members:

Z. Ngqwala Technology Services

The Work Group was appointed by the Underground Systems Study Committee, which, at the time of approval, comprised of the following members:

Nolubabalo Makana	Metering
Masape Mokgadi Kahumba	Metering
Gavin Jardine	Planning
David Makoni	SDC
Hilda Nonkonyana	Planning
Thabiso Letaoana	Logistics & Warehouse
Mpho Molohe	Logistics & Warehouse
Patrick Radebe	Public Light
Tiro Mokgosi	Quality Management

Recommendations for corrections, additions or deletions should be addressed to the:

Innovation Hub
Senior Manager
City Power Johannesburg (SOC) Ltd
P O Box 38766
Booyens
2016

INTRODUCTION

Miniature substations are utilised throughout the City Power distribution network and are the most common form of load centre. This document is utilised by Supply Chain Management department as a requirement specification when purchasing Type B miniature substations with ratings not exceeding 1000 kVA. Miniature substations purchased and installed on the City Power network shall comply with this document.

1 SCOPE

This specification covers City Power's minimum requirements for the selection, manufacture, testing and supply of outdoor type miniature substations. It is applicable to medium-voltage substations for systems with a.c. rated voltages of 7,2 and 12 kV. This specification covers Type B miniature substations not exceeding 1000 kVA.

The tests prescribed in this specification shall evaluate the performance capabilities of medium-voltage miniature substations.

The SANS 1029 miniature substation requirements have been adopted, in order to ensure that quality miniature substations are purchased.

City Power's requirements have also been rationalized to improve direct and indirect costs and supplier delivery times.

2 NORMATIVE REFERENCES

The following documents contain provisions that, through reference in the text, constitute requirements of this specification. At the time of publication, the editions indicated were valid. All standards and specifications are subject to revision, and parties to agreements based on this specification are encouraged to investigate the possibility of applying the most recent editions of the documents listed below.

SANS 1332	:	Accessories for Medium Voltage power cables (3,8/6,6kV to 19/33kV)
SANS 876	:	Cable terminations and live conductors within air insulated enclosures for rated a.c. voltages of 7,2 kV and up to and including 36 kV.
SANS 1029	:	Miniature substations
SANS 1874	:	Switchgear-Metal-enclosed ring main units for rated a.c voltages above 1kV and up to and including 36 KV.
SANS 1339	:	Electric cable – Crossed-link polyethylene (XLPE)- insulated cable for voltages from 3,8/6,6kV to 19/33kV
SANS 780	:	Distribution transformers
SANS 1091	:	National colour standard
SANS 62271-200	:	AC metal enclosed switchgear and controlgear for rated voltages above 1kV and up to and including 52 kV.
SANS 60076-11	:	Dry-type Transformers
SANS 1029	:	HV/LV prefabricated substations

SANS 555	:	Standard for Mineral insulating oil for transformers and switchgear (uninhibited)
SANS 61243-5	:	Live working – Voltage Detectors Part 5: Voltage detecting systems
EN 50180	:	Bushings above 1 kV up to 36 kV and from 250 A to 3,15 kA for liquid filled transformers.
CP_TSSPEC_006	:	Specification for 11 kV metal-enclosed ring main units for Type B miniature substations
CP_TSSPEC_018	:	Specification for moulded case circuit breakers
CP_TSSPEC_027	:	Specification for concrete plinths for use with miniature substations and free-standing ring main units
CP_TSSPEC_029	:	Specification for adjustable cable clamps
CP_TSSPEC_116	:	Specification for new and regenerated mineral Insulating oil
CP_TSSPEC_040	:	Specification for earth fault indicators
CP_TSSPEC_065	:	Specification for LV current transformers
CP_TSSPEC_116	:	Specification for new and regenerated mineral insulating oil
CP_TSINST_013	:	Technical instruction for the transport of miniature substations
CP_TSSEC_081	:	Thermal indicator sticker IEC 60551:Determination of transformer and reactor sound levels
CP_TSSDRAW_069	:	Type B Mini-substation plinth drawing, with cable front entry RMU, plinth details precast

3 DEFINITIONS AND ABBREVIATIONS

The definitions and abbreviations from SANS 1029 shall comply with this specification.

4 REQUIREMENTS

4.1 General

- 4.1.1 Nothing in this specification shall lessen the obligations of the supplier. The supplier shall be fully responsible for the design and its satisfactory performance in service. Approval by City Power shall not relieve the supplier of the responsibility for the adequacy of the design.
- 4.1.2 This specification covers the requirements for Type B mini- subs. Mini-subst shall be manufactured in accordance with SANS 1029. The specific requirements for Type B units are specified below. Where conflicting requirements with SANS 1029 occur, this specification shall take precedence.
- 4.1.3 The RMU, Screened Separable connectors Transformer, LV busbars, main LV MCCB shall be marked with a micro dot identification system. The required text shall read “Property of City Power JHB”. The location of the micro dotting identification shall be agreed to by City Power and the supplier.

4.2 Electrical requirements

4.2.1 Transformer

4.2.1.1 The oil immersed transformer shall bear the SANS 780 mark. The unit shall be three-phase, oil-immersed or dry naturally cooled. The natural mineral insulating oil shall be required for oil immersed transformer and shall comply to the requirements of SANS 555.

Note: Due to a commitment for City Power to migrate and continue to be a cleaner environment to its stakeholders (City of Johannesburg), the manufacture shall be required within 1 year after award to test and comply to the new natural ester oil.

Or an alternative dry-type distribution transformer shall be used, that complies and bear the SANS 60076-11 and is natural cooled.

The standard transformer power ratings for Type B miniature substation shall be:

- a) 315 kVA,
- b) 500 kVA,
- c) 630 kVA, and
- d) 1 MVA.

4.2.1.2 The MV nominal voltage shall be 6,6 or 11 kV or dual ratio. The rated voltage (U_m) of the transformer shall be 12kV. The transformer shall be capable of operating continuously at U_m without loss of life due to over-fluxing of the core.

4.2.1.3 The rated LV no-load phase to phase voltage shall be 415 V.

4.2.1.4 Physical transformer sizes and fixing arrangements shall be identical to facilitate interchangeability of transformers up to 630 kVA.

4.2.1.6 The rated impulse voltage withstand level (BIL) and the rated short-duration power frequency withstand r.m.s. voltage (1 minute) of the transformer shall be as specified in table 1.

Rated voltage kV (r.m.s.)	Rated lightning impulse withstand voltage (BIL) kV (peak)	Rated short-duration power frequency withstand r.m.s. voltage kV (r.m.s.) – 1 min
12	95	28
0,415	30	1

Table 1 Rated insulation levels

4.2.1.7 The transformer unit shall have a welded cover. The unit shall have a butt welded valve for the purpose of draining and filling oil must be situated at the top away from the core. The unit shall have no drain valve or pressure release device / breather.

4.2.1.8 A robust oil level indicator shall be fitted in the LV compartment. It shall not be subject to discolouration or deformity when exposed to heat generated within the MSS. Perspex or plastic oil level indicators shall not be accepted. The oil level indicator shall be clearly visible to the operator when standing at the open miniature substation LV compartment door.

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- 4.2.1.9 The transformer shall have a thermal indicator sticker which complies with the CP_TSSEC_081. The indicator shall be self-adhesive and will be affixed to the side of a transformer, alongside the tap changer switch.
- 4.2.1.10 An off-load tap-changer shall be fitted and on the 11 kV rating shall have a range of $\pm 6\%$ with incremental steps of 3% , i.e., -6% , -3% , 0% , $+3\%$, and $+6\%$.
- 4.2.1.11 The transformer medium-voltage bushings shall comply with EN 50180 Type C (630A – tapered), bolted-Type Bushings with an M16 x 2 thread. These bushings have an internal screen which shall be earthed.
- 4.2.1.12 The transformer earth terminal shall be a 30 mm long boss, with an internal M12 thread throughout, welded to the transformer tank. The boss shall be fitted with a M12 x 25 mm setscrew, washer and spring washer. The boss and the setscrew shall be stainless steel of grades 304 and 316 respectively.
- 4.2.1.13 Transformer windings, both MV and LV, shall be copper.

4.2.2 Earthing

- 4.2.2.1 The miniature substation shall have a copper earth bar, with a cross sectional area equal to at least 70 mm^2 , that is accessible from within both MV and LV compartments.

Note: two 70 mm^2 shall be used for the 1 MVA mini-sub.

- 4.2.2.2 The transformer earth terminal (boss) shall be connected to the miniature substation earth bar by means of a bare 70 mm^2 copper, wire conductor.
- 4.2.2.3 A combined LV neutral-earth busbar shall be provided and shall be insulated from the mini-sub. No separate LV earth bar shall be provided.
- 4.2.2.4 The neutral terminal of the transformer LV winding shall be connected to the LV neutral-earth busbar.
- 4.2.2.5 The miniature substation earth bar shall make provision, by means of a dedicated hole, for the fitting of a LV neutral surge armineral. A surge armineral shall be provided by the miniature substation manufacturer and positioned so that the 250mm insulated jumper is connected to the LV neutral-earth bus-bar (see figure 1). In addition, two electrolytic copper conductors, each with a cross-sectional area of at least 70 mm^2 shall be fitted (in parallel with the surge armineral) to provide an electrical bridge between the miniature substation earth bus-bar and the LV neutral-earth bus-bar.
- 4.2.2.6 The main RMU earth bar shall be connected to the mini-sub earth bar using 70 mm^2 bare copper conductor.
- 4.2.2.7 The earth connection to the transformer tank shall be between the transformer earth terminal (boss), provided on the MV side of the transformer and mini-sub earth bar by means of a 70 mm^2 bare copper conductor.
- 4.2.2.8 All metalwork shall be bonded to earth.
- 4.2.2.9 The earth resistance after the cut-in of the MSS shall not exceed $1\ \Omega$

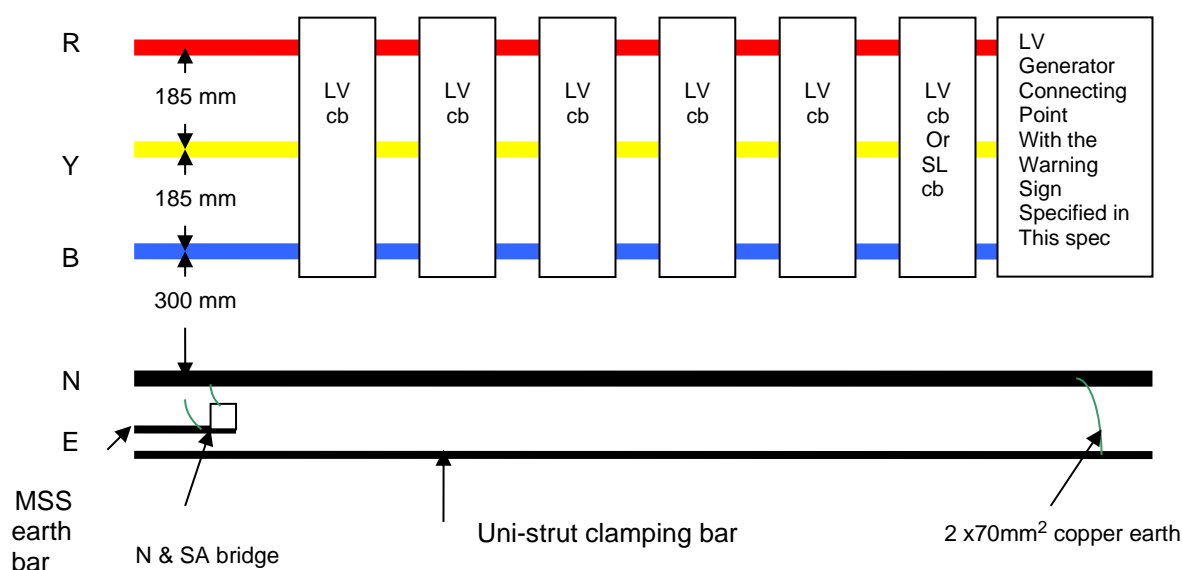


Figure 1 – LV panel showing bus-bar and circuit breaker arrangement

4.2.3 LV panel and main large frame MCCBs

4.2.3.1 The LV panel shall be constructed and designed for the use of large frame MCCB's. The LV bus-bar arrangement and circuit breaker arrangements are shown above in figures1.

4.2.3.2 A main LV large frame, adjustable, electronic MCCB, complying with CP_TSSPEC_018 shall be installed in each miniature substation as main LV protection. The MCCB shall be set to the specific transformer's full load secondary current. **The LV main MCCB shall be tested by City Power and certified as being correctly rated and operational. The approval of the MCCB shall take place prior to its installation.**

Note: The main MCCB is usually located below the LV transformer bushings and is not shown in figure 1

Transformer size (kVA)	Main MCCB Adjustability Range (A)
315	400 - 800
500	400 - 800
630	800 - 1600
1000	800 - 1600

Table 2 – Main MCCB current ratings

4.2.3.3 The main LV large frame MCCB shall have flash barriers at both ends and shall be barricaded from inadvertent contact and tampering by a protective shield. The barrier shall not prevent operation of the main MCCB.

4.2.3.4 The five main outgoing MCCB's and one streetlight MCCB shall not be provided with the MSS, unless specifically requested by City Power. In instances where these MCCB's are required,

it is not necessary to have them tested by Test Branch, but they shall comply with CP_TSSPEC_018. The outgoing MCCB's shall be an adjustable 160 – 400A circuit breaker.

- 4.2.3.5 The LV panel shall be provided with a mounting panel for the five main outgoing MCCB's and one streetlight MCCB. The onus is on the miniature substation manufacturer to provide mounting holes to suit the MCCBs being utilised by City Power. The main outgoing MCCB's and/or one streetlight MCCB shall be shielded from inadvertent contact and tampering. The shield shall accommodate the escutcheon height of the circuit breakers being utilised by City Power. The streetlight MCCB shall be an adjustable 160 – 250A circuit breaker.
- 4.2.3.6 All other exposed live LV connections and components (e.g. the transformer LV bushings) shall be barricaded (protected) using non-flammable plastic (e.g. acrylic) material to prevent inadvertent contact by persons requiring access to the LV compartment.
- Note:** The term 'barricaded' implies that each compartment containing live equipment shall have an IP2X rating.
- 4.2.3.7 All bus-bar holes intended for connection of cable conductors shall be 12mm clearance holes.
- 4.2.3.8 The generator connecting point shall be connected as shown in figure 1 and the connector must be red with the warning sign indicating that the main circuit breaker should be switched off before connecting the generator.

4.2.4 LV bus-bars

- 4.2.4.1 The LV phase bus-bars shall be positioned with 185 mm fixing centres as shown in figure 1. The spacing between the lowest LV phase bus-bar and the LV neutral-earth bus-bar shall be 300 mm. The spacing between the LV neutral-earth bus-bar and the Uni-strut clamping bar shall be 200 mm.
- 4.2.4.2 The LV bus-bars shall be rated at 1,2 times the kVA capacity of the transformer (see table 2) and the current density shall not exceed 1,8 A/mm².

Transformer rating (kVA)	LV bus-bar current rating (A)
315	525
500	835
630	1052
1000	1670

Table 3 – LV bus-bar current ratings

- 4.2.4.3 The rated short-time current withstand level (1 s) of the LV bus-bars shall be 25 kA for up to 630kVA miniature substations and 45 kA for 1000 kVA miniature substations.
- 4.2.4.4 The LV bus-bars shall be drilled (centrally located 14 mm diameter holes) to accommodate the number of outgoing LV feeders. The holes shall be horizontally spaced at intervals of 160 mm. The position and alignment of the holes shall correspond to the LV outgoing feeder cable bays (see figure 1). The distance between adjacent feeder bay centre-lines shall be 160 mm.
- 4.2.4.5 The busbars shall be staggered properly.
- 4.2.4.6 The LV neutral-earth bus-bar shall be dimensioned identically to the LV phase bus-bars and be made of tinned, hard-drawn copper in accordance with SANS 1029. The LV neutral-earth bus-bar shall be drilled (centrally located 14 mm diameter holes) at intervals of 160 mm along

the length of the bus-bar, so that the holes align vertically with the phase bus-bar holes (see figure 1).

4.2.4.7 Neutral isolating links are not required.

4.2.4.8 M12 set screws, nuts, washers and spring washers shall be provided for each 14 mm hole drilled on the LV bus-bars.

4.2.5 LV auxiliary circuits

4.2.5.1 A three pin socket outlet and 60W bulkhead fitting shall be fitted with the following protection equipment:

- a) A 20 A HRC fuse; and
- b) An instantaneous trip earth leakage unit: 20 A load capacity, 5 kA rupturing capacity, 30 mA sensitivity;
- c) A neutral fuse link.

Note: The socket outlet earth shall be connected to the LV neutral-earth busbar and not to the mini-sub earth busbar or any steelwork of the miniature substation. If the socket housing is metallic, care must be taken to ensure that this connection to the steelwork is not inadvertently made.

4.2.5.2 The LV supply for the earth fault indicator shall consist of:

- a) A 10A HRC fuse; and
- b) A neutral fuse link.

4.2.6 LV metering compartment

4.2.6.1 A separate LV metering compartment, for metering a dedicated supply, shall be provided between the MV and LV compartment. This compartment shall open to the front of the miniature substation.

4.2.6.2 The LV metering compartment shall be independent from both the MV and LV compartments. Only a 50 mm conduit pipe shall be used for internal metering wires between the LV compartment and the metering compartment. The LV metering compartment will be accessed by unskilled operators and the IP54 rating of the compartment is critically important.

4.2.6.3 The LV metering compartment shall be 400 mm wide x 400 mm deep.

4.2.6.4 The LV metering compartment shall make provision for an electronic maximum demand billing meter, which will be fitted by City Power.

4.2.6.5 A metering test block and 3 fuse holders with 2A HRC fuse, shall be fitted in the LV metering compartment. All approved internal wiring shall be terminated in the left-hand side of the LV compartment in an adequate terminal strip.

4.2.6.6 As per table 4, the following bus-bar mounted class 0.5 LV metering ring CT's shall be installed in the middle of the LV bus-bars, to the left of any of the 7 outgoing LV feeders. It shall be possible to connect a dedicated LV cables to the left of these CT's.

MSS rating (kVA)	LV CT rating (A)
315	600 / 5
500	800 / 5
630	1000 / 5
1000	1600 / 5

Table 4 :LV metering CTs

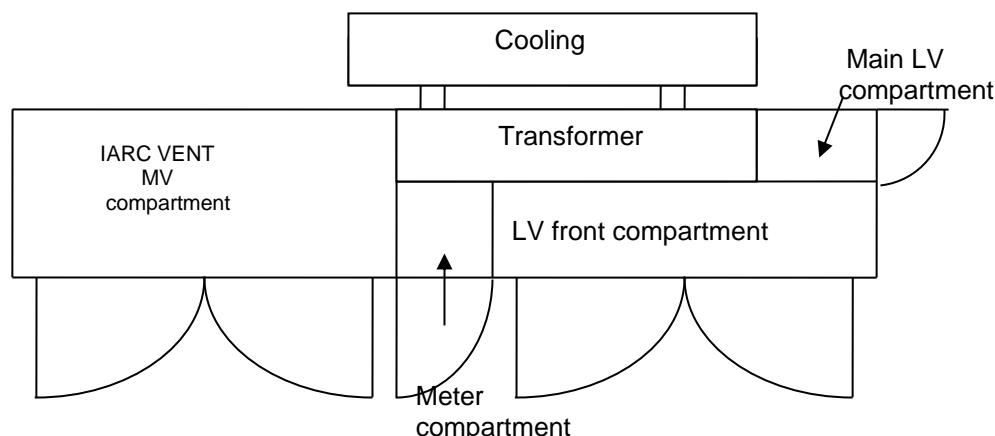
4.2.7 Additional equipment

- 4.2.7.1 Analogue LV ammeters shall be provided for all three phases. The ammeters shall be phase-identified, thermal maximum demand ammeters, integrating over a 15 min period. The individual current transformers shall be bus-bar mounted and securely fitted. All metering CT's shall comply with CP_TSSPEC_065.
- 4.2.7.2 One voltmeter shall be provided with a selector switch to enable any one of the phase voltages to be read.
- 4.2.7.3 The meters shall be mounted as high as is practicable on the right hand side of the LV compartment.
- 4.2.7.4 An earth-fault indicator (EFI) that complies with CP_TSSPEC_040 shall be provided and positioned on the right-hand side of the first MV compartment. Sufficient slack shall be provided on the EFI CT cable, to enable it to reach the furthest MV cable termination. The indicator shall be mounted on the outside of the miniature substation enclosure in such a manner that it can be clearly viewed from the front of the miniature substation (street-front). The unit shall be connected to the LV supply of the miniature substation
- 4.2.7.5 No provision shall be made for any street-lighting panels in the miniature substation. Provision shall be made for an MCCB protecting a street light circuit

4.3 Construction requirements

4.3.1 Design

- 4.3.1.1 The general layout of the miniature substation shall be in accordance with the Type B (lateral) layout, as specified in figure C.5, annexure C, SANS 1029. Figure 2 is a specific illustration of City Power requirements.



Note: Drawing not to scale.

Figure 2: Layout for City Power Type B MSS

4.3.1.2 The miniature substation construction design shall be modular. Each of the enclosures shall form a separate module on its own and shall have an ingress protection rating of IP54:

- 1.MV compartment;
- 2.Metering compartment;
- 3.Transformer compartment;
- 4.LV front compartment housing outgoing circuit breakers and ancillary equipment; and
5. Main LV compartment housing main circuit breaker, tap changer and dual ratio changeover switch.

4.3.1.3 The base channel and sills of the doors shall be constructed with removable sections adjacent to the MV compartment door(s) to allow the MV cables to be moved into position. These sections shall be lap bolted with the nuts on the inside of the base channel and housing. The base channel shall be designed to fit the concrete plinth detailed in CP_TSSPEC_027.

4.3.1.4 All doors shall be a manual three point locking mechanism, capable of being secured by a padlock, having a shackle diameter of 8mm. The doors shall remain in a secured position.

4.3.1.5 All doors shall be flush with the body of the miniature substation and the stainless steel door hinges shall be the concealed type. A door stop shall be provided to prevent the door from swinging. The door stop shall be strong enough to withstand the forces that might arise from wind on the open door.

4.3.1.6 All doors shall be a manual three point locking mechanism, capable of being secured by a padlock, having a shackle diameter of 8mm.

4.3.1.7 The three point locking mechanism on each door shall have an additional captive, 10mm allen cap screw

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- 4.3.1.8 The position of the lifting lugs shall take the centre of the gravity of the entire mini-sub into consideration to ensure the mini-sub is evenly balanced when lifting without the roof being removed.
- 4.3.1.9 After disconnection of the cables and fastening it shall be possible to lift the entire miniature substation from its plinth. The transformer shall have lifting lugs by which it can be lifted after the disconnection of the cables and fastenings.
- 4.3.1.10 Ventilation louvers shall be provided on the miniature substation doors. Louvres shall not be provided on the roof section of the miniature substation. A 6mm vermin mesh shall be provided on the inside of the louver.
- 4.3.1.11 The mini-sub enclosure shall be bonded to the miniature substation earth bar. All miniature substation housing sections (including the doors) shall be bonded to one another (i.e. interconnected). The bonding conductors shall be tinned electrolytic copper braiding with a minimum cross-sectional area of 50 mm².

4.3.2 Materials and corrosion protection

- 4.3.2.1 The miniature substation enclosure (roof, compartments and doors) and transformer tank shall be suitable for corrosive environments.
- 4.3.2.2 The unit shall be manufactured from mild steel which is 3 or 6mm thickness or 3 or 6mm 3CR12 stainless steel.
- 4.3.2.3 The transformer cooling radiator shall be hot dip galvanised mild steel.
- 4.3.2.4 The copper bus-bars and mini-sub earth bar shall be tinned.
- 4.3.2.5 The miniature substation steel base shall be hot dip galvanized in accordance with the relevant requirements of SANS ISO 1461 and, in addition, shall be coated with black epoxy tar paint.
- 4.3.2.6 A 5 mm thick cork packing shall be installed between the miniature substation end compartments and the transformer tank section, between the base and the end compartments, and between the base and the transformer tank section.
- 4.3.2.7 The final colour shall be Avocado Green C12 in accordance with SANS 1091.

4.4 Design

4.4.1 Layout

The Type B miniature substation layout shall comprise the following separate compartments:

- a) MV compartment housing a metal-enclosed ring main unit as specified in CP_TSSPEC_006,
- b) Transformer compartment housing the transformer,
- c) LV compartment for housing outgoing circuit breakers and ancillary equipment, and
- d) LV metering compartment with provision for mounting an electronic maximum demand billing meter.
- e) Main LV compartment housing main circuit breaker, rating plate, dual ratio change over switch and tap changer.

4.4.2 Electrical requirements

4.4.2.1 MV ring main unit (RMU) with voltage detecting system (VDS as per SANS 61243-5).

The non-extensible ring main unit shall comply with the requirements of CP_TSSPEC_006.

4.4.2.2 Connections between ring main unit and transformer

4.4.2.2.1 For connections between RMU circuit breaker and transformer, MV, type C bushings shall be screened, Type B, 70mm² aluminium, single-core XLPE cables that comply with SANS 1339. The screens shall be earthed on the RMU side only. Type 4 SSC terminations as per SANS 876 shall be supplied.

4.4.2.2.2 Fully screened separable connectors complying with SANS 1332 shall be installed at both ends of the above screened tails.

4.4.2.2.3 A Voltage detecting system with test points in accordance with SANS 61243-5 shall be installed for each functional units to determine the status of the outgoing consumer cable circuit.

4.4.2.3 Connections between outgoing LV MCCB and transformer LV bus-bars

4.4.2.3.1 These connections and the outgoing LV MCCB's shall only be provided if so specified by City Power Johannesburg (Pty) Ltd or the consultant/developer providing the minisub for use on the City Power network.

4.4.2.3.2 The connection between the top of the outgoing 160 – 400A, LV feeder MCCB and transformer LV bus-bars shall comprise 600/1000 V, single core, PVC insulated flexible cables with stranded copper conductors that comply with SANS 1574. The cross sectional area of each cable shall be 120mm².

4.4.2.3.3 The ends of these connections shall be terminated with a suitably crimped lug.

4.4.2.3.4 Acceptable allowance shall be made for short circuit effects such as thermal and electro-dynamic forces.

4.4.2.3.5 The cabling shall be colour coded. A coloured sleeve shall be fitted over the cable or lug barrel. The required colours shall be red, yellow, and blue.

4.4.2.4 Transformer MV bushings

4.4.2.4.1 The transformer medium-voltage bushings shall comply with EN 50180 Type C (630A – tapered), bolted-Type Bushings with an M16x2 thread. These bushings have an internal screen which shall be earthed.

Note: All transformer bushing shall be subjected to a partial discharged test in accordance with SANS 60137

4.4.2.4.2 The bushing-centre spacing and distance between the outer bushing-centres and the mini-sub metal enclosure shall be as specified in SANS 1332 for use with type 4 connections;

a) 135 mm between phase bushing-centres, and

b) 90mm between phase bushing-centres and earth.

4.4.2.4.3 A type C bushing shall be constant as per design.

4.4.2.5 Transformer overload protection and shunt-trip facility

The transformer liquid-immersed unit shall be fitted with a top-oil thermoelectric temperature-sensing element. This shall trip the main LV circuit breaker unit through a 230V shunt-trip facility when the transformer top-oil temperature exceeds 90 °C. The relay used to provide the shunt-trip facility shall be housed in an enclosure and sealed with a stainless steel meter sealing wire and a 12 mm tinned copper ferrule. The thermo electric shall have a transparent front cover in order to view the temperature setting on the relay. The supply to the shunt trip facility shall be fitted with:

- 1.A 10A HRC fuse,
- 2.10A miniature circuit breaker and
- 3.A neutral fuse link.

4.4.3 Construction requirements

- 4.4.3.1 The general arrangement of the miniature substation shall be in accordance with the Type B (lateral) layout, specified in SANS 1029.
- 4.4.3.2 The maximum overall length and width of the miniature substation (including the cooling radiator) shall be 3000 mm and 1650 mm respectively. The miniature substation base length and width shall be 3000 mm and 1200 mm respectively. The height of the miniature substation is restricted to 2000 mm. The base channel shall be designed to fit the concrete plinth detailed in CP_TSSPEC_027.
- 4.4.3.3 A barrier shall separate the end of the LV compartment (located on the LV side of the transformer) from the front LV compartment.
- 4.4.3.4 The miniature substation earth bus-bar shall be accessible from the front of the ring main unit. The ring main unit shall be bonded to the miniature substation earth bus-bar by a 70 mm² copper conductor.
- 4.4.3.5 Provision shall be made for the support (clamping) of two incoming (ring) cables in the MV compartment. Two adjustable cable clamps, each suitable for clamping cable ranging a maximum of one 300mm² x 3 core, copper/aluminium XLPE cable, shall be provided with the miniature substation. The minimum distance from the cable support point (clamp) to the RMU bushing centres shall be 800 mm as per SANS 876. Cable support clamps shall comply with CP_TSSPEC_029.
- 4.4.3.6 The design and construction of the mini-sub shall complement the internal arc-test requirements of the RMU (see CP_TSSPEC_006). The miniature substation shall be tested to assess the effects of arcing due to an internal fault inside the RMU. The minimum fault current inside the RMU shall be equal to the rated short time withstand current of the RMU. The minimum duration of the fault shall be 0,5 seconds. The miniature substation is intended to be installed in a site of unrestricted public accessibility and shall thus be tested with indicators placed in the front, lateral and rear sides (AB classification) of the miniature substation as per clause 6.106 and Annex A of SANS 62271-200.
- 4.4.3.7 The enclosure shall make provision to accommodate the following:
 - The enclosure shall fit on the concrete plinth as per specification CP_TSSPEC_027.

4.5 Transformer losses and capitalization

- 4.5.1 The following capitalization formula will be used in the evaluation of any tender, to establish the net present value of the total cost of the transformer:

$$Total\ cost = A + C_i P_i + C_c P_c$$

where

A is the cost of purchasing and installing the transformer (capital cost), R;

P_i is the no-load (iron) losses, kW;

P_c is the load (copper) losses, kW;

C_i is the capitalized cost of no-load (iron) loss, R/kW; and

C_c is the capitalized cost of load (copper) loss, R/kW.

- 4.5.2 The economic life of a transformer is assumed to be 30 years.
- 4.5.3 The values of parameters C_i and C_c are given in the technical schedules. These parameters will be revised as and when deemed necessary.
- 4.5.4 Regardless of the use of the capitalization formula, the losses shall not be greater than those given in table 5.

Rated power (kVA)	Component losses- No-load loss (W)		Load loss (W)	
	Dual ratio	Single Ratio	Dual ratio	Single Ratio
315	792	N/A	4180	N/A
500	1210	1180	5940	5400
630	1430	N/A	7040	N/A
1000	2090	N/A	10450	N/A

Table 5 – Maximum losses

- 4.5.5 Load and no-load losses, the percentage impedance and the X/R ratio of the transformer shall be stated in schedule B of the enquiry document. The load losses and the percentage impedance shall be stated at 75°C, in accordance with SANS 780 for oil distribution transformer and SANS 60076-11 for dry type.
- 4.5.6 Preference shall be given to low loss transformers.

4.6 Marking and labeling

4.6.1 Transformer rating plate information

- 4.6.1.1 In addition to the relevant requirements of SANS 780 for liquid immersed and SANS 60076-11 for dry-type transformer, the following information shall be clearly shown on the transformer rating plate:

- a) the manufacturer's name and year of manufacture;
- b) Type of transformer
- c) the serial number;
- d) City Power's order number;
- e) City Power's SAP material number;
- f) The total mass of the miniature substation.

4.6.1.2 The rating plate shall be permanently affixed in a prominent position at the LV transformer terminals so that it is clearly visible when the door to the LV compartment is open.

4.6.1.3 The transformer serial number shall be used as a miniature substation serial number.

4.6.2 Signs

4.6.2.1 A sign depicting "Treatment and Full First Aid Instructions" shall be pop riveted to the inside of the MV and LV compartment of the door that opens first.

4.6.2.2 External chromadek electrical safety notices, in accordance with design WW7 shall be securely mounted on the outside door of each compartment. If pop-rivets are used to attach the signs to the mini-sub doors, only aircraft pop-rivets will be acceptable. Normal pop-rivets are not acceptable.

4.6.2.3 The barrier used to barricade the LV bushings of the transformer shall have a sticker applied to it depicting an electrical symbolic warning sign (warning against "Unauthorized entry").

4.6.3 Labels

4.6.3.1 Phase labels shall be provided below all the bushings (primary and secondary) of the transformer and ring main unit.

4.6.3.2 The LV bus-bars shall be colour-coded in the colours of red, yellow, blue and black by a clearly visible painted-on spot at least 20 mm diameter.

4.6.3.3 The MV and LV compartment doors shall be labelled 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 stencilled on both the inside and outside of all the compartment doors.

4.6.3.4 The LV metering compartment door shall be labelled with "METERING COMPARTMENT". The labels shall be clearly and indelibly stencilled on outside of the metering compartment door.

4.6.3.5 The manufacturer's name, primary voltage, secondary voltage, 'kVA' rating and vector group shall be marked on the right hand side of the mini-sub, e.g. "GEORGE MSS11kV / 6,6 kV / 415 V 500 kVA Dyn11". The colour of markings shall be decided by SCM and displayed in characters not less than 50 mm high. The same information shall be displayed on the roof.

4.6.3.6 The SF₆ RMU and SF₆ Free RMU shall be provided with black on white sandwich board designation labels, permanently fixed on each circuit. The labels shall be 150mm long by 30mm high.

4.6.3.7 The LV outgoing circuits shall be provided with a 125 mm long, 21 mm high black on white sandwich board designation label, permanently fixed above each circuit breaker or on a mounting rail running the length of the LV circuits.

4.6.3.8 The LV auxiliary circuits shall be clearly labelled.

4.6.4 Safe-keeping of documentation

4.6.4.1 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 MV compartment door that opens first.

4.6.4.2 Provision shall be made for the safe-keeping of City Power documentation (A4 size booklet, 20mm thick) on the inside of the LV compartment door that opens first.

4.7 Documentation

4.7.1 Technical schedules

The full Technical Schedule B and the Deviation Schedule shall be completed by the tenderer for each item offered and, together with Technical Schedule A, shall be submitted to City Power for approval at the time of tendering.

4.7.2 Drawings

The following drawings shall be submitted to City Power for approval at the time of tendering:

4.7.2.1 Final design drawings (2 sets) reflecting the major dimensions (including the transformer and ring main unit dimensions) and layout of all components of the miniature substation. These drawings shall clearly indicate the following:

- a) the general assembly (showing the actual positioning of the transformer, RMU, LV compartment, MV compartment and LV metering compartment. The position of the RMU bushings and cable support clamps shall be clearly shown),
- b) the LV panel layout,
- c) the removable barrier that separates the end LV compartment from the front LV compartment,
- d) the removable barricading for the outgoing MCCBs,
- e) the removable sections adjacent to the cable entry positions.
- f) the design details of the interconnections between the ring main unit and the transformer MV bushings, and
- g) The internal arc complemented MV compartment details.

4.7.2.2 Wiring circuit diagrams (2 sets). These drawings shall clearly indicate the following:

- a) All auxiliary circuits and equipment; and
- b) Ferrule numbers used for labelling auxiliary circuits

Any revision to drawings of units being manufactured for and supplied to City Power shall clearly indicate the revision number and date, and shall be submitted to City Power for approval at the time of tendering.

4.7.3 Test reports

- 4.7.3.1 All required type test report (see 5.2.1) shall be submitted to City Power by the manufacturer at the time of tendering. Single copies of all type-test reports shall be in English, for the miniature substations offered.
- 4.7.3.2 Full routine test reports (see 5.2.5) shall be provided with the miniature substations supplied. Original manufacturer's test reports for bought-out (out-sourced) equipment shall be provided with the equipment supplied.
- 4.7.3.3 Test reports for each unit shall be traceable by reference to the manufacturer's serial reference number marked on the unit.
- 4.7.3.4 Any additional test report shall be marked "Additional tests" and kept separate from the required test report.

4.8 Transport

Each miniature substation shall be transported in accordance with the requirements of CP_TSINST_013.

5 TESTS

5.1 General

- 5.1.1 The tests shall be performed to establish the design characteristics of the miniature substation and assure compliance with the requirements specified. The tests shall be conducted on new units in the same state as they are normally supplied.
- 5.1.2 City Power reserves the right to witness any or all of these tests. The supplier or manufacturer shall demonstrate an ability to provide means to enable City Power to witness such tests.
- 5.1.3 Suppliers are requested to indicate their compliance with the relevant standard at the tendering stage and shall submit all the required type tests and design drawings. If the units offered have been tested for compliance with an internationally accepted standard, City Power may accept those test reports in place of the tests covered by this specification. The type test reports and alternative test standards shall be submitted with their tender, for City Power's consideration.
- 5.1.4 The qualifying type tests need not be performed if they were successfully completed for a previous City Power tender, provided that the design and material have not been changed or modified in any way. The type test reportss of completed successful type tests previously resubmitted shall be submitted with the current inquiry. Any change in the components shall be indicated at the time of tender. Reference to the appropriate inquiry for which the tests were successfully completed, shall be included in the current inquiry.
- 5.1.5 The transfer of test reportss between manufacturers will not be allowed.
- 5.1.6 City Power reserves the right to view an existing miniature substation complying with this specification or if no such unit exists a prototype shall be built and made available for inspection by representatives of City Power.

5.2 Qualifying tests

5.2.1 Type tests

- 5.2.1.1 Type tests are intended to establish design characteristics. They are normally only made once and repeated only when the design, components or the material of the unit are changed. The results of the type tests are recorded as evidence of compliance with design requirements.
- 5.2.1.2 The following type tests specified in SANS 1029 are required. The supplier shall pay the cost of type testing and shall provide City Power with the details of when and where these tests will be conducted.

5.2.2 Transformer unit

- 5.2.2.1 Type tests as specified in SANS 780 for oil and SANS 60076-1/3 for dry type (temperature rise, voltage withstand dielectric), tank stiffness and, if applicable, corrugated tank fatigue type tests) shall be carried out on the transformer. The insulation levels of the transformer windings shall be tested in accordance with table 1.
- 5.2.2.2 The transformer temperature rise test shall be carried out on the complete mini-sub in accordance with SANS 1029 with the compartment doors closed.
- 5.2.2.3 In addition, the following special type tests shall be carried out:
- a) Short-circuit withstand test in accordance with SANS 60076-5; and
 - b) The fully assembled miniature substation shall not exceed the specified maximum audio-sound levels specified in table 6 of this specification when tested in accordance with IEC 60551. This test shall be conducted with the compartment doors closed and the mini-sub standing on a solid level surface.

Rated power kVA	Maximum audio sound level dB(A)
315	50
500	52
630	54
1000	56

Table 6 – Maximum limits of transformer audio sound levels

5.2.3 Ring Main Unit

Type tests as specified in CP_TSSPEC_006 shall be carried out.

Note: Due to a commitment for City Power to migrate and continue to be a cleaner environment to its stakeholders (City of Johannesburg), the manufacture shall be required within 1 year after award to test and comply to the new SF6 free RMU.

5.2.4 Mini-sub

The miniature substation shall be tested to assess the effects of arcing due to an internal fault inside the RMU. The minimum fault current inside the RMU shall be equal to the rated short time withstand current of the RMU as given in CP_TSSPEC_006. The minimum duration of the fault shall be 0,5 seconds. The MSS is intended to be installed outdoors in a site of unrestricted public accessibility (i.e. Type B accessibility) and shall thus be tested with indicators placed in the front, lateral and rear sides of the MSS as per SANS 1029. However, the test shall be carried out with the miniature substation MV compartment doors (front) open. The conditions stated in clause A.5.3.4 of SANS 1029 (i.e. applicable to the "Combined Test "requirements) shall be fulfilled – giving the entire miniature substation the following internal arc classification (IAC):

Classification IAC	AB-FLR
Internal arc	20kA 0,5 s

The test setup shall thus be in accordance with the following conditions:

Front:	restricted to operators (Type A test requirements), and
Rear and lateral:	public accessibility (Type B test requirements).

The arc initiation shall be made in one of the ring main cable compartments (i.e. that which produces the highest stresses in the miniature substation) provided:

- the air-filled compartment(s) and SF₆ switchgear or SF₆ Free switchgear chamber(s) of the RMU have been previously internally arc tested in accordance with the requirements of SANS 62271-200 with a minimum classification IAC of "AB" for an internal arc of minimum current and duration as specified above; and
- the gas flow coming from the other air-filled cable compartment(s) and SF₆ switchgear or SF₆ Free switchgear chamber(s) is similar to that from the tested cable compartment in accordance with SANS 62271-200.

If the above conditions are met, then the miniature substation need not be tested for an arc initiated in the SF₆ switchgear chamber(s).

Venting of the internal arc emissions (i.e. gas flow) shall be directed upwards as miniature substations are normally installed on concrete plinths with the MV cable entry through the concrete plinth sealed with a sand-cement (10:1mix) screed. Individual cable compartment and SF₆ switchgear or SF₆ Free switchgear chamber venting ducts are not required.

The designation of IAC classification shall be clearly shown on a label provided in the MV compartment of the MSS. The label shall be clearly visible to the operator.

5.2.5 Routine tests

Routine tests are intended to prove conformance of units to specific requirements and shall be made on every unit. These tests shall be non-destructive. The following routine tests, in addition to those specified in SANS 1029, are required.

5.2.5.1 Transformer unit

The following routine tests, as specified in SANS 780 for oil immersed and IEC 60076-11 for Dry type, shall be carried out on the transformer:

- Measurement of winding resistance;

-
- b) Measurement of voltage ratio and check of phase displacement;
 - c) Measurement of short-circuit impedance and load loss;
 - d) Measurement of no-load loss and current;
 - e) Dielectric routine tests.

5.2.5.2 Ring main unit

Routine tests as specified in CP_TSSPEC_006 shall be carried out.

The circuit breaker shall be tested in accordance with the following minimum requirements and a routine test reports for the relay shall be produced and included with each miniature substation and stored in the documentation holder provided:

- a) Primary current injection tests shall be carried out to confirm the correct operation of the relays.
- b) A routine check shall be carried out to confirm that the relays are set according to relevant City Power procedures.

6 QUALITY MANAGEMENT

A quality management system shall be set up to assure the proper quality management of the 11KV type B miniature substation during design, development, production, installation and servicing phases. Guidance on the requirements for a quality management plan may be found in the ISO 9001:2015. The details shall be subject to agreement between City Power and the Supplier.

7 ENVIRONMENTAL MANAGEMENT

An environmental management system shall be set up to assure the proper environmental management of the 11KV type B miniature substation throughout its entire life cycle (i.e. during design, development, production, installation, operation and maintenance, decommissioning and disposal phases). Guidance on the requirements for an environmental management system may be found in ISO 14001:2015 standards. The details shall be subject to agreement between City Power and the Supplier. This is to ensure that the asset created conforms to environmental standards and City Power SHERQ Policy

8 HEALTH AND SAFETY

A health and safety systems shall be set up in order to ensure proper management of 11KV type B miniature substation and compliance of the queuing system during installation, operation, maintenance, and decommissioning phases. Guidance on the requirements of a health and safety plan may be found in ISO 45001:2018 standards. This is to ensure that the asset conforms to standard operating procedures and City Power SHERQ Policy. The details shall be subject to agreement between City Power and the Supplier.

9 TECHNICAL SCHEDULES A AND B AND DEVIATION SCHEDULE REQUIREMENT

9.1 The purchaser shall require the tenderer to fill in schedule B. By doing this, the tenderer shall state compliance with this document and provide the information the purchaser has requested. Schedule B shall be completed in full by the supplier.

9.2 Deviations/modifications/alterations from the requirements specified in Schedule A or the rest of the specification shall be well documented in the deviation schedule.

AnnexA - Bibliography

DISSCAAM7: 2005, Eskom specification for medium-voltage miniature substations for systems with rated voltages from 11 kV to 22 kV.

Annex B - Revision information

DATE	REV. NO.	NOTES
Dec 2002	0	First issue
June 2006	1	Second Issue
		Primary normative reference changed from NRS 004 to SANS 1029 – all references changed
		4.2.1.1 The transformer shall bear the SABS 780 mark. Figure 1: Drawing revised Figure 2: Drawing revised
		4.2.1.3 The MV nominal voltage shall be 6,6 / 11 kV dual ratio and 11 kV single ratio. The rated voltage (U_m) of the transformer shall be 12kV. The transformer shall be capable of operating continuously at U_m without loss of life due to over-fluxing of the core.
		4.2.1.8 A robust oil level indicator shall be fitted in the LV compartment. It shall not be subject to discolouration or deformity when exposed to heat generated within the MSS. Perspex or plastic oil level indicators shall not be accepted. The oil level indicator shall be clearly visible to the operator when standing at the open MSS door.
		4.2.1.11 The transformer MV bushing requirements are specified in 4.4.2.4.1.
		4.2.2.7 The 65mm diameter holes shall be suitable for carrying a number 6 cable gland bar in accordance with CP_TSPEC_030 rev 1. The 49mm diameter holes shall be suitable for carrying a number 5 cable gland in accordance with CP_TSSPEC_030 rev 1. The gland plate on the far right shall be suitable for carrying two number 4 cable gland in accordance with CP_TSPEC_030 rev 1.
		4.2.3.2 A main LV large frame, adjustable, electronic MCCB, complying with CP_TSSPEC_018 shall be installed in each MSS as main LV protection. The MCCB shall be set to the specific transformer's full load secondary current. The MCCB shall be tested by City Power Test Branch (contact Grant Hageman at 490 7000) and certified as being correctly rated and operational. The approval of the MCCB shall take place prior to its installation.
		Note: The main MCCB is usually located below the LV transformer bushings and is not shown in figure 1 Table 2: New table

4.2.3.4 The six main outgoing MCCB's and one streetlight MCCB shall not be provided with the MSS, unless specifically requested by City Power. In instances where these MCCB's are required, it is not necessary to have them tested by Test Branch, but they shall comply with CP_TSSPEC_018.

4.2.3.6 **Note:** The term 'barricaded' implies that each compartment containing live equipment shall have an IP2X rating.

4.2.3.9 The LV panel shall be provided with a mounting panel for the six main outgoing MCCB's and one streetlight MCCB. The onus is on the MSS manufacturer to provide mounting holes to suit the MCCB's being utilised by City Power. The six main outgoing MCCB's and one streetlight MCCB shall be shielded from inadvertent contact and tampering. The shield shall accommodate the escutcheon height of the circuit breakers being utilised by City Power. The streetlight MCCB shall be an adjustable 160 – 250A circuit breaker.

4.2.3.10 All bus-bar holes intended for connection of cable conductors shall have a 14mm diameter.

4.2.7.6 As per table 4, the following bus-bar mounted class 1 LV metering ring CT's shall be installed in the middle of the LV bus-bars, to the left of any of the 7 outgoing LV feeders. It shall be possible to connect a dedicated LV cable/s to the left of these CT's

4.4.2.2.2 Terminations shall be executed in accordance with CP_TSPROC_001.

4.4.2.3 Connections between outgoing LV MCCB and transformer LV bus-bars

4.4.2.3.1 These connections and the outgoing LV MCCB's shall only be provided if so specified by City Power Johannesburg (Pty) Ltd or the consultant/developer providing the minisub for use on the City Power network.

4.4.2.3.2 The connection between the top of the outgoing 160 – 400A, LV MCCB and transformer LV bus-bars shall comprise 660/1000 V, single core, PVC insulated flexible cords with stranded copper conductors that comply with SANS 1574. The cross sectional area of each cord shall be 120mm².

4.4.2.3.4 Due allowance shall be made for short circuit effects such as thermal and electro dynamic forces.

4.4.2.4.3 The minimum creepage distance of the bushings shall be 31 mm/kV.

4.6.3.7 The SF₆ RMU shall be provided with black on white sandwich board designation labels, permanently fixed on each circuit. The labels shall be 150mm long by 30mm high.

4.6.3.8 The LV outgoing circuits designations shall be provided with a 125 mm long, 21 mm high black on white sandwich board designation label, permanently fixed above each circuit breaker or on a mounting rail running the length of the LV circuits.

4.6.4.1 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 MV compartment door that opens first.

4.6.4.2 Provision shall be made for the safe-keeping of City Power documentation (A4 size booklet, 20mm thick) on the inside of the LV compartment door that opens first.

4.8 Transport - Each MSS shall be transported in accordance with the requirements of CP_TSINST_013.

Addition of: 5.2.4 Mini-sub

The MSS shall be tested to assess the effects of arcing due to an internal fault inside the RMU. The minimum fault current inside the RMU shall be equal to the rated short time withstand current of the RMU as given in CP_TSSPEC_006. The minimum duration of the fault shall be 0,5 seconds. The MSS is intended to be installed outdoors in a site of unrestricted public accessibility (i.e. Type B accessibility) and shall thus be tested with indicators placed in the front, lateral and rear sides of the MSS as per Annex A of SANS 61330. However, the test shall be carried out with the MSS MV compartment doors (front) open. The conditions stated in clause A.5.3.4 of SANS 1029 (i.e. applicable to the "Combined Test requirements") shall be fulfilled – giving the entire MSS the following internal arc classification (IAC):

Classification IAC	AB-FLR
Internal arc	20Ka 0,5 s

The test setup shall thus be in accordance with the following conditions:

Front:	restricted to operators (Type A test requirements), and
Rear and lateral:	public accessibility (Type B test requirements).

The arc initiation shall be made in one of the ring main cable compartments (i.e. that which produces the highest stresses in the MSS) provided:

a) the air-filled compartment(s) and SF₆ switchgear chamber(s) of the RMU have been previously internally arc tested in accordance with the requirements of SANS 62271-200 with a minimum classification IAC of "AB" for an internal arc of minimum current and duration as specified above; and

- c) the gas flow coming from the other air-filled cable compartment(s) and SF₆switchgear chamber(s) is similar to that from the tested cable compartment in accordance with clause A.3 of SANS 61330.

If the above conditions are met, then the mini-sub need not be tested for an arc initiated in the SF₆switchgear chamber(s)

Venting of the internal arc emissions (i.e. gas flow) shall be directed upwards as minisubs are normally installed on concrete plinths with the MV cable entry through the concrete plinth sealed with a sand-cement (10:1mix) screed. Individual cable compartment and SF₆switchgear chamber venting ducts are not required.

The designation of IAC classification shall be clearly shown on a label provided in the MV compartment of the MSS. The label shall be clearly visible to the operator.

Addition of single ratio MSS to Technical Schedules– 6,6 AND 11kV as per G Teunissen's request at TEC in November 2005

April 2008

2

Format changes

Figure 2 altered to accommodate 52mm diameter glandholes & 100mm wide gland

All references in text to "mini – sub" changed to "miniature substation"

June 2011

3

The main RMU earth bar shall be connected to the mini-sub earth bar using 70 mm² bare copper conductor.

The earth connection to the transformer tank shall be between the transformer earth terminal (boss), provided on the MV side of the transformer and mini-sub earth bar by means of a 70 mm² bare copper conductor.

All metalwork shall be bonded to earth.

The earth resistance after the cut-in of the MSS shall not exceed 1 Ω

The position of the lifting lugs shall take the centre of the gravity of the entire mini-sub into consideration to ensure the mini-sub is evenly balanced when lifting without the lid being removed.

All transformer bushing shall be subjected to a partial discharged test in accordance with SANS 60137.

Requirements of shunt trip relay specified

Change the minimum distance from top of cable clamp to bushing centre to 800 mm as per SANS 876 (2009)

Clarification of IAC rating

Inclusion of the door lock protection

Inclusion of the Generator connector point

Remove all single ratio transformer technical schedule

Remove gland plate clauses and replace it with a uni-strut

Inclusion of the monitoring devices (RFID and TETRA compatible modem

Inclusion of micro dotting of equipment in the mini-substation.

February 2015	4	<p>Updated new list of committee members.</p> <p>4.1.2 Removal of RFID and TETRA compatible modem.</p> <p>4.21.1 Added dry-type distribution transformer</p> <p>4.2.1.2 Added 500 KVA Single ratio, 11KV/415</p> <p>4.2.6.6 LV CT metering class, changed from class 1 to class 0.5</p> <p>4.3.1.4 Tree point locking system changed to motorized. M10 Allen Cap Screw Removed.</p> <p>4.3.1.10 Locking box removed.</p> <p>4.3.2.8The unit shall be manufactured from mild steel which is 6 mm (minimum) thick and shall be manufactured from 3CR12 stainless steel.</p> <p>4.4.2.4.3 Type C creeping distance changed to 140 mm.</p> <p>f) Addition: Control and Monitoring System.</p> <p>6.4.8 Mini-Substation changed to 75 – 80 degrees Celsius.</p>
March 2019	5	<p>Updated new list of Committee members.</p> <p>6. Control and Monitoring system removed.</p> <p>All NRS removed.</p> <p>Added SF6 FREE Ring Main Unit</p> <p>SANS 555 for Natural mineral oil to be replaced by SANS 62770: for Unused Natural Mineral Oil for transformers.</p>
Oct 2019	6	<p>Natural Ester Oil removed, replaced by Natural mineral oil as insulating medium</p> <p>SANS 555</p> <p>General editing</p>
September 2024	7	<p>General editing.</p> <p>Remove electronic locking system</p> <p>Change Certificate to test report</p> <p>Replace ISO 18001 with ISO 45001</p>

Annex C - Technical schedules A and B for

MSS TB 315KVA DR DYN11 3MM THICK AV SF6 OIL TYPE TRFR (SAP 424)

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_00 5	Description	Schedule A	Schedule B
1		Standard operating conditions		
1.1		a) Altitude m	1800	
1.2		b) Ambient air temperature °C	-5 to +40	
1.3		c) Lightning ground flash density Flashes/ km ² /year	> 10	
1.4		d) Maximum solar radiation W/m ²	1000	
1.5		e) Ultraviolet radiation	High	
1.6		f) Relative humidity %	10 to 95	
1.7		g) Corrosive conditions (inland therefore non-corrosive)	Non- corrosive	
1.8		h) wind pressure Pa	700	
2	4.2.1	Ratings		
2.1		Transformer power rating kVA	315	
2.2		Nominal voltage of system (Dual ratio) kV _{rms}	6,6 & 11	
2.3		System frequency Hz	50	
2.4		Number of phases	3	
2.5		Rated no-load secondary voltage V _{rms}	415	
2.6		Rated power-frequency voltage kV _{rms}	12	
2.7		Rated lightning impulse withstand voltage kV _{peak}	95	
2.8		Rated short-duration power frequency withstand voltage [50Hz: 1 min] kV _{rms}	28	
2.9		Induced voltage withstand level kV _{rms}	22	
2.10		Internal arc classification	AB-FLR	
2.11		Internal arc current and duration	20KA/500 ms	

Note: Ticks, Cross [√, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

Tender Number: _____

Tenderer's Authorised Signatory: _____

Name in block letters

Signature

Full name of company: _____

Annex C - Technical schedules A and B for

MSS TB 315KVA DR DYN11 3MM THICK AV SF6 OIL TYPE TRFR (SAP 424)

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
3	4.3.1	Construction design		
3.1		Layout	Type B	
3.2		Construction	Modular	
3.3		Removable base sections adjacent to MV compartment (sections to be lap bolted with nuts on the inside of the channel and housing)	Required	
3.4		All doors shall be a manual three point locking mechanism, capable of being secured by a padlock, having a shackle diameter of 8mm.	Required	
3.5		Compartment lock protection facility (with welded mesh top with inside visibility)	Required	
3.6		Total mass of miniature substation kg	Required	
3.7		Overall maximum dimensions		
3.8		a) MV compartment length mm	Required	
		b) LV compartment length mm	Required	
		c) LV metering compartment mm	400 x 400	
		d) Overall length mm	3000	
		e) Overall width mm	1650	
		f) Overall height mm	2000	
		g) Base width mm	1200	
		h) Thickness mm	3mm	
		Provision for lifting of complete mini-sub onto a concrete plinth without need for dismantling	Required	
3.9		Provision of lifting lugs on roof for ease of removal	Required	
3.10		MV switchgear, LV panel, LV metering and transformer confined to separate compartments	Required	
3.11		Mini-sub housing sections and doors bonded	Required	

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MSS TB 315KVA DR DYN11 3MM THICK AV SF6 OIL TYPE TRFR (SAP 424)

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
4	4.2.1	Transformer unit (Oil immersed)		
4.1		Electrical requirements	As per SANS 780	
4.2		Vector group	Dyn 11	
4.3		MV system earthing	Effective	
4.4		LV transformer neutral earthing	Solid – connection to insulated LV neutral/earth bar	
4.5		MV system fault level	kA 25	
4.6		Temperature rise limits	As per SANS 780 Table 6	
4.7		Secondary voltage regulation (Off-load on the 11 kV supply voltage windings)	% +6.0, + 3.0, 0, –3.0, –6.0	
4.8		No-load losses	W Required	
4.9		Load losses	W Required	
4.10		Impedance	% SAN S780	
4.11		Cost /kW of no-load losses (Jul 2002)	R/kW 13 669	
4.12		Cost /kW of load losses (Jul 2002)	R/kW 1 623	
4.13		X/R	SANS 780	
4.14		Audio-sound level – maximum (see table 6)	dB(A) Table 6	
4.15		Sealed transformer unit	Required	

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Annex C - Technical schedules A and B for

MSS TB 315KVA DR DYN11 3MM THICK AV SF6 OIL TYPE TRFR (SAP 424)

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
4.16	4.4.2	Transformer MV bushings (NB internal screen to be earthed)	BS 7215 –Type C with M16x2 thread	
4.17		MV bushing-centre clearances (minimum) mm	135	
4.18		Clearances between outer bushing-centres and mini-sub metal enclosure (minimum) mm	90	
4.19		Transformer overload protection facility	Required	
4.20		Winding material	Required	
			Required	
4.21		Manufacturer of the distribution transformer of the distribution transformer	Required	
5		MV compartment		
5.1		Equipment in MV compartment	Ring Main Unit (CP_TSSPEC_006)	
5.2		Ring Main Unit manufacturer	Required	
5.3		Incoming MV cable requirements		
		a) 185 mm ² 3 core Cu or 300 mm ² 3C Al XLPE	Required	
		b) Cable support (clamping) required	Required	
		c) Minimum distance from cable clamp to centre-line of RMU bushings mm	800	
		d) Type of connection	Screened	
5.4		Mini-sub earth bar (accessible in front of RMU)	Required	
5.5		Interconnection arrangement between RMU and transformer MV bushings	Required	
5.6		Unscreened interconnecting equipment and connections between ring main unit and transformer to be barricaded	Required	
5.7		Type of earth fault indicator	Required	
5.8		Voltage detecting system (VDS)	Required	

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Annex C - Technical schedules A and B for

MSS TB 315KVA DR DYN11 3MM THICK AV SF6 OIL TYPE TRFR (SAP 424)

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
6	4.2.8	LV Compartment		
6.1		Bus-bar-rating (see Table 2)	A	1,2 times the kVA capacity
6.2		Bus-bar-insulation		Air insulated
6.3		Bus-bars	Ø	3 + one identical neutral-earth bus-bar (insulated from frame)
6.4		Current density of bus-bars	A/mm ²	1,8 maximum
6.5		Rated withstand current – 1 s (25 kA for up to 630 kVA & 45 kA for 1000 kVA)	kA _{rms}	As per rating.
6.6		Min clearance to earth and between phases	mm	20
6.7		Provision of a LV neutral surge armineral fitted between mini-sub earth bar and LV neutral-earth bus-bar		Required
6.8		LV neutral-earth bus-bar to be earthed (via an electrical bridge to the mini-sub earth bar)		Required
6.9		Neutral isolating links		Not Required
6.10		Provision of LV main isolating switch		Not Required
6.11		Number of outgoing LV feeders to be provided for (drill bus-bar Ø14mm holes)		6
6.12		Spacing between holes (see Figure 1)	mm	110
6.13		LV panel designed for large frame MCCBs		Required
		Spacing (vertical): Between phase bus-bars	mm	185
		Between lowest LV bus-bar and LV neutral	mm	300
		Minimum distance between LV neutral and uni-strut	mm	200

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Annex C - Technical schedules A and B for

MSS TB 315KVA DR DYN11 3MM THICK AV SF6 OIL TYPE TRFR (SAP 424)

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
6.14		LV maximum demand ammeters	On all three phases	
6.15		Ammeter type	Thermal integrating over 15 min period	
6.16		LV indicating voltmeter with a selector switch	Required	
6.17		Ammeter and voltmeter size and display mm	96 × 96, 90°	
6.18		Ammeter and voltmeter position	Top right hand side in LV compartment	
6.19		Analogue meter capable of reading current and voltage	Required	
6.20		Provision of removable non-flammable barrier to separate LV end compartment and front LV compartment	Required	
6.21		Main MCCB manufacturer	Required	
6.22		Catalogue/model code of main MCCB	Required	
6.23		Size of main MCCB A	As per table 2	

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Annex C - Technical schedules A and B for

MSS TB 315KVA DR DYN11 3MM THICK AV SF6 OIL TYPE TRFR (SAP 424)

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
7	4.2.6	LV auxiliaries		
7.1		Provision of three point socket outlet in LV compartment (with instantaneous-trip earth leakage unit [20 A; 5 kA rupturing capacity; 30 mA sensitivity] and 20 A HRC fuse with neutral fuse link)	Required	
7.2		Numbering ferrules for auxiliary wiring	Required	
8	4.3.2	Materials and corrosion protection		
8.1		Mini-sub enclosure and transformer tank thickness 3 or 6mm	Mild steel	
8.2		Radiator thickness 6(mm)	Mild steel	
8.3		Tinned copper bus-bars	Required	
8.4		Mini-sub base material	Steel	
8.5		5mm cork packing (between ends and tank, base and ends, base and tank)	Required	
8.6		Final colour	Avocado Green (12)	

Note: Ticks, Cross [√, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Annex C - Technical schedules A and B for

MSS TB 315KVA DR DYN11 3MM THICK AV SF6 OIL TYPE TRFR (SAP 424)

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
9	4.6.2	Notices, signs and labels		
9.1		Transformer rating plate	Required	
9.2		Treatment and Full First Aid Instructions on inside of MV and LV compartment doors	Required	
9.3		Elec. warning signs on all doors and barriers	Required	
9.4		Transformer phase labels below bushings	Required	
9.5		Colour-coded LV bus-bars	Required	
9.6		Stenciled labeling of MV and LV compartment doors (both inside and outside)	Required	
9.7		kVA, Prim V, Sec V & Corrosion Class	Required	
9.8		ID markings linking roof to body per batch	Required	
9.9		Provision for the safe-keeping of documents	Required	
10	4.7	Documentation		
10.1		Type test reports (provide ref. numbers of reports)	Sets 1	
10.2		Routine test reports	Sets 1	
10.3		Drawings	Sets 2	
10.4		Circuit diagrams (LV auxiliary wiring and equipment)	Sets 2	

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Technical schedules A and B Deviation schedule for

MSS TB 315KVA DR DYN11 3MM THICK AV SF6 OIL TYPE TRFR (SAP 424)

Any deviations offered to this specification shall be listed below with reasons for deviation. In addition, evidence shall be provided that the proposed deviation will at least be more cost-effective than that specified by City Power.

Item	Sub clause of CP_TSSPEC_005	Proposed deviation

Note: Ticks, Cross [√, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Annex C - Technical schedules A and B for

MSS TB 315KVA DR DYN11 6MM THICK AV SF6 OIL TYPE TRFR (SAP 3583)

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_00 5	Description	Schedule A	Schedule B
1		Standard operating conditions		
1.1		b) Altitude m	1800	
1.2		b) Ambient air temperature °C	-5 to +40	
1.3		c) Lightning ground flash density Flashes/ km ² /year	> 10	
1.4		d) Maximum solar radiation W/m ²	1000	
1.5		e) Ultraviolet radiation	High	
1.6		f) Relative humidity %	10 to 95	
1.7		g) Corrosive conditions (inland therefore non-corrosive)	Non- corrosive	
1.8		h) wind pressure Pa	700	
2	4.2.1	Ratings		
2.1		Transformer power rating kVA	315	
2.2		Nominal voltage of system (Dual ratio) kV _{rms}	6,6 & 11	
2.3		System frequency Hz	50	
2.4		Number of phases	3	
2.5		Rated no-load secondary voltage V _{rms}	415	
2.6		Rated power-frequency voltage kV _{rms}	12	
2.7		Rated lightning impulse withstand voltage kV _{peak}	95	
2.8		Rated short-duration power frequency withstand voltage [50Hz: 1 min] kV _{rms}	28	
2.9		Induced voltage withstand level kV _{rms}	22	
2.10		Internal arc classification	AB-FLR	
2.11		Internal arc current and duration	20KA/500 ms	

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Annex C - Technical schedules A and B for

MSS TB 315KVA DR DYN11 6MM THICK AV SF6 OIL TYPE TRFR (SAP 3583)

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
3	4.3.1	Construction design		
3.1		Layout	Type B	
3.2		Construction	Modular	
3.3		Removable base sections adjacent to MV compartment (sections to be lap bolted with nuts on the inside of the channel and housing)	Required	
3.4		All doors shall be a manual three point locking mechanism, capable of being secured by a padlock, having a shackle diameter of 8mm.	Required	
3.5		Compartment lock protection facility (with welded mesh top with inside visibility)	Required	
3.6		Total mass of miniature substation kg	Required	
3.7		Overall maximum dimensions	Required	
3.8		a) MV compartment length mm	Required	
		b) LV compartment length mm	Required	
		c) LV metering compartment mm	400 x 400	
		d) Overall length mm	3000	
		e) Overall width mm	1650	
		f) Overall height mm	2000	
		i) Base width mm	1200	
		j) Thickness mm	6	
		Provision for lifting of complete mini-sub onto a concrete plinth without need for dismantling	Required	
3.9		Provision of lifting lugs on roof for ease of removal	Required	
3.10		MV switchgear, LV panel, LV metering and transformer confined to separate compartments	Required	
3.11		Mini-sub housing sections and doors bonded	Required	

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Annex C - Technical schedules A and B for

MSS TB 315KVA DR DYN11 6MM THICK AV SF6 OIL TYPE TRFR (SAP 3583)

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
4	4.2.1	Transformer unit (Oil immersed)		
4.1		Electrical requirements	As per SANS 780	
4.2		Vector group	Dyn 11	
4.3		MV system earthing	Effective	
4.4		LV transformer neutral earthing	Solid – connection to insulated LV neutral/earth bar	
4.5		MV system fault level	kA 25	
4.6		Temperature rise limits	As per SANS 780 Table 6	
4.7		Secondary voltage regulation (Off-load on the 11 kV supply voltage windings)	% +6.0, + 3.0, 0, –3.0, –6.0	
4.8		No-load losses	W Required	
4.9		Load losses	W Required	
4.10		Impedance	% SANS 780	
4.11		Cost /kW of no-load losses (Jul 2002)	R/kW 13 669	
4.12		Cost /kW of load losses (Jul 2002)	R/kW 1 623	
4.13		X/R	SANS780	
4.14		Audio-sound level – maximum (see table 6)	dB(A) Table 6	
4.15		Sealed transformer unit	Required	

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Annex C - Technical schedules A and B for

MSS TB 315KVA DR DYN11 6MM THICK AV SF6 OIL TYPE TRFR (SAP 3583)

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
4.16	4.4.2	Transformer MV bushings (NB internal screen to be earthed)	BS 7215 –Type C with M16x2 thread	
4.17		MV bushing-centre clearances (minimum) mm	135	
4.18		Clearances between outer bushing-centres and mini-sub metal enclosure (minimum) mm	90	
4.19		Transformer overload protection facility	Required	
4.20		Winding material	MV Copper LV Copper	
4.21		Manufacturer of the distribution transformer of the distribution transformer	Required	
5		MV compartment		
5.1		Equipment in MV compartment	Ring Main Unit (CP_TSSPEC_006)	
5.2		Ring Main Unit manufacturer	Required	
5.3		Incoming MV cable requirements		
		a) 185 mm ² 3 core Cu or 300 mm ² 3C Al XLPE	Required	
		b) Cable support (clamping) required	Required	
		c) Minimum distance from cable clamp to centre-line of RMU bushings mm	800	
		d) Type of connection	Screened	
5.4		Mini-sub earth bar (accessible in front of RMU)	Required	
5.5		Interconnection arrangement between RMU and transformer MV bushings	Required	
5.6		Unscreened interconnecting equipment and connections between ring main unit and transformer to be barricaded	Required	
5.7		Type of earth fault indicator	Required	
5.8		Voltage detecting system (VDS)	Required	

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Annex C - Technical schedules A and B for

MSS TB 315KVA DR DYN11 6MM THICK AV SF6 OIL TYPE TRFR (SAP 3583)

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
6	4.2.8	LV Compartment		
6.1		Bus-bar-rating (see Table 2)	A	1,2 times the kVA capacity
6.2		Bus-bar-insulation		Air insulated
6.3		Bus-bars	Ø	3 + one identical neutral-earth bus-bar (insulated from frame)
6.4		Current density of bus-bars	A/mm ²	1,8 maximum
6.5		Rated withstand current – 1 s (25 kA for up to 630 kVA & 45 kA for 1000 kVA)	kA _{rms}	As per rating.
6.6		Min clearance to earth and between phases	mm	20
6.7		Provision of a LV neutral surge armineral fitted between mini-sub earth bar and LV neutral-earth bus-bar		Required
6.8		LV neutral-earth bus-bar to be earthed (via an electrical bridge to the mini-sub earth bar)		Required
6.9		Neutral isolating links		Not Required
6.10		Provision of LV main isolating switch		Not Required
6.11		Number of outgoing LV feeders to be provided for (drill bus-bar Ø14mm holes)		6
6.12		Spacing between holes (see Figure 1)	mm	110
6.13		LV panel designed for large frame MCCBs		Required
		Spacing (vertical): Between phase bus-bars	mm	185
		Between lowest LV bus-bar and LV neutral	mm	300
		Minimum distance between LV neutral and uni-strut	mm	200

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Annex C - Technical schedules A and B for

MSS TB 315KVA DR DYN11 6MM THICK AV SF6 OIL TYPE TRFR (SAP 3583)

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
6.14		LV maximum demand ammeters	On all three phases	
6.15		Ammeter type	Thermal integrating over 15 min period	
6.16		LV indicating voltmeter with a selector switch	Required	
6.17		Ammeter and voltmeter size and display mm	96 × 96, 90°	
6.18		Ammeter and voltmeter position	Top right hand side in LV compartment	
6.19		Analogue meter capable of reading current and voltage	Required	
6.20		Provision of removable non flammable barrier to separate LV end compartment and front LV compartment	Required	
6.21		Main MCCB manufacturer	Required	
6.22		Catalogue/model code of main MCCB	Required	
6.23		Size of main MCCB A	As per table 2	

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Annex C - Technical schedules A and B for

MSS TB 315KVA DR DYN11 6MM THICK AV SF6 OIL TYPE TRFR (SAP 3583)

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
7	4.2.6	LV auxiliaries		
7.1		Provision of three point socket outlet in LV compartment (with instantaneous-trip earth leakage unit [20 A; 5 kA rupturing capacity; 30 mA sensitivity] and 20 A HRC fuse with neutral fuse link)	Required	
7.2		Numbering ferrules for auxiliary wiring	Required	
8	4.3.2	Materials and corrosion protection		
8.1		Mini-sub enclosure and transformer tank thickness 6mm or 3 mm	Mild steel	
8.2		Radiator thickness 6(mm)	Mild steel	
8.3		Tinned copper bus-bars	Required	
8.4		Mini-sub base material	Steel	
8.5		5mm cork packing (between ends and tank, base and ends, base and tank)	Required	
8.6		Final colour	Avocado Green (12)	

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Annex C - Technical schedules A and B for

MSS TB 315KVA DR DYN11 6MM THICK AV SF6 OIL TYPE TRFR (SAP 3583)

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
9	4.6.2	Notices, signs and labels		
9.1		Transformer rating plate	Required	
9.2		Treatment and Full First Aid Instructions on inside of MV and LV compartment doors	Required	
9.3		Elec. warning signs on all doors and barriers	Required	
9.4		Transformer phase labels below bushings	Required	
9.5		Colour-coded LV bus-bars	Required	
9.6		Stenciled labeling of MV and LV compartment doors (both inside and outside)	Required	
9.7		kVA, Prim V, Sec V & Corrosion Class	Required	
9.8		ID markings linking roof to body per batch	Required	
9.9		Provision for the safe-keeping of documents	Required	
10	4.7	Documentation		
10.1		Type test reports (provide ref. numbers of reports)	Sets 1	
10.2		Routine test reports	Sets 1	
10.3		Drawings	Sets 2	
10.4		Circuit diagrams (LV auxiliary wiring and equipment)	Sets 2	

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Technical schedules A and B Deviation schedule for

MSS TB 315KVA DR DYN11 6MM THICK AV SF6 OIL TYPE TRFR (SAP 3583)

Any deviations offered to this specification shall be listed below with reasons for deviation. In addition, evidence shall be provided that the proposed deviation will at least be more cost-effective than that specified by City Power.

Item	Sub clause of CP_TSSPEC_005	Proposed deviation

Note: Ticks, Cross [$\sqrt{}$, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Annex C - Technical schedules A and B for

MSS TB 315KVA DR DYN11 3MM THICK AV SF6 DRY TYPE TRFR (SAP 3701)

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
1		Standard operating conditions		
1.1		c) Altitude m	1800	
1.2		b) Ambient air temperature °C	-5 to +40	
1.3		c) Lightning ground flash density Flashes/ km ² /year	> 10	
1.4		d) Maximum solar radiation W/m ²	1000	
1.5		e) Ultraviolet radiation	High	
1.6		f) Relative humidity %	10 to 95	
1.7		g) Corrosive conditions (inland therefore non-corrosive)	Non- corrosive	
1.8		h) wind pressure Pa	700	
2	4.2.1	Ratings		
2.1		Transformer power rating kVA	315	
2.2		Nominal voltage of system (Dual ratio) kV _{rms}	6,6 & 11	
2.3		System frequency Hz	50	
2.4		Number of phases	3	
2.5		Rated no-load secondary voltage V _{rms}	415	
2.6		Rated power-frequency voltage kV _{rms}	12	
2.7		Rated lightning impulse withstand voltage kV _{peak}	95	
2.8		Rated short-duration power frequency withstand voltage [50Hz: 1 min] kV _{rms}	28	
2.9		Induced voltage withstand level kV _{rms}	22	
2.10		Internal arc classification	AB-FLR	
2.11		Internal arc current and duration	20KA/500 ms	

Note: Ticks, Cross [√, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Annex C - Technical schedules A and B for

MSS TB 315KVA DR DYN11 3MM THICK AV SF6 DRY TYPE TRFR (SAP 3701)

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
3	4.3.1	Construction design		
3.1		Layout	Type B	
3.2		Construction	Modular	
3.3		Removable base sections adjacent to MV compartment (sections to lap bolted with nuts on the inside of the channel and housing)	Required	
3.4		All doors shall be a manual three point locking mechanism, capable of being secured by a padlock, having a shackle diameter of 8mm.	Required	
3.5		Compartment lock protection facility (with welded mesh top with inside visibility)	Required	
3.6		Total mass of miniature substation Kg	Required	
3.7		Overall maximum dimensions	Required	
3.8		a) MV compartment length mm	Required	
		b) LV compartment length mm	Required	
		c) LV metering compartment mm	400 x 400	
		d) Overall length mm	3000	
		e) Overall width mm	1650	
		f) Overall height mm	2000	
		g)Base width mm	1200	
		h)Thickness mm	3	
		Provision for lifting of complete mini-sub onto a concrete plinth without need for dismantling	Required	
3.9		Provision of lifting lugs on roof for ease of removal	Required	
3.10		MV switchgear, LV panel, LV metering and transformer confined to separate compartments	Required	
3.11		Mini-sub housing sections and doors bonded	Required	

Note: Ticks, Cross [√, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Annex C - Technical schedules A and B for

MSS TB 315KVA DR DYN11 3MM THICK AV SF6 DRY TYPE TRFR (SAP 3701)

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
4	4.2.1	Transformer unit (Dry-Type)		
4.1		Electrical requirements	As per SANS 60076-11	
4.2		Vector group	Dyn 11	
4.3		MV system earthing	Effective	
4.4		LV transformer neutral earthing	Solid – connection to insulated LV neutral/earth bar	
4.5		MV system fault level	kA 25	
4.6		Temperature rise limits	As per SANS 60076	
4.7		Secondary voltage regulation (Off-load on the 11 kV supply voltage windings)	% +6.0, + 3.0, 0, –3.0, –6.0	
4.8		No-load losses	W Required	
4.9		Load losses	W Required	
4.10		Impedance	% SANS 60076	
4.11		Cost /kW of no-load losses (Jul 2002)	R/kW 13 669	
4.12		Cost /kW of load losses (Jul 2002)	R/kW 1 623	
4.13		X/R	SANS 60076	
4.14		Audio-sound level – maximum	dB(A) Required	
4.15		Sealed transformer unit	Required	

Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA [“To Be Advice”] will not be accepted.

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Annex C - Technical schedules A and B for

MSS TB 315KVA DR DYN11 3MM THICK AV SF6 DRY TYPE TRFR (SAP 3701)

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
4.16	4.4.2	Transformer MV bushings (NB internal screen to be earthed)	BS 7215 –Type C with M16x2 thread	
4.17		MV bushing-centre clearances (minimum) mm	135	
4.18		Clearances between outer bushing-centres and mini-sub metal enclosure (minimum) mm	90	
4.19		Transformer overload protection facility	Required	
4.20		Winding material	MV Copper LV Copper	
4.21		Manufacturer of the distribution transformer of the distribution transformer	Required	
5		MV compartment		
5.1		Equipment in MV compartment	Ring Main Unit (CP_TSSPEC_006)	
5.2		Ring Main Unit manufacturer	Required	
5.3		Incoming MV cable requirements		
		a) 185 mm ² 3 core Cu or 300 mm ² 3C Al XLPE	Required	
		b) Cable support (clamping) required	Required	
		c) Minimum distance from cable clamp to centre-line of RMU bushings mm	800	
		d) Type of connection	Screened	
5.4		Mini-sub earth bar (accessible in front of RMU)	Required	
5.5		Interconnection arrangement between RMU and transformer MV bushings	Required	
5.6		Unscreened interconnecting equipment and connections between ring main unit and transformer to be barricaded	Required	
5.7		Type of earth fault indicator	Required	
5.8		Voltage detecting system (VDS)	Required	

Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Annex C - Technical schedules A and B for

MSS TB 315KVA DR DYN11 3MM THICK AV SF6 DRY TYPE TRFR (SAP 3701)

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
6	4.2.8	LV Compartment		
6.1		Bus-bar-rating (see Table 2)	A	1,2 times the kVA capacity
6.2		Bus-bar-insulation		Air insulated
6.3		Bus-bars	Ø	3 + one identical neutral-earth bus-bar (insulated from frame)
6.4		Current density of bus-bars	A/mm ²	1,8 maximum
6.5		Rated withstand current – 1 s (25 kA for up to 630 kVA & 45 kA for 1000 kVA)	kA _{rms}	As per rating.
6.6		Min clearance to earth and between phases	mm	20
6.7		Provision of a LV neutral surge armineral fitted between mini-sub earth bar and LV neutral-earth bus-bar		Required
6.8		LV neutral-earth bus-bar to be earthed (via an electrical bridge to the mini-sub earth bar)		Required
6.9		Neutral isolating links		Not Required
6.10		Provision of LV main isolating switch		Not Required
6.11		Number of outgoing LV feeders to be provided for (drill bus-bar Ø14mm holes)		6
6.12		Spacing between holes (see Figure 1)	mm	110
6.13		LV panel designed for large frame MCCBs		Required
		Spacing (vertical): Between phase bus-bars	mm	185
		Between lowest LV bus-bar and LV neutral	mm	300
		Minimum distance between LV neutral and uni-strut	mm	200

Note: Ticks, Cross [√, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Annex C - Technical schedules A and B for

MSS TB 315KVA DR DYN11 3MM THICK AV SF6 DRY TYPE TRFR (SAP 3701)

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
6.14		LV maximum demand ammeters	On all three phases	
6.15		Ammeter type	Thermal integrating over 15 min period	
6.16		LV indicating voltmeter with a selector switch	Required	
6.17		Ammeter and voltmeter size and display mm	96 × 96, 90°	
6.18		Ammeter and voltmeter position	Top right hand side in LV compartment	
6.19		Electronic meter capable of reading current and voltage	Required	
6.20		Provision of removable non flammable barrier to separate LV end compartment and front LV compartment	Required	
6.21		Main MCCB manufacturer	Required	
6.22		Catalogue/model code of main MCCB	Required	
6.23		Size of main MCCB A	As per table 2	

Note: Ticks, Cross [√, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Annex C - Technical schedules A and B for

MSS TB 315KVA DR DYN11 3MM THICK AV SF6 DRY TYPE TRFR (SAP 3701)

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
7	4.2.6	LV auxiliaries		
7.1		Provision of three point socket outlet and 60W bulkhead fitting in LV compartment (with instantaneous-trip earth leakage unit [20 A; 5 kA rupturing capacity; 30 mA sensitivity] and 20 A HRC fuse with neutral fuse link)	Required	
7.2		Numbering ferrules for auxiliary wiring	Required	
7.3		Push-button fitted to shunt trip RMU tee-off	Required	
8	4.3.2	Materials and corrosion protection		
8.1		Mini-sub enclosure and transformer tank thickness 3 mm	Mild steel	
8.2		Radiator	Mild steel	
8.3		Tinned copper bus-bars	Required	
8.4		Mini-sub base:Material	Steel	
8.5		Uni-strut clamping bar:Material	Required	
8.6		5mm cork packing (between ends and tank, base and ends, base and tank, and base and plinth)	Required	
8.7		Final colour	Avocado Green (12)	

Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Full name of company: _____

Annex C - Technical schedules A and B for

MSS TB 315KVA DR DYN11 3MM THICK AV SF6 DRY TYPE TRFR (SAP 3701)

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
9	4.6.2	Notices, signs and labels		
9.1		Transformer rating plate	Required	
9.2		Treatment and Full First Aid Instructions on inside of MV and LV compartment doors	Required	
9.3		Elec. warning signs on all doors and barriers	Required	
9.4		Transformer phase labels below bushings	Required	
9.5		Colour-coded LV bus-bars	Required	
9.6		Stenciled labeling of MV and LV compartment doors (both inside and outside)	Required	
9.7		kVA, Prim V, Sec V & Corrosion Class	Required	
9.8		ID markings linking roof to body per batch	Required	
9.9		Provision for the safe-keeping of documents	Required	
10	4.7	Documentation		
10.1		Type test reports (provide ref. numbers of reports)	Sets 1	
10.2		Routine test reports	Sets 1	
10.3		Drawings	Sets 2	
10.4		Circuit diagrams (LV auxiliary wiring and equipment)	Sets 2	

Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Technical schedules A and B Deviation schedule for

MSS TB 315KVA DR DYN11 3MM THICK AV SF6 DRY TYPE TRFR (SAP 3701)

Any deviations offered to this specification shall be listed below with reasons for deviation. In addition, evidence shall be provided that the proposed deviation will at least be more cost-effective than that specified by City Power.

Item	Sub clause of CP_TSSPEC_005	Proposed deviation

Note: Ticks, Cross [√, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Annex C - Technical schedules A and B for

MSS TB 315KVA DR DYN11 6MMTHICK AV SF6 DRY TYPE TRFR (SAP 3706)

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
1		Standard operating conditions		
1.1		d) Altitude m	1800	
1.2		b) Ambient air temperature °C	-5 to +40	
1.3		c) Lightning ground flash density Flashes/km ² /year	> 10	
1.4		d) Maximum solar radiation W/m ²	1000	
1.5		e) Ultraviolet radiation	High	
1.6		f) Relative humidity %	10 to 95	
1.7		g) Corrosive conditions (inland therefore non-corrosive)	Non-corrosive	
1.8		h) wind pressure Pa	700	
2	4.2.1	Ratings		
2.1		Transformer power rating kVA	315	
2.2		Nominal voltage of system (Dual ratio) kV _{rms}	6,6 & 11	
2.3		System frequency Hz	50	
2.4		Number of phases	3	
2.5		Rated no-load secondary voltage V _{rms}	415	
2.6		Rated power-frequency voltage kV _{rms}	12	
2.7		Rated lightning impulse withstand voltage kV _{peak}	95	
2.8		Rated short-duration power frequency withstand voltage [50Hz: 1 min] kV _{rms}	28	
2.9		Induced voltage withstand level kV _{rms}	22	
2.10		Internal arc classification	AB-FLR	
2.11		Internal arc current and duration	20KA/500 ms	

Note: Ticks, Cross [√, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Annex C - Technical schedules A and B for

MSS TB 315KVA DR DYN11 6MMTHICK AV SF6 DRY TYPE TRFR (SAP 3706)

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
3	4.3.1	Construction design		
3.1		Layout	Type B	
3.2		Construction	Modular	
3.3		Removable base sections adjacent to MV compartment (sections to lap bolted with nuts on the inside of the channel and housing)	Required	
3.4		All doors shall be a manual three point locking mechanism, capable of being secured by a padlock, having a shackle diameter of 8mm.	Required	
3.5		Compartment lock protection facility (with welded mesh top with inside visibility)	Required	
3.6		Total mass of miniature substation Kg	Required	
3.7		Overall maximum dimensions	Required	
3.8		a) MV compartment length mm	Required	
		b) LV compartment length mm	Required	
		c) LV metering compartment mm	400 x 400	
		d) Overall length mm	3000	
		e) Overall width mm	1650	
		f) Overall height mm	2000	
		g)Base width mm	1200	
		h)Thickness mm	6	
		Provision for lifting of complete mini-sub onto a concrete plinth without need for dismantling	Required	
3.9		Provision of lifting lugs on roof for ease of removal	Required	
3.10		MV switchgear, LV panel, LV metering and transformer confined to separate compartments	Required	
3.11		Mini-sub housing sections and doors bonded	Required	

Note: Ticks, Cross [√, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Annex C - Technical schedules A and B for

MSS TB 315KVA DR DYN11 6MMTHICK AV SF6 DRY TYPE TRFR (SAP 3706)

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
4	4.2.1	Transformer unit Dry-Type)		
4.1		Electrical requirements	As per SANS 60076	
4.2		Vector group	Dyn 11	
4.3		MV system earthing	Effective	
4.4		LV transformer neutral earthing	Solid – connection to insulated LV neutral/earth bar	
4.5		MV system fault level	kA 25	
4.6		Temperature rise limits	As per SANS 60076	
4.7		Secondary voltage regulation (Off-load on the 11 kV supply voltage windings)	% +6.0, + 3.0, 0, –3.0, –6.0	
4.8		No-load losses	W Required	
4.9		Load losses	W Required	
4.10		Impedance	% SANS 60076	
4.11		Cost /kW of no-load losses (Jul 2002)	R/kW 13 669	
4.12		Cost /kW of load losses (Jul 2002)	R/kW 1 623	
4.13		X/R	SANS 60076	
4.14		Audio-sound level – maximum	dB(A) Required	
4.15		Sealed transformer unit	Required	

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Annex C - Technical schedules A and B for

MSS TB 315KVA DR DYN11 6MMTHICK AV SF6 DRY TYPE TRFR (SAP 3706)

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
4.16	4.4.2	Transformer MV bushings (NB internal screen to be earthed)	BS 7215 –Type C with M16x2 thread	
4.17		MV bushing-centre clearances (minimum) mm	135	
4.18		Clearances between outer bushing-centres and mini-sub metal enclosure (minimum) mm	90	
4.19		Transformer overload protection facility	Required	
4.20		Winding material	MV Copper LV Copper	
4.21		Manufacturer of the distribution transformer of the distribution transformer	Required	
5		MV compartment		
5.1		Equipment in MV compartment	Ring Main Unit (CP_TSSPEC_006)	
5.2		Ring Main Unit manufacturer	Required	
5.3		Incoming MV cable requirements		
		a) 185 mm ² 3 core Cu or 300 mm ² 3C Al XLPE	Required	
		b) Cable support (clamping) required	Required	
		c) Minimum distance from cable clamp to centre-line of RMU bushings mm	800	
		d) Type of connection	Screened	
5.4		Mini-sub earth bar (accessible in front of RMU)	Required	
5.5		Interconnection arrangement between RMU and transformer MV bushings	Required	
5.6		Unscreened interconnecting equipment and connections between ring main unit and transformer to be barricaded	Required	
5.7		Type of earth fault indicator	Required	
5.8		Voltage detecting system (VDS)	Required	

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Full name of company: _____

Annex C - Technical schedules A and B for

MSS TB 315KVA DR DYN11 6MMTHICK AV SF6 DRY TYPE TRFR (SAP 3706)

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
6	4.2.8	LV Compartment		
6.1		Bus-bar-rating (see Table 2)	A	1,2 times the kVA capacity
6.2		Bus-bar-insulation		Air insulated
6.3		Bus-bars	Ø	3 + one identical neutral-earth bus-bar (insulated from frame)
6.4		Current density of bus-bars	A/mm ²	1,8 maximum
6.5		Rated withstand current – 1 s (25 kA for up to 630 kVA & 45 kA for 1000 kVA)	kA _{rms}	As per rating.
6.6		Min clearance to earth and between phases	mm	20
6.7		Provision of a LV neutral surge armineral fitted between mini-sub earth bar and LV neutral-earth bus-bar		Required
6.8		LV neutral-earth bus-bar to be earthed (via an electrical bridge to the mini-sub earth bar)		Required
6.9		Neutral isolating links		Not Required
6.10		Provision of LV main isolating switch		Not Required
6.11		Number of outgoing LV feeders to be provided for (drill bus-bar Ø14mm holes)		6
6.12		Spacing between holes (see Figure 1)	mm	110
6.13		LV panel designed for large frame MCCBs		Required
		Spacing (vertical): Between phase bus-bars	mm	185
		Between lowest LV bus-bar and LV neutral	mm	300
		Minimum distance between LV neutral and uni-strut	mm	200

Note: Ticks, Cross [√, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Annex C - Technical schedules A and B for

MSS TB 315KVA DR DYN11 6MMTHICK AV SF6 DRY TYPE TRFR (SAP 3706)

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
6.14		LV maximum demand ammeters	On all three phases	
6.15		Ammeter type	Thermal integrating over 15 min period	
6.16		LV indicating voltmeter with a selector switch	Required	
6.17		Ammeter and voltmeter size and display mm	96 × 96, 90°	
6.18		Ammeter and voltmeter position	Top right hand side in LV compartment	
6.19		Electronic meter capable of reading current and voltage	Required	
6.20		Provision of removable non flammable barrier to separate LV end compartment and front LV compartment	Required	
6.21		Main MCCB manufacturer	Required	
6.22		Catalogue/model code of main MCCB	Required	
6.23		Size of main MCCB A	As per table 2	

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Annex C - Technical schedules A and B for

MSS TB 315KVA DR DYN11 6MMTHICK AV SF6 DRY TYPE TRFR (SAP 3706)

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
7	4.2.6	LV auxiliaries		
7.1		Provision of three point socket outlet and 60W bulkhead fitting in LV compartment (with instantaneous-trip earth leakage unit [20 A; 5 kA rupturing capacity; 30 mA sensitivity] and 20 A HRC fuse with neutral fuse link)	Required	
7.2		Numbering ferrules for auxiliary wiring	Required	
7.3		Push-button fitted to shunt trip RMU tee-off	Required	
8	4.3.2	Materials and corrosion protection		
8.1		Mini-sub enclosure and transformer tank thickness 6(mm)	Mild steel	
8.2		Radiator	Mild steel	
8.3		Tinned copper bus-bars	Required	
8.4		Mini-sub base:Material	Steel	
8.5		Uni-strut clamping bar:Material	Required	
8.6		5mm cork packing (between ends and tank, base and ends, base and tank, and base and plinth)	Required	
8.7		Final colour	Avocado Green (12)	

Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Annex C - Technical schedules A and B for

MSS TB 315KVA DR DYN11 6MMTHICK AV SF6 DRY TYPE TRFR (SAP 3706)

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
9	4.6.2	Notices, signs and labels		
9.1		Transformer rating plate	Required	
9.2		Treatment and Full First Aid Instructions on inside of MV and LV compartment doors	Required	
9.3		Elec. warning signs on all doors and barriers	Required	
9.4		Transformer phase labels below bushings	Required	
9.5		Colour-coded LV bus-bars	Required	
9.6		Stenciled labeling of MV and LV compartment doors (both inside and outside)	Required	
9.7		kVA, Prim V, Sec V & Corrosion Class	Required	
9.8		ID markings linking roof to body per batch	Required	
9.9		Provision for the safe-keeping of documents	Required	
10	4.7	Documentation		
10.1		Type test reports (provide ref. numbers of reports)	Sets 1	
10.2		Routine test reports	Sets 1	
10.3		Drawings	Sets 2	
10.4		Circuit diagrams (LV auxiliary wiring and equipment)	Sets 2	

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Technical schedules A and B Deviation schedule for

MSS TB 315KVA DR DYN11 6MMTHICK AV SF6 DRY TYPE TRFR (SAP 3706)

Any deviations offered to this specification shall be listed below with reasons for deviation. In addition, evidence shall be provided that the proposed deviation will at least be more cost-effective than that specified by City Power.

Item	Sub clause of CP_TSSPEC_005	Proposed deviation

Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Annex C - Technical schedules A and B for

MSS TB 315KVA SR DYN11 3MM THICK AV SF6 DRY TYPE TRFR (SAP 3705)

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
1		Standard operating conditions		
1.1		e) Altitude m	1800	
1.2		b) Ambient air temperature °C	-5 to +40	
1.3		c) Lightning ground flash density Flashes/ km ² /year	> 10	
1.4		d) Maximum solar radiation W/m ²	1000	
1.5		e) Ultraviolet radiation	High	
1.6		f) Relative humidity %	10 to 95	
1.7		g) Corrosive conditions (inland therefore non-corrosive)	Non- corrosive	
1.8		h) wind pressure Pa	700	
2	4.2.1	Ratings		
2.1		Transformer power rating kVA	315	
2.2		Nominal voltage of system (single ratio) kV _{rms}	11	
2.3		System frequency Hz	50	
2.4		Number of phases	3	
2.5		Rated no-load secondary voltage V _{rms}	415	
2.6		Rated power-frequency voltage kV _{rms}	12	
2.7		Rated lightning impulse withstand voltage kV _{peak}	95	
2.8		Rated short-duration power frequency withstand voltage [50Hz: 1 min] kV _{rms}	28	
2.9		Induced voltage withstand level kV _{rms}	22	
2.10		Internal arc classification	AB-FLR	
2.11		Internal arc current and duration	20KA/500 ms	

Note: Ticks, Cross [√, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Annex C - Technical schedules A and B for

MSS TB 315KVA SR DYN11 3MM THICK AV SF6 DRY TYPE TRFR (SAP 3705)

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
3	4.3.1	Construction design		
3.1		Layout	Type B	
3.2		Construction	Modular	
3.3		Removable base sections adjacent to MV compartment (sections to lap bolted with nuts on the inside of the channel and housing)	Required	
3.4		All doors shall be a manual three point locking mechanism, capable of being secured by a padlock, having a shackle diameter of 8mm.	Required	
3.5		Compartment lock protection facility (with welded mesh top with inside visibility)	Required	
3.6		Total mass of miniature substation Kg	Required	
3.7		Overall maximum dimensions	Required	
3.8		a) MV compartment length mm	Required	
		b) LV compartment length mm	Required	
		c) LV metering compartment mm	400 x 400	
		d) Overall length mm	3000	
		e) Overall width mm	1650	
		f) Overall height mm	2000	
		g)Base width mm	1200	
		h)Thickness mm	3	
		Provision for lifting of complete mini-sub onto a concrete plinth without need for dismantling	Required	
3.9		Provision of lifting lugs on roof for ease of removal	Required	
3.10		MV switchgear, LV panel, LV metering and transformer confined to separate compartments	Required	
3.11		Mini-sub housing sections and doors bonded	Required	

Note: Ticks, Cross [√, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Annex C - Technical schedules A and B for

MSS TB 315KVA SR DYN11 3MM THICK AV SF6 DRY TYPE TRFR (SAP 3705)

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
4	4.2.1	Transformer unit Dry-Type)		
4.1		Electrical requirements	As per SANS 60076	
4.2		Vector group	Dyn 11	
4.3		MV system earthing	Effective	
4.4		LV transformer neutral earthing	Solid – connection to insulated LV neutral/earth bar	
4.5		MV system fault level	kA 25	
4.6		Temperature rise limits	As per SANS 60076	
4.7		Secondary voltage regulation (Off-load on the 11 kV supply voltage windings)	% +6.0, + 3.0, 0, –3.0, –6.0	
4.8		No-load losses	W Required	
4.9		Load losses	W Required	
4.10		Impedance	% SANS 60076	
4.11		Cost /kW of no-load losses (Jul 2002)	R/kW 13 669	
4.12		Cost /kW of load losses (Jul 2002)	R/kW 1 623	
4.13		X/R	SANS 60076	
4.14		Audio-sound level – maximum	dB(A) Required	
4.15		Sealed transformer unit	Required	

Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA [“To Be Advice”] will not be accepted.

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Annex C - Technical schedules A and B for

MSS TB 315KVA SR DYN11 3MM THICK AV SF6 DRY TYPE TRFR (SAP 3705)

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
4.16	4.4.2	Transformer MV bushings (NB internal screen to be earthed)	BS 7215 –Type C with M16x2 thread	
4.17		MV bushing-centre clearances (minimum) mm	135	
4.18		Clearances between outer bushing-centres and mini-sub metal enclosure (minimum) mm	90	
4.19		Transformer overload protection facility	Required	
4.20		Winding material	MV Copper LV Copper	
4.21		Manufacturer of the distribution transformer of the distribution transformer	Required	
5		MV compartment		
5.1		Equipment in MV compartment	Ring Main Unit (CP_TSSPEC_006)	
5.2		Ring Main Unit manufacturer	Required	
5.3		Incoming MV cable requirements		
		a) 185 mm ² 3 core Cu or 300 mm ² 3C Al XLPE	Required	
		b) Cable support (clamping) required	Required	
		c) Minimum distance from cable clamp to centre-line of RMU bushings mm	800	
		d) Type of connection	Screened	
5.4		Mini-sub earth bar (accessible in front of RMU)	Required	
5.5		Interconnection arrangement between RMU and transformer MV bushings	Required	
5.6		Unscreened interconnecting equipment and connections between ring main unit and transformer to be barricaded	Required	
5.7		Type of earth fault indicator	Required	
5.8		Voltage detecting system (VDS)	Required	

Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Annex C - Technical schedules A and B for

MSS TB 315KVA SR DYN11 3MM THICK AV SF6 DRY TYPE TRFR (SAP 3705)

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
6	4.2.8	LV Compartment		
6.1		Bus-bar-rating (see Table 2)	A	1,2 times the kVA capacity
6.2		Bus-bar-insulation		Air insulated
6.3		Bus-bars	Ø	3 + one identical neutral-earth bus-bar (insulated from frame)
6.4		Current density of bus-bars	A/mm ²	1,8 maximum
6.5		Rated withstand current – 1 s (25 kA for up to 630 kVA & 45 kA for 1000 kVA)	kA _{rms}	As per rating.
6.6		Min clearance to earth and between phases	mm	20
6.7		Provision of a LV neutral surge armineral fitted between mini-sub earth bar and LV neutral-earth bus-bar		Required
6.8		LV neutral-earth bus-bar to be earthed (via an electrical bridge to the mini-sub earth bar)		Required
6.9		Neutral isolating links		Not Required
6.10		Provision of LV main isolating switch		Not Required
6.11		Number of outgoing LV feeders to be provided for (drill bus-bar Ø14mm holes)		6
6.12		Spacing between holes (see Figure 1)	mm	110
6.13		LV panel designed for large frame MCCBs		Required
		Spacing (vertical): Between phase bus-bars	mm	185
		Between lowest LV bus-bar and LV neutral	mm	300
		Minimum distance between LV neutral and uni-strut	mm	200

Note: Ticks, Cross [√, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Annex C - Technical schedules A and B for

MSS TB 315KVA SR DYN11 3MM THICK AV SF6 DRY TYPE TRFR (SAP 3705)

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
6.14		LV maximum demand ammeters	On all three phases	
6.15		Ammeter type	Thermal integrating over 15 min period	
6.16		LV indicating voltmeter with a selector switch	Required	
6.17		Ammeter and voltmeter size and display mm	96 × 96, 90°	
6.18		Ammeter and voltmeter position	Top right hand side in LV compartment	
6.19		Electronic meter capable of reading current and voltage	Required	
6.20		Provision of removable non flammable barrier to separate LV end compartment and front LV compartment	Required	
6.21		Main MCCB manufacturer	Required	
6.22		Catalogue/model code of main MCCB	Required	
6.23		Size of main MCCB A	As per table 2	

Note: Ticks, Cross [√, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Annex C - Technical schedules A and B for

MSS TB 315KVA SR DYN11 3MM THICK AV SF6 DRY TYPE TRFR (SAP 3705)

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
7	4.2.6	LV auxiliaries		
7.1		Provision of three point socket outlet and 60W bulkhead fitting in LV compartment (with instantaneous-trip earth leakage unit [20 A; 5 kA rupturing capacity; 30 mA sensitivity] and 20 A HRC fuse with neutral fuse link)	Required	
7.2		Numbering ferrules for auxiliary wiring	Required	
7.3		Push-button fitted to shunt trip RMU tee-off	Required	
8	4.3.2	Materials and corrosion protection		
8.1		Mini-sub enclosure and transformer tank thickness 6(mm) or 3 mm	Mild steel	
8.2		Radiator	Mild steel	
8.3		Tinned copper bus-bars	Required	
8.4		Mini-sub base:Material	Steel	
8.5		Uni-strut clamping bar:Material	Required	
8.6		5mm cork packing (between ends and tank, base and ends, base and tank, and base and plinth)	Required	
8.7		Final colour	Avocado Green (12)	

Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Full name of company: _____

Annex C - Technical schedules A and B for

MSS TB 315KVA SR DYN11 3MM THICK AV SF6 DRY TYPE TRFR (SAP 3705)

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
9	4.6.2	Notices, signs and labels		
9.1		Transformer rating plate	Required	
9.2		Treatment and Full First Aid Instructions on inside of MV and LV compartment doors	Required	
9.3		Elec. warning signs on all doors and barriers	Required	
9.4		Transformer phase labels below bushings	Required	
9.5		Colour-coded LV bus-bars	Required	
9.6		Stenciled labeling of MV and LV compartment doors (both inside and outside)	Required	
9.7		kVA, Prim V, Sec V & Corrosion Class	Required	
9.8		ID markings linking roof to body per batch	Required	
9.9		Provision for the safe-keeping of documents	Required	
10	4.7	Documentation		
10.1		Type test reports (provide ref. numbers of reports) Sets	1	
10.2		Routine test reports Sets	1	
10.3		Drawings Sets	2	
10.4		Circuit diagrams (LV auxiliary wiring and equipment) Sets	2	

Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Technical schedules A and B Deviation schedule for

MSS TB 315KVA SR DYN11 3MM THICK AV SF6 DRY TYPE TRFR (SAP 3705)

Any deviations offered to this specification shall be listed below with reasons for deviation. In addition, evidence shall be provided that the proposed deviation will at least be more cost-effective than that specified by City Power.

Item	Sub clause of CP_TSSPEC_005	Proposed deviation

Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

Tender Number: _____

Tenderer's Authorised Signatory: _____

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Full name of company: _____

Annex C - Technical schedules A and B for

MSS TB 315KVA SR DYN11 6MM THICK AV SF6 OIL TYPE TRFR (SAP 3704)

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
1		Standard operating conditions		
1.1		f) Altitude m	1800	
1.2		b) Ambient air temperature °C	-5 to +40	
1.3		c) Lightning ground flash density Flashes/ km ² /year	> 10	
1.4		d) Maximum solar radiation W/m ²	1000	
1.5		e) Ultraviolet radiation	High	
1.6		f) Relative humidity %	10 to 95	
1.7		g) Corrosive conditions (inland therefore non-corrosive)	Non- corrosive	
1.8		h) wind pressure Pa	700	
2	4.2.1	Ratings		
2.1		Transformer power rating kVA	315	
2.2		Nominal voltage of system (Single ratio) kV _{rms}	11	
2.3		System frequency Hz	50	
2.4		Number of phases	3	
2.5		Rated no-load secondary voltage V _{rms}	415	
2.6		Rated power-frequency voltage kV _{rms}	12	
2.7		Rated lightning impulse withstand voltage kV _{peak}	95	
2.8		Rated short-duration power frequency withstand voltage [50Hz: 1 min] kV _{rms}	28	
2.9		Induced voltage withstand level kV _{rms}	22	
2.10		Internal arc classification	AB-FLR	
2.11		Internal arc current and duration	20KA/500 ms	

Note: Ticks, Cross [√, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Annex C - Technical schedules A and B for

MSS TB 315KVA SR DYN11 6MM THICK AV SF6 OIL TYPE TRFR (SAP 3704)

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
3	4.3.1	Construction design		
3.1		Layout	Type B	
3.2		Construction	Modular	
3.3		Removable base sections adjacent to MV compartment (sections to lap bolted with nuts on the inside of the channel and housing)	Required	
3.4		All doors shall be a manual three point locking mechanism, capable of being secured by a padlock, having a shackle diameter of 8mm.	Required	
3.5		Compartment lock protection facility (with welded mesh top with inside visibility)	Required	
3.6		Total mass of miniature substation Kg	Required	
3.7		Overall maximum dimensions	Required	
3.8		a) MV compartment length mm	Required	
		b) LV compartment length mm	Required	
		c) LV metering compartment mm	400 x 400	
		d) Overall length mm	3000	
		e) Overall width mm	1650	
		f) Overall height mm	2000	
		g)Base width mm	1200	
		h)Thickness mm	6	
		Provision for lifting of complete mini-sub onto a concrete plinth without need for dismantling	Required	
3.9		Provision of lifting lugs on roof for ease of removal	Required	
3.10		MV switchgear, LV panel, LV metering and transformer confined to separate compartments	Required	
3.11		Mini-sub housing sections and doors bonded	Required	

Note: Ticks, Cross [√, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Annex C - Technical schedules A and B for

MSS TB 315KVA SR DYN11 6MM THICK AV SF6 OIL TYPE TRFR (SAP 3704)

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
4	4.2.1	Transformer unit(Oil immersedType)		
4.1		Electrical requirements	As per SANS 780	
4.2		Vector group	Dyn 11	
4.3		MV system earthing	Effective	
4.4		LV transformer neutral earthing	Solid – connection to insulated LV neutral/earth bar	
4.5		MV system fault level	kA 25	
4.6		Temperature rise limits	As per SANS 780	
4.7		Secondary voltage regulation (Off-load on the 11 kV supply voltage windings)	% +6.0, + 3.0, 0, –3.0, –6.0	
4.8		No-load losses	W Required	
4.9		Load losses	W Required	
4.10		Impedance	% SANS 780	
4.11		Cost /kW of no-load losses (Jul 2002)	R/kW 13 669	
4.12		Cost /kW of load losses (Jul 2002)	R/kW 1 623	
4.13		X/R	SANS 780	
4.14		Audio-sound level – maximum (see table 6)	dB(A) Table 6	
4.15		Sealed transformer unit	Required	

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Annex C - Technical schedules A and B for

MSS TB 315KVA SR DYN11 6MM THICK AV SF6 OIL TYPE TRFR (SAP 3704)

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
4.16	4.4.2	Transformer MV bushings (NB internal screen to be earthed)	BS 7215 –Type C with M16x2 thread	
4.17		MV bushing-centre clearances (minimum) mm	135	
4.18		Clearances between outer bushing-centres and mini-sub metal enclosure (minimum) mm	90	
4.19		Transformer overload protection facility	Required	
4.20		Winding material	MV Copper LV Copper	
4.21		Manufacturer of the distribution transformer of the distribution transformer	Required	
5		MV compartment		
5.1		Equipment in MV compartment	Ring Main Unit (CP_TSSPEC_006)	
5.2		Ring Main Unit manufacturer	Required	
5.3		Incoming MV cable requirements		
		a) 185 mm ² 3 core Cu or 300 mm ² 3C Al XLPE	Required	
		b) Cable support (clamping) required	Required	
		c) Minimum distance from cable clamp to centre-line of RMU bushings mm	800	
		d) Type of connection	Screened	
5.4		Mini-sub earth bar (accessible in front of RMU)	Required	
5.5		Interconnection arrangement between RMU and transformer MV bushings	Required	
5.6		Unscreened interconnecting equipment and connections between ring main unit and transformer to be barricaded	Required	
5.7		Type of earth fault indicator	Required	
5.8		Voltage detecting system (VDS)	Required	

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Annex C - Technical schedules A and B for

MSS TB 315KVA SR DYN11 6MM THICK AV SF6 OIL TYPE TRFR (SAP 3704)

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
6	4.2.8	LV Compartment		
6.1		Bus-bar-rating (see Table 2)	A	1,2 times the kVA capacity
6.2		Bus-bar-insulation		Air insulated
6.3		Bus-bars	Ø	3 + one identical neutral-earth bus-bar (insulated from frame)
6.4		Current density of bus-bars	A/mm ²	1,8 maximum
6.5		Rated withstand current – 1 s (25 kA for up to 630 kVA & 45 kA for 1000 kVA)	kA _{rms}	As per rating.
6.6		Min clearance to earth and between phases	mm	20
6.7		Provision of a LV neutral surge armineral fitted between mini-sub earth bar and LV neutral-earth bus-bar		Required
6.8		LV neutral-earth bus-bar to be earthed (via an electrical bridge to the mini-sub earth bar)		Required
6.9		Neutral isolating links		Not Required
6.10		Provision of LV main isolating switch		Not Required
6.11		Number of outgoing LV feeders to be provided for (drill bus-bar Ø14mm holes)		6
6.12		Spacing between holes (see Figure 1)	mm	110
6.13		LV panel designed for large frame MCCBs		Required
		Spacing (vertical): Between phase bus-bars	mm	185
		Between lowest LV bus-bar and LV neutral	mm	300
		Minimum distance between LV neutral and uni-strut	mm	200

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Annex C - Technical schedules A and B for

MSS TB 315KVA SR DYN11 6MM THICK AV SF6 OIL TYPE TRFR (SAP 3704)

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
6.14		LV maximum demand ammeters	On all three phases	
6.15		Ammeter type	Thermal integrating over 15 min period	
6.16		LV indicating voltmeter with a selector switch	Required	
6.17		Ammeter and voltmeter size and display mm	96 × 96, 90°	
6.18		Ammeter and voltmeter position	Top right hand side in LV compartment	
6.19		Electronic meter capable of reading current and voltage	Required	
6.20		Provision of removable non flammable barrier to separate LV end compartment and front LV compartment	Required	
6.21		Main MCCB manufacturer	Required	
6.22		Catalogue/model code of main MCCB	Required	
6.23		Size of main MCCB A	As per table 2	

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Annex C - Technical schedules A and B for

MSS TB 315KVA SR DYN11 6MM THICK AV SF6 OIL TYPE TRFR (SAP 3704)

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
7	4.2.6	LV auxiliaries		
7.1		Provision of three point socket outlet and 60W bulkhead fitting in LV compartment (with instantaneous-trip earth leakage unit [20 A; 5 kA rupturing capacity; 30 mA sensitivity] and 20 A HRC fuse with neutral fuse link)	Required	
7.2		Numbering ferrules for auxiliary wiring	Required	
7.3		Push-button fitted to shunt trip RMU tee-off	Required	
8	4.3.2	Materials and corrosion protection		
8.1		Mini-sub enclosure and transformer tank thickness 6(mm) or 3 mm	Mild steel	
8.2		Radiator	Mild steel	
8.3		Tinned copper bus-bars	Required	
8.4		Mini-sub base:Material	Steel	
8.5		Uni-strut clamping bar:Material	Required	
8.6		5mm cork packing (between ends and tank, base and ends, base and tank, and base and plinth)	Required	
8.7		Final colour	Avocado Green (12)	

Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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**Annex C - Technical schedules A and B for
MSS TB 315KVA SR DYN11 6MM THICK AV SF6 OIL TYPE TRFR (SAP 3704)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
9	4.6.2	Notices, signs and labels		
9.1		Transformer rating plate	Required	
9.2		Treatment and Full First Aid Instructions on inside of MV and LV compartment doors	Required	
9.3		Elec. warning signs on all doors and barriers	Required	
9.4		Transformer phase labels below bushings	Required	
9.5		Colour-coded LV bus-bars	Required	
9.6		Stenciled labeling of MV and LV compartment doors (both inside and outside)	Required	
9.7		kVA, Prim V, Sec V & Corrosion Class	Required	
9.8		ID markings linking roof to body per batch	Required	
9.9		Provision for the safe-keeping of documents	Required	
10	4.7	Documentation		
10.1		Type test reports (provide ref. numbers of reports)	Sets 1	
10.2		Routine test reports	Sets 1	
10.3		Drawings	Sets 2	
10.4		Circuit diagrams (LV auxiliary wiring and equipment)	Sets 2	

Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Technical schedules A and B Deviation schedule for

MSS TB 315KVA SR DYN11 6MM THICK AV SF6 OIL TYPE TRFR (SAP 3704)

Any deviations offered to this specification shall be listed below with reasons for deviation. In addition, evidence shall be provided that the proposed deviation will at least be more cost-effective than that specified by City Power.

Item	Sub clause of CP_TSSPEC_005	Proposed deviation

Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Annex C - Technical schedules A and B for

MSS TB 315KVA SR DYN11 3MM THICK AV SF6 OIL TYPE TRFR (SAP 3702)

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
1		Standard operating conditions		
1.1		g) Altitude m	1800	
1.2		b) Ambient air temperature °C	-5 to +40	
1.3		c) Lightning ground flash density Flashes/ km ² /year	> 10	
1.4		d) Maximum solar radiation W/m ²	1000	
1.5		e) Ultraviolet radiation	High	
1.6		f) Relative humidity %	10 to 95	
1.7		g) Corrosive conditions (inland therefore non-corrosive)	Non- corrosive	
1.8		h) wind pressure Pa	700	
2	4.2.1	Ratings		
2.1		Transformer power rating kVA	315	
2.2		Nominal voltage of system (Single ratio) kV _{rms}	11	
2.3		System frequency Hz	50	
2.4		Number of phases	3	
2.5		Rated no-load secondary voltage V _{rms}	415	
2.6		Rated power-frequency voltage kV _{rms}	12	
2.7		Rated lightning impulse withstand voltage kV _{peak}	95	
2.8		Rated short-duration power frequency withstand voltage [50Hz: 1 min] kV _{rms}	28	
2.9		Induced voltage withstand level kV _{rms}	22	
2.10		Internal arc classification	AB-FLR	
2.11		Internal arc current and duration	20KA/500 ms	

Note: Ticks, Cross [√, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Full name of company: _____

Annex C - Technical schedules A and B for

MSS TB 315KVA SR DYN11 3MM THICK AV SF6 OIL TYPE TRFR (SAP 3702)

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
3	4.3.1	Construction design		
3.1		Layout	Type B	
3.2		Construction	Modular	
3.3		Removable base sections adjacent to MV compartment (sections to lap bolted with nuts on the inside of the channel and housing)	Required	
3.4		All doors shall be a manual three point locking mechanism, capable of being secured by a padlock, having a shackle diameter of 8mm.	Required	
3.5		Compartment lock protection facility (with welded mesh top with inside visibility)	Required	
3.6		Total mass of miniature substation Kg	Required	
3.7		Overall maximum dimensions	Required	
3.8		a) MV compartment length mm	Required	
		b) LV compartment length mm	Required	
		c) LV metering compartment mm	400 x 400	
		d) Overall length mm	3000	
		e) Overall width mm	1650	
		f) Overall height mm	2000	
		g)Base width mm	1200	
		h)Thickness mm	3	
		Provision for lifting of complete mini-sub onto a concrete plinth without need for dismantling	Required	
3.9		Provision of lifting lugs on roof for ease of removal	Required	
3.10		MV switchgear, LV panel, LV metering and transformer confined to separate compartments	Required	
3.11		Mini-sub housing sections and doors bonded	Required	

Note: Ticks, Cross [√, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Annex C - Technical schedules A and B for

MSS TB 315KVA SR DYN11 3MM THICK AV SF6 OIL TYPE TRFR (SAP 3702)

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
4	4.2.1	Transformer unit (Oil Immersed)		
4.1		Electrical requirements	As per SANS 780	
4.2		Vector group	Dyn 11	
4.3		MV system earthing	Effective	
4.4		LV transformer neutral earthing	Solid – connection to insulated LV neutral/earth bar	
4.5		MV system fault level	kA 25	
4.6		Temperature rise limits	As per SANS 780	
4.7		Secondary voltage regulation (Off-load on the 11 kV supply voltage windings)	% +6.0, + 3.0, 0, –3.0, –6.0	
4.8		No-load losses	W Required	
4.9		Load losses	W Required	
4.10		Impedance	% SANS 60076	
4.11		Cost /kW of no-load losses (Jul 2002)	R/kW 13 669	
4.12		Cost /kW of load losses (Jul 2002)	R/kW 1 623	
4.13		X/R	SANS 60076	
4.14		Audio-sound level – maximum (see table 6)	dB(A) Table 6	
4.15		Sealed transformer unit	Required	

Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA [“To Be Advice”] will not be accepted.

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Annex C - Technical schedules A and B for

MSS TB 315KVA SR DYN11 3MM THICK AV SF6 OIL TYPE TRFR (SAP 3702)

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
4.16	4.4.2	Transformer MV bushings (NB internal screen to be earthed)	BS 7215 –Type C with M16x2 thread	
4.17		MV bushing-centre clearances (minimum) mm	135	
4.18		Clearances between outer bushing-centres and mini-sub metal enclosure (minimum) mm	90	
4.19		Transformer overload protection facility	Required	
4.20		Winding material	MV Copper LV Copper	
4.21		Manufacturer of the distribution transformer of the distribution transformer	Required	
5		MV compartment		
5.1		Equipment in MV compartment	Ring Main Unit (CP_TSSPEC_006)	
5.2		Ring Main Unit manufacturer	Required	
5.3		Incoming MV cable requirements		
		a) 185 mm ² 3 core Cu or 300 mm ² 3C Al XLPE	Required	
		b) Cable support (clamping) required	Required	
		c) Minimum distance from cable clamp to centre-line of RMU bushings mm	800	
		d) Type of connection	Screened	
5.4		Mini-sub earth bar (accessible in front of RMU)	Required	
5.5		Interconnection arrangement between RMU and transformer MV bushings	Required	
5.6		Unscreened interconnecting equipment and connections between ring main unit and transformer to be barricaded	Required	
5.7		Type of earth fault indicator	Required	
5.8		Voltage detecting system (VDS)	Required	

Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Annex C - Technical schedules A and B for

MSS TB 315KVA SR DYN11 3MM THICK AV SF6 OIL TYPE TRFR (SAP 3702)

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
6	4.2.8	LV Compartment		
6.1		Bus-bar-rating (see Table 2)	A	1,2 times the kVA capacity
6.2		Bus-bar-insulation		Air insulated
6.3		Bus-bars	Ø	3 + one identical neutral-earth bus-bar (insulated from frame)
6.4		Current density of bus-bars	A/mm ²	1,8 maximum
6.5		Rated withstand current – 1 s (25 kA for up to 630 kVA & 45 kA for 1000 kVA)	kA _{rms}	As per rating.
6.6		Min clearance to earth and between phases	mm	20
6.7		Provision of a LV neutral surge armineral fitted between mini-sub earth bar and LV neutral-earth bus-bar		Required
6.8		LV neutral-earth bus-bar to be earthed (via an electrical bridge to the mini-sub earth bar)		Required
6.9		Neutral isolating links		Not Required
6.10		Provision of LV main isolating switch		Not Required
6.11		Number of outgoing LV feeders to be provided for (drill bus-bar Ø14mm holes)		6
6.12		Spacing between holes (see Figure 1)	mm	110
6.13		LV panel designed for large frame MCCBs		Required
		Spacing (vertical): Between phase bus-bars	mm	185
		Between lowest LV bus-bar and LV neutral	mm	300
		Minimum distance between LV neutral and uni-strut	mm	200

Note: Ticks, Cross [√, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Annex C - Technical schedules A and B for

MSS TB 315KVA SR DYN11 3MM THICK AV SF6 OIL TYPE TRFR (SAP 3702)

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
6.14		LV maximum demand ammeters	On all three phases	
6.15		Ammeter type	Thermal integrating over 15 min period	
6.16		LV indicating voltmeter with a selector switch	Required	
6.17		Ammeter and voltmeter size and display mm	96 × 96, 90°	
6.18		Ammeter and voltmeter position	Top right hand side in LV compartment	
6.19		Electronic meter capable of reading current and voltage	Required	
6.20		Provision of removable non flammable barrier to separate LV end compartment and front LV compartment	Required	
6.21		Main MCCB manufacturer	Required	
6.22		Catalogue/model code of main MCCB	Required	
6.23		Size of main MCCB A	As per table 2	

Note: Ticks, Cross [√, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Annex C - Technical schedules A and B for

MSS TB 315KVA SR DYN11 3MM THICK AV SF6 OIL TYPE TRFR (SAP 3702)

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
7	4.2.6	LV auxiliaries		
7.1		Provision of three point socket outlet and 60W bulkhead fitting in LV compartment (with instantaneous-trip earth leakage unit [20 A; 5 kA rupturing capacity; 30 mA sensitivity] and 20 A HRC fuse with neutral fuse link)	Required	
7.2		Numbering ferrules for auxiliary wiring	Required	
7.3		Push-button fitted to shunt trip RMU tee-off	Required	
8	4.3.2	Materials and corrosion protection		
8.1		Mini-sub enclosure and transformer tank thickness 6(mm) or 3 mm	Mild steel	
8.2		Radiator	Mild steel	
8.3		Tinned copper bus-bars	Required	
8.4		Mini-sub base:Material	Steel	
8.5		Uni-strut clamping bar:Material	Required	
8.6		5mm cork packing (between ends and tank, base and ends, base and tank, and base and plinth)	Required	
8.7		Final colour	Avocado Green (12)	

Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Annex C - Technical schedules A and B for

MSS TB 315KVA SR DYN11 3MM THICK AV SF6 OIL TYPE TRFR (SAP 3702)

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
9	4.6.2	Notices, signs and labels		
9.1		Transformer rating plate	Required	
9.2		Treatment and Full First Aid Instructions on inside of MV and LV compartment doors	Required	
9.3		Elec. warning signs on all doors and barriers	Required	
9.4		Transformer phase labels below bushings	Required	
9.5		Colour-coded LV bus-bars	Required	
9.6		Stenciled labeling of MV and LV compartment doors (both inside and outside)	Required	
9.7		kVA, Prim V, Sec V & Corrosion Class	Required	
9.8		ID markings linking roof to body per batch	Required	
9.9		Provision for the safe-keeping of documents	Required	
10	4.7	Documentation		
10.1		Type test reports (provide ref. numbers of reports) Sets	1	
10.2		Routine test reports Sets	1	
10.3		Drawings Sets	2	
10.4		Circuit diagrams (LV auxiliary wiring and equipment) Sets	2	

Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Technical schedules A and B Deviation schedule for

MSS TB 315KVA SR DYN11 3MM THICK AV SF6 OIL TYPE TRFR (SAP 3702)

Any deviations offered to this specification shall be listed below with reasons for deviation. In addition, evidence shall be provided that the proposed deviation will at least be more cost-effective than that specified by City Power.

Item	Sub clause of CP_TSSPEC_005	Proposed deviation

Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Annex C - Technical schedules A and B for

MSS TB 315KVA SR DYN11 6MM THICK AV SF6 DRY TYPE TRFR (SAP 3707)

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
1		Standard operating conditions		
1.1		h) Altitude m	1800	
1.2		b) Ambient air temperature °C	-5 to +40	
1.3		c) Lightning ground flash density Flashes/ km ² /year	> 10	
1.4		d) Maximum solar radiation W/m ²	1000	
1.5		e) Ultraviolet radiation	High	
1.6		f) Relative humidity %	10 to 95	
1.7		g) Corrosive conditions (inland therefore non-corrosive)	Non- corrosive	
1.8		h) wind pressure Pa	700	
2	4.2.1	Ratings		
2.1		Transformer power rating kVA	315	
2.2		Nominal voltage of system (Single ratio) kV _{rms}	11	
2.3		System frequency Hz	50	
2.4		Number of phases	3	
2.5		Rated no-load secondary voltage V _{rms}	415	
2.6		Rated power-frequency voltage kV _{rms}	12	
2.7		Rated lightning impulse withstand voltage kV _{peak}	95	
2.8		Rated short-duration power frequency withstand voltage [50Hz: 1 min] kV _{rms}	28	
2.9		Induced voltage withstand level kV _{rms}	22	
2.10		Internal arc classification	AB-FLR	
2.11		Internal arc current and duration	20KA/500 ms	

Note: Ticks, Cross [√, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Annex C - Technical schedules A and B for

MSS TB 315KVA SR DYN11 6MM THICK AV SF6 DRY TYPE TRFR (SAP 3707)

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
3	4.3.1	Construction design		
3.1		Layout	Type B	
3.2		Construction	Modular	
3.3		Removable base sections adjacent to MV compartment (sections to lap bolted with nuts on the inside of the channel and housing)	Required	
3.4		All doors shall be a manual three point locking mechanism, capable of being secured by a padlock, having a shackle diameter of 8mm.	Required	
3.5		Compartment lock protection facility (with welded mesh top with inside visibility)	Required	
3.6		Total mass of miniature substation Kg	Required	
3.7		Overall maximum dimensions	Required	
3.8		a) MV compartment length mm	Required	
		b) LV compartment length mm	Required	
		c) LV metering compartment mm	400 x 400	
		d) Overall length mm	3000	
		e) Overall width mm	1650	
		f) Overall height mm	2000	
		g)Base width mm	1200	
		h)Thickness mm	6	
		Provision for lifting of complete mini-sub onto a concrete plinth without need for dismantling	Required	
3.9		Provision of lifting lugs on roof for ease of removal	Required	
3.10		MV switchgear, LV panel, LV metering and transformer confined to separate compartments	Required	
3.11		Mini-sub housing sections and doors bonded	Required	

Note: Ticks, Cross [√, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Annex C - Technical schedules A and B for

MSS TB 315KVA SR DYN11 6MM THICK AV SF6 DRY TYPE TRFR (SAP 3707)

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
4	4.2.1	Transformer unit (Dry-Type)		
4.1		Electrical requirements	As per SANS 60076	
4.2		Vector group	Dyn 11	
4.3		MV system earthing	Effective	
4.4		LV transformer neutral earthing	Solid – connection to insulated LV neutral/earth bar	
4.5		MV system fault level	kA 25	
4.6		Temperature rise limits	As per SANS 60076	
4.7		Secondary voltage regulation (Off-load on the 11 kV supply voltage windings)	% +6.0, + 3.0, 0, –3.0, –6.0	
4.8		No-load losses	W Required	
4.9		Load losses	W Required	
4.10		Impedance	% SANS 60076	
4.11		Cost /kW of no-load losses (Jul 2002)	R/kW 13 669	
4.12		Cost /kW of load losses (Jul 2002)	R/kW 1 623	
4.13		X/R	SANS 60076	
4.14		Audio-sound level – maximum	dB(A) Required	
4.15		Sealed transformer unit	Required	

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Annex C - Technical schedules A and B for

MSS TB 315KVA SR DYN11 6MM THICK AV SF6 DRY TYPE TRFR (SAP 3707)

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
4.16	4.4.2	Transformer MV bushings (NB internal screen to be earthed)	BS 7215 –Type C with M16x2 thread	
4.17		MV bushing-centre clearances (minimum) mm	135	
4.18		Clearances between outer bushing-centres and mini-sub metal enclosure (minimum) mm	90	
4.19		Transformer overload protection facility	Required	
4.20		Winding material	MV Copper LV Copper	
4.21		Manufacturer of the distribution transformer of the distribution transformer	Required	
5		MV compartment		
5.1		Equipment in MV compartment	Ring Main Unit (CP_TSSPEC_006)	
5.2		Ring Main Unit manufacturer	Required	
5.3		Incoming MV cable requirements		
		a) 185 mm ² 3 core Cu or 300 mm ² 3C Al XLPE	Required	
		b) Cable support (clamping) required	Required	
		c) Minimum distance from cable clamp to centre-line of RMU bushings mm	800	
		d) Type of connection	Screened	
5.4		Mini-sub earth bar (accessible in front of RMU)	Required	
5.5		Interconnection arrangement between RMU and transformer MV bushings	Required	
5.6		Unscreened interconnecting equipment and connections between ring main unit and transformer to be barricaded	Required	
5.7		Type of earth fault indicator	Required	
5.8		Voltage detecting system (VDS)	Required	

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Annex C - Technical schedules A and B for

MSS TB 315KVA SR DYN11 6MM THICK AV SF6 DRY TYPE TRFR (SAP 3707)

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
6	4.2.8	LV Compartment		
6.1		Bus-bar-rating (see Table 2)	A	1,2 times the kVA capacity
6.2		Bus-bar-insulation		Air insulated
6.3		Bus-bars	Ø	3 + one identical neutral-earth bus-bar (insulated from frame)
6.4		Current density of bus-bars	A/mm ²	1,8 maximum
6.5		Rated withstand current – 1 s (25 kA for up to 630 kVA & 45 kA for 1000 kVA)	kA _{rms}	As per rating.
6.6		Min clearance to earth and between phases	mm	20
6.7		Provision of a LV neutral surge armineral fitted between mini-sub earth bar and LV neutral-earth bus-bar		Required
6.8		LV neutral-earth bus-bar to be earthed (via an electrical bridge to the mini-sub earth bar)		Required
6.9		Neutral isolating links		Not Required
6.10		Provision of LV main isolating switch		Not Required
6.11		Number of outgoing LV feeders to be provided for (drill bus-bar Ø14mm holes)		6
6.12		Spacing between holes (see Figure 1)	mm	110
6.13		LV panel designed for large frame MCCBs		Required
		Spacing (vertical): Between phase bus-bars	mm	185
		Between lowest LV bus-bar and LV neutral	mm	300
		Minimum distance between LV neutral and uni-strut	mm	200

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Annex C - Technical schedules A and B for

MSS TB 315KVA SR DYN11 6MM THICK AV SF6 DRY TYPE TRFR (SAP 3707)

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
6.14		LV maximum demand ammeters	On all three phases	
6.15		Ammeter type	Thermal integrating over 15 min period	
6.16		LV indicating voltmeter with a selector switch	Required	
6.17		Ammeter and voltmeter size and display mm	96 × 96, 90°	
6.18		Ammeter and voltmeter position	Top right hand side in LV compartment	
6.19		Electronic meter capable of reading current and voltage	Required	
6.20		Provision of removable non flammable barrier to separate LV end compartment and front LV compartment	Required	
6.21		Main MCCB manufacturer	Required	
6.22		Catalogue/model code of main MCCB	Required	
6.23		Size of main MCCB A	As per table 2	

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Annex C - Technical schedules A and B for

MSS TB 315KVA SR DYN11 6MM THICK AV SF6 DRY TYPE TRFR (SAP 3707)

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
7	4.2.6	LV auxiliaries		
7.1		Provision of three point socket outlet and 60W bulkhead fitting in LV compartment (with instantaneous-trip earth leakage unit [20 A; 5 kA rupturing capacity; 30 mA sensitivity] and 20 A HRC fuse with neutral fuse link)	Required	
7.2		Numbering ferrules for auxiliary wiring	Required	
7.3		Push-button fitted to shunt trip RMU tee-off	Required	
8	4.3.2	Materials and corrosion protection		
8.1		Mini-sub enclosure and transformer tank thickness 6(mm) or 3 mm	Mild steel	
8.2		Radiator	Mild steel	
8.3		Tinned copper bus-bars	Required	
8.4		Mini-sub base:Material	Steel	
8.5		Uni-strut clamping bar:Material	Required	
8.6		5mm cork packing (between ends and tank, base and ends, base and tank, and base and plinth)	Required	
8.7		Final colour	Avocado Green (12)	

Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Annex C - Technical schedules A and B for

MSS TB 315KVA SR DYN11 6MM THICK AV SF6 DRY TYPE TRFR (SAP 3707)

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
9	4.6.2	Notices, signs and labels		
9.1		Transformer rating plate	Required	
9.2		Treatment and Full First Aid Instructions on inside of MV and LV compartment doors	Required	
9.3		Elec. warning signs on all doors and barriers	Required	
9.4		Transformer phase labels below bushings	Required	
9.5		Colour-coded LV bus-bars	Required	
9.6		Stenciled labeling of MV and LV compartment doors (both inside and outside)	Required	
9.7		kVA, Prim V, Sec V & Corrosion Class	Required	
9.8		ID markings linking roof to body per batch	Required	
9.9		Provision for the safe-keeping of documents	Required	
10	4.7	Documentation		
10.1		Type test reports (provide ref. numbers of reports)	Sets 1	
10.2		Routine test reports	Sets 1	
10.3		Drawings	Sets 2	
10.4		Circuit diagrams (LV auxiliary wiring and equipment)	Sets 2	

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Technical schedules A and B Deviation schedule for

MSS TB 315KVA SR DYN11 6MM THICK AV SF6 DRY TYPE TRFR (SAP 3707)

Any deviations offered to this specification shall be listed below with reasons for deviation. In addition, evidence shall be provided that the proposed deviation will at least be more cost-effective than that specified by City Power.

Item	Sub clause of CP_TSSPEC_005	Proposed deviation

Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Annex C - Technical schedules A and B for

MSS TB 315KVA DR DYN11 3MM THICK AV SF6 FREE OIL TYPE TRFR (SAP 4363)

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_00 5	Description	Schedule A	Schedule B
1		Standard operating conditions		
1.1		i) Altitude m	1800	
1.2		b) Ambient air temperature °C	-5 to +40	
1.3		c) Lightning ground flash density Flashes/ km ² /year	> 10	
1.4		d) Maximum solar radiation W/m ²	1000	
1.5		e) Ultraviolet radiation	High	
1.6		f) Relative humidity %	10 to 95	
1.7		g) Corrosive conditions (inland therefore non-corrosive)	Non- corrosive	
1.8		h) wind pressure Pa	700	
2	4.2.1	Ratings		
2.1		Transformer power rating kVA	315	
2.2		Nominal voltage of system (Dual ratio) kV _{rms}	6,6 & 11	
2.3		System frequency Hz	50	
2.4		Number of phases	3	
2.5		Rated no-load secondary voltage V _{rms}	415	
2.6		Rated power-frequency voltage kV _{rms}	12	
2.7		Rated lightning impulse withstand voltage kV _{peak}	95	
2.8		Rated short-duration power frequency withstand voltage [50Hz: 1 min] kV _{rms}	28	
2.9		Induced voltage withstand level kV _{rms}	22	
2.10		Internal arc classification	AB-FLR	
2.11		Internal arc current and duration	20KA/500 ms	

Note: Ticks, Cross [√, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Annex C - Technical schedules A and B for

MSS TB 315KVA DR DYN11 3MM THICK AV SF6 FREE OIL TYPE TRFR (SAP 4363)

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
3	4.3.1	Construction design		
3.1		Layout	Type B	
3.2		Construction	Modular	
3.3		Removable base sections adjacent to MV compartment (sections to be lap bolted with nuts on the inside of the channel and housing)	Required	
3.4		All doors shall be a manual three point locking mechanism, capable of being secured by a padlock, having a shackle diameter of 8mm.	Required	
3.5		Compartment lock protection facility (with welded mesh top with inside visibility)	Required	
3.6		Total mass of miniature substation kg	Required	
3.7		Overall maximum dimensions	Required	
3.8		a) MV compartment length mm	Required	
		b) LV compartment length mm	Required	
		c) LV metering compartment mm	400 x 400	
		d) Overall length mm	3000	
		e) Overall width mm	1650	
		f) Overall height mm	2000	
		k) Base width mm	1200	
		l) Thickness mm	3mm	
		Provision for lifting of complete mini-sub onto a concrete plinth without need for dismantling	Required	
3.9		Provision of lifting lugs on roof for ease of removal	Required	
3.10		MV switchgear, LV panel, LV metering and transformer confined to separate compartments	Required	
3.11		Mini-sub housing sections and doors bonded	Required	

Note: Ticks, Cross [√, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Full name of company: _____

Annex C - Technical schedules A and B for

MSS TB 315KVA DR DYN11 3MM THICK AV SF6 FREE OIL TYPE TRFR (SAP 4363)

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
4	4.2.1	Transformer unit (Oil immersed)		
4.1		Electrical requirements	As per SANS 780	
4.2		Vector group	Dyn 11	
4.3		MV system earthing	Effective	
4.4		LV transformer neutral earthing	Solid – connection to insulated LV neutral/earth bar	
4.5		MV system fault level	kA 25	
4.6		Temperature rise limits	As per SANS 780 Table 6	
4.7		Secondary voltage regulation (Off-load on the 11 kV supply voltage windings)	% +6.0, + 3.0, 0, –3.0, –6.0	
4.8		No-load losses	W Required	
4.9		Load losses	W Required	
4.10		Impedance	% SAN S780	
4.11		Cost /kW of no-load losses (Jul 2002)	R/kW 13 669	
4.12		Cost /kW of load losses (Jul 2002)	R/kW 1 623	
4.13		X/R	SANS 780	
4.14		Audio-sound level – maximum (see table 6)	dB(A) Table 6	
4.15		Sealed transformer unit	Required	

Note: Ticks, Cross [√, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Annex C - Technical schedules A and B for

MSS TB 315KVA DR DYN11 3MM THICK AV SF6 FREE OIL TYPE TRFR (SAP 4363)

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
4.16	4.4.2	Transformer MV bushings (NB internal screen to be earthed)	BS 7215 –Type C with M16x2 thread	
4.17		MV bushing-centre clearances (minimum) mm	135	
4.18		Clearances between outer bushing-centres and mini-sub metal enclosure (minimum) mm	90	
4.19		Transformer overload protection facility	Required	
4.20		Winding material	MV Copper LV Copper	
4.21		Manufacturer of the distribution transformer distribution transformer	Required	
5		MV compartment		
5.1		Equipment in MV compartment	SF6 FREE Ring Main Unit (CP_TSSPEC_006)	
5.2		Ring Main Unit manufacturer	Required	
5.3		Incoming MV cable requirements		
		a) 185 mm ² 3 core Cu or 300 mm ² 3C Al XLPE	Required	
		b) Cable support (clamping) required	Required	
		c) Minimum distance from cable clamp to centre-line of RMU bushings mm	800	
		d) Type of connection	Screened	
5.4		Mini-sub earth bar (accessible in front of RMU)	Required	
5.5		Interconnection arrangement between RMU and transformer MV bushings	Required	
5.6		Unscreened interconnecting equipment and connections between ring main unit and transformer to be barricaded	Required	
5.7		Type of earth fault indicator	Required	
5.8		Voltage detecting system (VDS)	Required	

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Annex C - Technical schedules A and B for

MSS TB 315KVA DR DYN11 3MM THICK AV SF6 FREE OIL TYPE TRFR (SAP 4363)

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
6	4.2.8	LV Compartment		
6.1		Bus-bar-rating (see Table 2)	A	1,2 times the kVA capacity
6.2		Bus-bar-insulation		Air insulated
6.3		Bus-bars	Ø	3 + one identical neutral-earth bus-bar (insulated from frame)
6.4		Current density of bus-bars	A/mm ²	1,8 maximum
6.5		Rated withstand current – 1 s (25 kA for up to 630 kVA & 45 kA for 1000 kVA)	kA _{rms}	As per rating.
6.6		Min clearance to earth and between phases	mm	20
6.7		Provision of a LV neutral surge armineral fitted between mini-sub earth bar and LV neutral-earth bus-bar		Required
6.8		LV neutral-earth bus-bar to be earthed (via an electrical bridge to the mini-sub earth bar)		Required
6.9		Neutral isolating links		Not Required
6.10		Provision of LV main isolating switch		Not Required
6.11		Number of outgoing LV feeders to be provided for (drill bus-bar Ø14mm holes)		6
		Spacing between holes (see Figure 1)	mm	110
6.12		LV panel designed for large frame MCCBs		Required
6.13		Spacing (vertical): Between phase bus-bars	mm	185
		Between lowest LV bus-bar and LV neutral	mm	300
		Minimum distance between LV neutral and uni-strut	mm	200

Note: Ticks, Cross [√, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Annex C - Technical schedules A and B for

MSS TB 315KVA DR DYN11 3MM THICK AV SF6 FREE OIL TYPE TRFR (SAP 4363)

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
6.14		LV maximum demand ammeters	On all three phases	
6.15		Ammeter type	Thermal integrating over 15 min period	
6.16		LV indicating voltmeter with a selector switch	Required	
6.17		Ammeter and voltmeter size and display mm	96 × 96, 90°	
6.18		Ammeter and voltmeter position	Top right hand side in LV compartment	
6.19		Analogue meter capable of reading current and voltage	Required	
6.20		Provision of removable non flammable barrier to separate LV end compartment and front LV compartment	Required	
6.21		Main MCCB manufacturer	Required	
6.22		Catalogue/model code of main MCCB	Required	
6.23		Size of main MCCB A	As per table 2	

**Note: Ticks, Cross [√, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be
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Full name of company: _____

Annex C - Technical schedules A and B for

MSS TB 315KVA DR DYN11 3MM THICK AV SF6 FREE OIL TYPE TRFR (SAP 4363)

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
7	4.2.6	LV auxiliaries		
7.1		Provision of three point socket outlet in LV compartment (with instantaneous-trip earth leakage unit [20 A; 5 kA rupturing capacity; 30 mA sensitivity] and 20 A HRC fuse with neutral fuse link)	Required	
7.2		Numbering ferrules for auxiliary wiring	Required	
8	4.3.2	Materials and corrosion protection		
8.1		Mini-sub enclosure and transformer tank thickness 3 or 6mm	Mild steel	
8.2		Radiator thickness 6(mm)	Mild steel	
8.3		Tinned copper bus-bars	Required	
8.4		Mini-sub base material	Steel	
8.5		5mm cork packing (between ends and tank, base and ends, base and tank)	Required	
8.6		Final colour	Avocado Green (12)	

Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Annex C - Technical schedules A and B for

MSS TB 315KVA DR DYN11 3MM THICK AV SF6 FREE OIL TYPE TRFR (SAP 4363)

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
9	4.6.2	Notices, signs and labels		
9.1		Transformer rating plate	Required	
9.2		Treatment and Full First Aid Instructions on inside of MV and LV compartment doors	Required	
9.3		Elec. warning signs on all doors and barriers	Required	
9.4		Transformer phase labels below bushings	Required	
9.5		Colour-coded LV bus-bars	Required	
9.6		Stenciled labeling of MV and LV compartment doors (both inside and outside)	Required	
9.7		kVA, Prim V, Sec V & Corrosion Class	Required	
9.8		ID markings linking roof to body per batch	Required	
9.9		Provision for the safe-keeping of documents	Required	
10	4.7	Documentation		
10.1		Type test reports (provide ref. numbers of reports) Sets	1	
10.2		Routine test reports Sets	1	
10.3		Drawings Sets	2	
10.4		Circuit diagrams (LV auxiliary wiring and equipment) Sets	2	

Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Technical schedules A and B Deviation schedule for

MSS TB 315KVA DR DYN11 3MM THICK AV SF6 FREE OIL TYPE TRFR (SAP 4363)

Any deviations offered to this specification shall be listed below with reasons for deviation. In addition, evidence shall be provided that the proposed deviation will at least be more cost-effective than that specified by City Power.

Item	Sub clause of CP_TSSPEC_005	Proposed deviation

Note: Ticks, Cross [√, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Annex C - Technical schedules A and B for

**MSS TB 315KVA DR DYN11 6MM THICK AV SF6 FREE OIL TYPE TRFR (SAP
4368)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_00 5	Description	Schedule A	Schedule B
1		Standard operating conditions		
1.1		j) Altitude m	1800	
1.2		b) Ambient air temperature °C	-5 to +40	
1.3		c) Lightning ground flash density Flashes/ km ² /year	> 10	
1.4		d) Maximum solar radiation W/m ²	1000	
1.5		e) Ultraviolet radiation	High	
1.6		f) Relative humidity %	10 to 95	
1.7		g) Corrosive conditions (inland therefore non-corrosive)	Non- corrosive	
1.8		h) wind pressure Pa	700	
2	4.2.1	Ratings		
2.1		Transformer power rating kVA	315	
2.2		Nominal voltage of system (Dual ratio) kV _{rms}	6,6 & 11	
2.3		System frequency Hz	50	
2.4		Number of phases	3	
2.5		Rated no-load secondary voltage V _{rms}	415	
2.6		Rated power-frequency voltage kV _{rms}	12	
2.7		Rated lightning impulse withstand voltage kV _{peak}	95	
2.8		Rated short-duration power frequency withstand voltage [50Hz: 1 min] kV _{rms}	28	
2.9		Induced voltage withstand level kV _{rms}	22	
2.10		Internal arc classification	AB-FLR	
2.11		Internal arc current and duration	20KA/500 ms	

**Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be
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Annex C - Technical schedules A and B for

MSS TB 315KVA DR DYN11 6MM THICK AV SF6 FREE OIL TYPE TRFR (SAP 4368)

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
3	4.3.1	Construction design		
3.1		Layout	Type B	
3.2		Construction	Modular	
3.3		Removable base sections adjacent to MV compartment (sections to be lap bolted with nuts on the inside of the channel and housing)	Required	
3.4		All doors shall be a manual three point locking mechanism, capable of being secured by a padlock, having a shackle diameter of 8mm.	Required	
3.5		Compartment lock protection facility (with welded mesh top with inside visibility)	Required	
3.6		Total mass of miniature substation kg	Required	
3.7		Overall maximum dimensions	Required	
3.8		a) MV compartment length mm	Required	
		b) LV compartment length mm	Required	
		c) LV metering compartment mm	400 x 400	
		d) Overall length mm	3000	
		e) Overall width mm	1650	
		f) Overall height mm	2000	
		m) Base width mm	1200	
		n) Thickness mm	6	
		Provision for lifting of complete mini-sub onto a concrete plinth without need for dismantling	Required	
3.9		Provision of lifting lugs on roof for ease of removal	Required	
3.10		MV switchgear, LV panel, LV metering and transformer confined to separate compartments	Required	
3.11		Mini-sub housing sections and doors bonded	Required	

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Annex C - Technical schedules A and B for

MSS TB 315KVA DR DYN11 6MM THICK AV SF6 FREE OIL TYPE TRFR (SAP 4368)

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
4	4.2.1	Transformer unit (Oil immersed)		
4.1		Electrical requirements	As per SANS 780	
4.2		Vector group	Dyn 11	
4.3		MV system earthing	Effective	
4.4		LV transformer neutral earthing	Solid – connection to insulated LV neutral/earth bar	
4.5		MV system fault level	kA 25	
4.6		Temperature rise limits	As per SANS 780 Table 6	
4.7		Secondary voltage regulation (Off-load on the 11 kV supply voltage windings)	% +6.0, + 3.0, 0, –3.0, –6.0	
4.8		No-load losses	W Required	
4.9		Load losses	W Required	
4.10		Impedance	% SANS 780	
4.11		Cost /kW of no-load losses (Jul 2002)	R/kW 13 669	
4.12		Cost /kW of load losses (Jul 2002)	R/kW 1 623	
4.13		X/R	SANS780	
4.14		Audio-sound level – maximum (see table 6)	dB(A) Table 6	
4.15		Sealed transformer unit	Required	

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Annex C - Technical schedules A and B for

MSS TB 315KVA DR DYN11 6MM THICK AV SF6 FREE OIL TYPE TRFR (SAP 4368)

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
4.16	4.4.2	Transformer MV bushings (NB internal screen to be earthed)	BS 7215 –Type C with M16x2 thread	
4.17		MV bushing-centre clearances (minimum) mm	135	
4.18		Clearances between outer bushing-centres and mini-sub metal enclosure (minimum) mm	90	
4.19		Transformer overload protection facility	Required	
4.20		Winding material MV	Copper	
		LV	Copper	
4.21		Manufacturer of the distribution transformer of distribution transformer	Required	
5		MV compartment		
5.1		Equipment in MV compartment	SF6 FREE Ring Main Unit (CP_TSSPEC_006)	
5.2		Ring Main Unit manufacturer	Required	
5.3		Incoming MV cable requirements		
		a) 185 mm ² 3 core Cu or 300 mm ² 3C Al XLPE	Required	
		b) Cable support (clamping) required	Required	
		c) Minimum distance from cable clamp to centre-line of RMU bushings mm	800	
		d) Type of connection	Screened	
5.4		Mini-sub earth bar (accessible in front of RMU)	Required	
5.5		Interconnection arrangement between RMU and transformer MV bushings	Required	
5.6		Unscreened interconnecting equipment and connections between ring main unit and transformer to be barricaded	Required	
5.7		Type of earth fault indicator	Required	
5.8		Voltage detecting system (VDS)	Required	

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Annex C - Technical schedules A and B for

MSS TB 315KVA DR DYN11 6MM THICK AV SF6 FREE OIL TYPE TRFR (SAP 4368)

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
6	4.2.8	LV Compartment		
6.1		Bus-bar-rating (see Table 2)	A	1,2 times the kVA capacity
6.2		Bus-bar-insulation		Air insulated
6.3		Bus-bars	Ø	3 + one identical neutral-earth bus-bar (insulated from frame)
6.4		Current density of bus-bars	A/mm ²	1,8 maximum
6.5		Rated withstand current – 1 s (25 kA for up to 630 kVA & 45 kA for 1000 kVA)	kA _{rms}	As per rating.
6.6		Min clearance to earth and between phases	mm	20
6.7		Provision of a LV neutral surge arrester fitted between mini-sub earth bar and LV neutral-earth bus-bar		Required
6.8		LV neutral-earth bus-bar to be earthed (via an electrical bridge to the mini-sub earth bar)		Required
6.9		Neutral isolating links		Not Required
6.10		Provision of LV main isolating switch		Not Required
6.11		Number of outgoing LV feeders to be provided for (drill bus-bar Ø14mm holes)		6
6.12		Spacing between holes (see Figure 1)	mm	110
6.13		LV panel designed for large frame MCCBs		Required
		Spacing (vertical): Between phase bus-bars	mm	185
		Between lowest LV bus-bar and LV neutral	mm	300
		Minimum distance between LV neutral and uni-strut	mm	200

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Annex C - Technical schedules A and B for

MSS TB 315KVA DR DYN11 6MM THICK AV SF6 FREE OIL TYPE TRFR (SAP 4368)

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
6.14		LV maximum demand ammeters	On all three phases	
6.15		Ammeter type	Thermal integrating over 15 min period	
6.16		LV indicating voltmeter with a selector switch	Required	
6.17		Ammeter and voltmeter size and display mm	96 × 96, 90°	
6.18		Ammeter and voltmeter position	Top right hand side in LV compartment	
6.19		Analogue meter capable of reading current and voltage	Required	
6.20		Provision of removable non flammable barrier to separate LV end compartment and front LV compartment	Required	
6.21		Main MCCB manufacturer	Required	
6.22		Catalogue/model code of main MCCB	Required	
6.23		Size of main MCCB A	As per table 2	

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Annex C - Technical schedules A and B for

MSS TB 315KVA DR DYN11 6MM THICK AV SF6 FREE OIL TYPE TRFR (SAP 4368)

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
7	4.2.6	LV auxiliaries		
7.1		Provision of three point socket outlet in LV compartment (with instantaneous-trip earth leakage unit [20 A; 5 kA rupturing capacity; 30 mA sensitivity] and 20 A HRC fuse with neutral fuse link)	Required	
7.2		Numbering ferrules for auxiliary wiring	Required	
8	4.3.2	Materials and corrosion protection		
8.1		Mini-sub enclosure and transformer tank thickness 6mm or 3 mm	Mild steel	
8.2		Radiator thickness 6(mm)	Mild steel	
8.3		Tinned copper bus-bars	Required	
8.4		Mini-sub base material	Steel	
8.5		5mm cork packing (between ends and tank, base and ends, base and tank)	Required	
8.6		Final colour	Avocado Green (12)	

Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Annex C - Technical schedules A and B for

MSS TB 315KVA DR DYN11 6MM THICK AV SF6 FREE OIL TYPE TRFR (SAP 4368)

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
9	4.6.2	Notices, signs and labels		
9.1		Transformer rating plate	Required	
9.2		Treatment and Full First Aid Instructions on inside of MV and LV compartment doors	Required	
9.3		Elec. warning signs on all doors and barriers	Required	
9.4		Transformer phase labels below bushings	Required	
9.5		Colour-coded LV bus-bars	Required	
9.6		Stenciled labeling of MV and LV compartment doors (both inside and outside)	Required	
9.7		kVA, Prim V, Sec V & Corrosion Class	Required	
9.8		ID markings linking roof to body per batch	Required	
9.9		Provision for the safe-keeping of documents	Required	
10	4.7	Documentation		
10.1		Type test reports (provide ref. numbers of reports)	Sets 1	
10.2		Routine test reports	Sets 1	
10.3		Drawings	Sets 2	
10.4		Circuit diagrams (LV auxiliary wiring and equipment)	Sets 2	

Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Technical schedules A and B Deviation schedule for

**MSS TB 315KVA DR DYN11 6MM THICK AV SF6 FREE OIL TYPE TRFR (SAP
4368)**

Any deviations offered to this specification shall be listed below with reasons for deviation. In addition, evidence shall be provided that the proposed deviation will at least be more cost-effective than that specified by City Power.

Item	Sub clause of CP_TSSPEC_005	Proposed deviation

Note: Ticks, Cross [√, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Annex C - Technical schedules A and B for

MSS TB 315KVA DR DYN11 3MM THICK AV SF6 FREE DRY TYPE TRFR

(SAP 4373)

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
1		Standard operating conditions		
1.1		k) Altitude m	1800	
1.2		b) Ambient air temperature °C	-5 to +40	
1.3		c) Lightning ground flash density Flashes/ km ² /year	> 10	
1.4		d) Maximum solar radiation W/m ²	1000	
1.5		e) Ultraviolet radiation	High	
1.6		f) Relative humidity %	10 to 95	
1.7		g) Corrosive conditions (inland therefore non-corrosive)	Non- corrosive	
1.8		h) wind pressure Pa	700	
2	4.2.1	Ratings		
2.1		Transformer power rating kVA	315	
2.2		Nominal voltage of system (Dual ratio) kV _{rms}	6,6 & 11	
2.3		System frequency Hz	50	
2.4		Number of phases	3	
2.5		Rated no-load secondary voltage V _{rms}	415	
2.6		Rated power-frequency voltage kV _{rms}	12	
2.7		Rated lightning impulse withstand voltage kV _{peak}	95	
2.8		Rated short-duration power frequency withstand voltage [50Hz: 1 min] kV _{rms}	28	
2.9		Induced voltage withstand level kV _{rms}	22	
2.10		Internal arc classification	AB-FLR	
2.11		Internal arc current and duration	20KA/500 ms	

Note: Ticks, Cross [√, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Tenderer's Authorised Signatory: _____

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Full name of company: _____

Annex C - Technical schedules A and B for

**MSS TB 315KVA DR DYN11 3MM THICK AV SF6 FREE RMU DRY TYPE TRFR
(SAP 4373)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
3	4.3.1	Construction design		
3.1		Layout	Type B	
3.2		Construction	Modular	
3.3		Removable base sections adjacent to MV compartment (sections to lap bolted with nuts on the inside of the channel and housing)	Required	
3.4		All doors shall be a manual three point locking mechanism, capable of being secured by a padlock, having a shackle diameter of 8mm.	Required	
3.5		Compartment lock protection facility (with welded mesh top with inside visibility)	Required	
3.6		Total mass of miniature substation Kg	Required	
3.7		Overall maximum dimensions	Required	
3.8		a) MV compartment length mm	Required	
		b) LV compartment length mm	Required	
		c) LV metering compartment mm	400 x 400	
		d) Overall length mm	3000	
		e) Overall width mm	1650	
		f) Overall height mm	2000	
		g)Base width mm	1200	
		h)Thickness mm	3	
		Provision for lifting of complete mini-sub onto a concrete plinth without need for dismantling	Required	
3.9		Provision of lifting lugs on roof for ease of removal	Required	
3.10		MV switchgear, LV panel, LV metering and transformer confined to separate compartments	Required	
3.11		Mini-sub housing sections and doors bonded	Required	

Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Annex C - Technical schedules A and B for

**MSS TB 315KVA DR DYN11 3MM THICK AV SF6 FREE RMU DRY TYPE TRFR
(SAP 4373)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
4	4.2.1	Transformer unit (Dry-Type)		
4.1		Electrical requirements	As per SANS 60076-11	
4.2		Vector group	Dyn 11	
4.3		MV system earthing	Effective	
4.4		LV transformer neutral earthing	Solid – connection to insulated LV neutral/earth bar	
4.5		MV system fault level	kA 25	
4.6		Temperature rise limits	As per SANS 60076	
4.7		Secondary voltage regulation (Off-load on the 11 kV supply voltage windings)	% +6.0, + 3.0, 0, –3.0, –6.0	
4.8		No-load losses	W Required	
4.9		Load losses	W Required	
4.10		Impedance	% SANS 60076	
4.11		Cost /kW of no-load losses (Jul 2002)	R/kW 13 669	
4.12		Cost /kW of load losses (Jul 2002)	R/kW 1 623	
4.13		X/R	SANS 60076	
4.14		Audio-sound level – maximum	dB(A) Required	
4.15		Sealed transformer unit	Required	

Note: Ticks, Cross [√, X], Asterick [*], Word [Noted] or TBA [“To Be Advice”] will not be accepted.

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Annex C - Technical schedules A and B for

**MSS TB 315KVA DR DYN11 3MM THICK AV SF6 FREE RMU DRY TYPE TRFR
(SAP 4373)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
4.16	4.4.2	Transformer MV bushings (NB internal screen to be earthed)	BS 7215 –Type C with M16x2 thread	
4.17		MV bushing-centre clearances (minimum) mm	135	
4.18		Clearances between outer bushing-centres and mini-sub metal enclosure (minimum) mm	90	
4.19		Transformer overload protection facility	Required	
4.20		Winding material MV	Copper	
			LV	
4.21		Manufacturer of the distribution transformer of the distribution transformer	Copper	
			Required	
5		MV compartment		
5.1		Equipment in MV compartment	SF6 FREE Ring Main Unit (CP_TSSPEC_006)	
5.2		Ring Main Unit manufacturer	Required	
5.3		Incoming MV cable requirements		
		a) 185 mm ² 3 core Cu or 300 mm ² 3C Al XLPE	Required	
		b) Cable support (clamping) required	Required	
		c) Minimum distance from cable clamp to centre-line of RMU bushings mm	800	
		d) Type of connection	Screened	
5.4		Mini-sub earth bar (accessible in front of RMU)	Required	
5.5		Interconnection arrangement between RMU and transformer MV bushings	Required	
5.6		Unscreened interconnecting equipment and connections between ring main unit and transformer to be barricaded	Required	
5.7		Type of earth fault indicator	Required	
5.8		Voltage detecting system (VDS)	Required	

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Annex C - Technical schedules A and B for

**MSS TB 315KVA DR DYN11 3MM THICK AV SF6 FREE RMU DRY TYPE TRFR
(SAP 4373)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
6	4.2.8	LV Compartment		
6.1		Bus-bar-rating (see Table 2)	A	1,2 times the kVA capacity
6.2		Bus-bar-insulation		Air insulated
6.3		Bus-bars	Ø	3 + one identical neutral-earth bus-bar (insulated from frame)
6.4		Current density of bus-bars	A/mm ²	1,8 maximum
6.5		Rated withstand current – 1 s (25 kA for up to 630 kVA & 45 kA for 1000 kVA)	kA _{rms}	As per rating.
6.6		Min clearance to earth and between phases	mm	20
6.7		Provision of a LV neutral surge armineral fitted between mini-sub earth bar and LV neutral-earth bus-bar		Required
6.8		LV neutral-earth bus-bar to be earthed (via an electrical bridge to the mini-sub earth bar)		Required
6.9		Neutral isolating links		Not Required
6.10		Provision of LV main isolating switch		Not Required
6.11		Number of outgoing LV feeders to be provided for (drill bus-bar Ø14mm holes)		6
6.12		Spacing between holes (see Figure 1)	mm	110
6.13		LV panel designed for large frame MCCBs		Required
		Spacing (vertical): Between phase bus-bars	mm	185
		Between lowest LV bus-bar and LV neutral	mm	300
		Minimum distance between LV neutral and uni-strut	mm	200

**Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be
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Annex C - Technical schedules A and B for

**MSS TB 315KVA DR DYN11 3MM THICK AV SF6 FREE RMU DRY TYPE TRFR
(SAP 4373)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
6.14		LV maximum demand ammeters	On all three phases	
6.15		Ammeter type	Thermal integrating over 15 min period	
6.16		LV indicating voltmeter with a selector switch	Required	
6.17		Ammeter and voltmeter size and display mm	96 × 96, 90°	
6.18		Ammeter and voltmeter position	Top right hand side in LV compartment	
6.19		Electronic meter capable of reading current and voltage	Required	
6.20		Provision of removable non flammable barrier to separate LV end compartment and front LV compartment	Required	
6.21		Main MCCB manufacturer	Required	
6.22		Catalogue/model code of main MCCB	Required	
6.23		Size of main MCCB A	As per table 2	

Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Annex C - Technical schedules A and B for

**M MSS TB 315KVA DR DYN11 3MM THICK AV SF6 FREE RMU DRY TYPE TRFR
(SAP 4373)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
7	4.2.6	LV auxiliaries		
7.1		Provision of three point socket outlet and 60W bulkhead fitting in LV compartment (with instantaneous-trip earth leakage unit [20 A; 5 kA rupturing capacity; 30 mA sensitivity] and 20 A HRC fuse with neutral fuse link)	Required	
7.2		Numbering ferrules for auxiliary wiring	Required	
7.3		Push-button fitted to shunt trip RMU tee-off	Required	
8	4.3.2	Materials and corrosion protection		
8.1		Mini-sub enclosure and transformer tank thickness 3 mm	Mild steel	
8.2		Radiator	Mild steel	
8.3		Tinned copper bus-bars	Required	
8.4		Mini-sub base:Material	Steel	
8.5		Uni-strut clamping bar:Material	Required	
8.6		5mm cork packing (between ends and tank, base and ends, base and tank, and base and plinth)	Required	
8.7		Final colour	Avocado Green (12)	

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**Annex C - Technical schedules A and B for
MSS TB 315KVA DR DYN11 3MM THICK AV SF6 FREE RMU DRY TYPE TRFR
(SAP 4373)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
9	4.6.2	Notices, signs and labels		
9.1		Transformer rating plate	Required	
9.2		Treatment and Full First Aid Instructions on inside of MV and LV compartment doors	Required	
9.3		Elec. warning signs on all doors and barriers	Required	
9.4		Transformer phase labels below bushings	Required	
9.5		Colour-coded LV bus-bars	Required	
9.6		Stenciled labeling of MV and LV compartment doors (both inside and outside)	Required	
9.7		kVA, Prim V, Sec V & Corrosion Class	Required	
9.8		ID markings linking roof to body per batch	Required	
9.9		Provision for the safe-keeping of documents	Required	
10	4.7	Documentation		
10.1		Type test reportss (provide ref. numbers of reports)	Sets 1	
10.2		Routine test reportss	Sets 1	
10.3		Drawings	Sets 2	
10.4		Circuit diagrams (LV auxiliary wiring and equipment)	Sets 2	

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Technical schedules A and B Deviation schedule for

**M MSS TB 315KVA DR DYN11 3MM THICK AV SF6 FREE RMU DRY TYPE TRFR
(SAP 4373)**

Any deviations offered to this specification shall be listed below with reasons for deviation.
In addition, evidence shall be provided that the proposed deviation will at least be more
cost-effective than that specified by City Power.

Item	Sub clause of CP_TSSPEC_005	Proposed deviation

**Note: Ticks, Cross [$\sqrt{}$, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be
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Annex C - Technical schedules A and B for

**MSS TB 315KVA DR DYN11 6MM THICK AV SF6 FREE RMU DRY TYPE
TRFR (SAP 4374)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
1		Standard operating conditions		
1.1		l) Altitude m	1800	
1.2		b) Ambient air temperature °C	-5 to +40	
1.3		c) Lightning ground flash density Flashes/ km ² /year	> 10	
1.4		d) Maximum solar radiation W/m ²	1000	
1.5		e) Ultraviolet radiation	High	
1.6		f) Relative humidity %	10 to 95	
1.7		g) Corrosive conditions (inland therefore non-corrosive)	Non- corrosive	
1.8		h) wind pressure Pa	700	
2	4.2.1	Ratings		
2.1		Transformer power rating kVA	315	
2.2		Nominal voltage of system (Dual ratio) kV _{rms}	6,6 & 11	
2.3		System frequency Hz	50	
2.4		Number of phases	3	
2.5		Rated no-load secondary voltage V _{rms}	415	
2.6		Rated power-frequency voltage kV _{rms}	12	
2.7		Rated lightning impulse withstand voltage kV _{peak}	95	
2.8		Rated short-duration power frequency withstand voltage [50Hz: 1 min] kV _{rms}	28	
2.9		Induced voltage withstand level kV _{rms}	22	
2.10		Internal arc classification	AB-FLR	
2.11		Internal arc current and duration	20KA/500 ms	

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Annex C - Technical schedules A and B for

**MSS TB 315KVA DR DYN11 6MM THICK AV SF6 FREE RMU DRY TYPE
TRFR (SAP 4374)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
3	4.3.1	Construction design		
3.1		Layout	Type B	
3.2		Construction	Modular	
3.3		Removable base sections adjacent to MV compartment (sections to lap bolted with nuts on the inside of the channel and housing)	Required	
3.4		All doors shall be a manual three point locking mechanism, capable of being secured by a padlock, having a shackle diameter of 8mm.	Required	
3.5		Compartment lock protection facility (with welded mesh top with inside visibility)	Required	
3.6		Total mass of miniature substation Kg	Required	
3.7		Overall maximum dimensions	Required	
3.8		a) MV compartment length mm	Required	
		b) LV compartment length mm	Required	
		c) LV metering compartment mm	400 x 400	
		d) Overall length mm	3000	
		e) Overall width mm	1650	
		f) Overall height mm	2000	
		g)Base width mm	1200	
		h)Thickness mm	6	
		Provision for lifting of complete mini-sub onto a concrete plinth without need for dismantling	Required	
3.9		Provision of lifting lugs on roof for ease of removal	Required	
3.10		MV switchgear, LV panel, LV metering and transformer confined to separate compartments	Required	
3.11		Mini-sub housing sections and doors bonded	Required	

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Annex C - Technical schedules A and B for

**MSS TB 315KVA DR DYN11 6MM THICK AV SF6 FREE RMU DRY TYPE TRFR
(SAP 4374)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
4	4.2.1	Transformer unit Dry-Type)		
4.1		Electrical requirements	As per SANS 60076	
4.2		Vector group	Dyn 11	
4.3		MV system earthing	Effective	
4.4		LV transformer neutral earthing	Solid – connection to insulated LV neutral/earth bar	
4.5		MV system fault level	kA 25	
4.6		Temperature rise limits	As per SANS 60076	
4.7		Secondary voltage regulation (Off-load on the 11 kV supply voltage windings)	% +6.0, + 3.0, 0, –3.0, –6.0	
4.8		No-load losses	W Required	
4.9		Load losses	W Required	
4.10		Impedance	% SANS 60076	
4.11		Cost /kW of no-load losses (Jul 2002)	R/kW 13 669	
4.12		Cost /kW of load losses (Jul 2002)	R/kW 1 623	
4.13		X/R	SANS 60076	
4.14		Audio-sound level – maximum	dB(A) Required	
4.15		Sealed transformer unit	Required	

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Annex C - Technical schedules A and B for

**MSS TB 315KVA DR DYN11 6MM THICK AV SF6 FREE RMU DRY TYPE
TRFR (SAP 4374)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
4.16	4.4.2	Transformer MV bushings (NB internal screen to be earthed)	BS 7215 –Type C with M16x2 thread	
4.17		MV bushing-centre clearances (minimum) mm	135	
4.18		Clearances between outer bushing-centres and mini-sub metal enclosure (minimum) mm	90	
4.19		Transformer overload protection facility	Required	
4.20		Winding material	MV Copper LV Copper	
4.21		Manufacturer of the distribution transformer	Required	
5		MV compartment		
5.1		Equipment in MV compartment	Ring Main Unit (CP_TSSPEC_006)	
5.2		Ring Main Unit manufacturer	Required	
5.3		Incoming MV cable requirements		
		a) 185 mm ² 3 core Cu or 300 mm ² 3C Al XLPE	Required	
		b) Cable support (clamping) required	Required	
		c) Minimum distance from cable clamp to centre-line of RMU bushings mm	800	
		d) Type of connection	Screened	
5.4		Mini-sub earth bar (accessible in front of RMU)	Required	
5.5		Interconnection arrangement between RMU and transformer MV bushings	Required	
5.6		Unscreened interconnecting equipment and connections between ring main unit and transformer to be barricaded	Required	
5.7		Type of earth fault indicator	Required	
5.8		Voltage detecting system (VDS)	Required	

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Annex C - Technical schedules A and B for

**MSS TB 315KVA DR DYN11 6MM THICK AV SF6 FREE RMU DRY TYPE
TRFR (SAP 4374)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
6	4.2.8	LV Compartment		
6.1		Bus-bar-rating (see Table 2)	A	1,2 times the kVA capacity
6.2		Bus-bar-insulation		Air insulated
6.3		Bus-bars	Ø	3 + one identical neutral-earth bus-bar (insulated from frame)
6.4		Current density of bus-bars	A/mm ²	1,8 maximum
6.5		Rated withstand current – 1 s (25 kA for up to 630 kVA & 45 kA for 1000 kVA)	kA _{rms}	As per rating.
6.6		Min clearance to earth and between phases	mm	20
6.7		Provision of a LV neutral surge armineral fitted between mini-sub earth bar and LV neutral-earth bus-bar		Required
6.8		LV neutral-earth bus-bar to be earthed (via an electrical bridge to the mini-sub earth bar)		Required
6.9		Neutral isolating links		Not Required
6.10		Provision of LV main isolating switch		Not Required
6.11		Number of outgoing LV feeders to be provided for (drill bus-bar Ø14mm holes)		6
6.12		Spacing between holes (see Figure 1)	mm	110
6.13		LV panel designed for large frame MCCBs		Required
		Spacing (vertical): Between phase bus-bars	mm	185
		Between lowest LV bus-bar and LV neutral	mm	300
		Minimum distance between LV neutral and uni-strut	mm	200

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Annex C - Technical schedules A and B for

**MSS TB 315KVA DR DYN11 6MM THICK AV SF6 FREE RMU DRY TYPE
TRFR (SAP 4374)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
6.14		LV maximum demand ammeters	On all three phases	
6.15		Ammeter type	Thermal integrating over 15 min period	
6.16		LV indicating voltmeter with a selector switch	Required	
6.17		Ammeter and voltmeter size and display mm	96 × 96, 90°	
6.18		Ammeter and voltmeter position	Top right hand side in LV compartment	
6.19		Electronic meter capable of reading current and voltage	Required	
6.20		Provision of removable non flammable barrier to separate LV end compartment and front LV compartment	Required	
6.21		Main MCCB manufacturer	Required	
6.22		Catalogue/model code of main MCCB	Required	
6.23		Size of main MCCB A	As per table 2	

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Annex C - Technical schedules A and B for

**MSS TB 315KVA DR DYN11 6MM THICK AV SF6 FREE RMU DRY TYPE
TRFR (SAP 4374)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
7	4.2.6	LV auxiliaries		
7.1		Provision of three point socket outlet and 60W bulkhead fitting in LV compartment (with instantaneous-trip earth leakage unit [20 A; 5 kA rupturing capacity; 30 mA sensitivity] and 20 A HRC fuse with neutral fuse link)	Required	
7.2		Numbering ferrules for auxiliary wiring	Required	
7.3		Push-button fitted to shunt trip RMU tee-off	Required	
8	4.3.2	Materials and corrosion protection		
8.1		Mini-sub enclosure and transformer tank thickness 6(mm)	Mild steel	
8.2		Radiator	Mild steel	
8.3		Tinned copper bus-bars	Required	
8.4		Mini-sub base:Material	Steel	
8.5		Uni-strut clamping bar:Material	Required	
8.6		5mm cork packing (between ends and tank, base and ends, base and tank, and base and plinth)	Required	
8.7		Final colour	Avocado Green (12)	

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**Annex C - Technical schedules A and B for
MSS TB 315KVA DR DYN11 6MM THICK AV SF6 FREE RMU DRY TYPE
TRFR (SAP 4374)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
9	4.6.2	Notices, signs and labels		
9.1		Transformer rating plate	Required	
9.2		Treatment and Full First Aid Instructions on inside of MV and LV compartment doors	Required	
9.3		Elec. warning signs on all doors and barriers	Required	
9.4		Transformer phase labels below bushings	Required	
9.5		Colour-coded LV bus-bars	Required	
9.6		Stenciled labeling of MV and LV compartment doors (both inside and outside)	Required	
9.7		kVA, Prim V, Sec V & Corrosion Class	Required	
9.8		ID markings linking roof to body per batch	Required	
9.9		Provision for the safe-keeping of documents	Required	
10	4.7	Documentation		
10.1		Type test reportss (provide ref. numbers of reports)	Sets 1	
10.2		Routine test reportss	Sets 1	
10.3		Drawings	Sets 2	
10.4		Circuit diagrams (LV auxiliary wiring and equipment)	Sets 2	

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Technical schedules A and B Deviation schedule for

**MSS TB 315KVA DR DYN11 6MM THICK AV SF6 FREE RMU DRY TYPE
TRFR (SAP 4374)**

Any deviations offered to this specification shall be listed below with reasons for deviation. In addition, evidence shall be provided that the proposed deviation will at least be more cost-effective than that specified by City Power.

Item	Sub clause of CP_TSSPEC_005	Proposed deviation

Note: Ticks, Cross [√, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Annex C - Technical schedules A and B for

**MSS TB 315KVA SR DYN11 3MM THICK AV SF6 FREE RMU OIL TYPE TRFR
(SAP 4375)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
1		Standard operating conditions		
1.1		m) Altitude m	1800	
1.2		b) Ambient air temperature °C	-5 to +40	
1.3		c) Lightning ground flash density Flashes/ km ² /year	> 10	
1.4		d) Maximum solar radiation W/m ²	1000	
1.5		e) Ultraviolet radiation	High	
1.6		f) Relative humidity %	10 to 95	
1.7		g) Corrosive conditions (inland therefore non-corrosive)	Non- corrosive	
1.8		h) wind pressure Pa	700	
2	4.2.1	Ratings		
2.1		Transformer power rating kVA	315	
2.2		Nominal voltage of system (Single ratio) kV _{rms}	11	
2.3		System frequency Hz	50	
2.4		Number of phases	3	
2.5		Rated no-load secondary voltage V _{rms}	415	
2.6		Rated power-frequency voltage kV _{rms}	12	
2.7		Rated lightning impulse withstand voltage kV _{peak}	95	
2.8		Rated short-duration power frequency withstand voltage [50Hz: 1 min] kV _{rms}	28	
2.9		Induced voltage withstand level kV _{rms}	22	
2.10		Internal arc classification	AB-FLR	
2.11		Internal arc current and duration	20KA/500 ms	

Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Annex C - Technical schedules A and B for

**MSS TB 315KVA SR DYN11 3MM THICK AV SF6 FREE RMU OIL TYPE TRFR
(SAP 4375)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
3	4.3.1	Construction design		
3.1		Layout	Type B	
3.2		Construction	Modular	
3.3		Removable base sections adjacent to MV compartment (sections to lap bolted with nuts on the inside of the channel and housing)	Required	
3.4		All doors shall be a manual three point locking mechanism, capable of being secured by a padlock, having a shackle diameter of 8mm.	Required	
3.5		Compartment lock protection facility (with welded mesh top with inside visibility)	Required	
3.6		Total mass of miniature substation Kg	Required	
3.7		Overall maximum dimensions	Required	
3.8		a) MV compartment length mm	Required	
		b) LV compartment length mm	Required	
		c) LV metering compartment mm	400 x 400	
		d) Overall length mm	3000	
		e) Overall width mm	1650	
		f) Overall height mm	2000	
		g)Base width mm	1200	
		h)Thickness mm	3	
		Provision for lifting of complete mini-sub onto a concrete plinth without need for dismantling	Required	
3.9		Provision of lifting lugs on roof for ease of removal	Required	
3.10		MV switchgear, LV panel, LV metering and transformer confined to separate compartments	Required	
3.11		Mini-sub housing sections and doors bonded	Required	

Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Annex C - Technical schedules A and B for

**MSS TB 315KVA SR DYN11 3MM THICK AV SF6 FREE RMU OIL TYPE TRFR
(SAP 4375)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
4	4.2.1	Transformer unit (Oil Immersed)		
4.1		Electrical requirements	As per SANS 780	
4.2		Vector group	Dyn 11	
4.3		MV system earthing	Effective	
4.4		LV transformer neutral earthing	Solid – connection to insulated LV neutral/earth bar	
4.5		MV system fault level	kA 25	
4.6		Temperature rise limits	As per SANS 780 Table 6/60076	
4.7		Secondary voltage regulation (Off-load on the 11 kV supply voltage windings)	% +6.0, + 3.0, 0, –3.0, –6.0	
4.8		No-load losses	W Required	
4.9		Load losses	W Required	
4.10		Impedance	% SANS 780	
4.11		Cost /kW of no-load losses (Jul 2002)	R/kW 13 669	
4.12		Cost /kW of load losses (Jul 2002)	R/kW 1 623	
4.13		X/R	SANS 780	
4.14		Audio-sound level – maximum	dB(A) Required	
4.15		Sealed transformer unit	Required	

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Annex C - Technical schedules A and B for

**MSS TB 315KVA SR DYN11 3MM THICK AV SF6 FREE RMU OIL TYPE TRFR
(SAP 4375)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
4.16	4.4.2	Transformer MV bushings (NB internal screen to be earthed)	BS 7215 –Type C with M16x2 thread	
4.17		MV bushing-centre clearances (minimum) mm	135	
4.18		Clearances between outer bushing-centres and mini-sub metal enclosure (minimum) mm	90	
4.19		Transformer overload protection facility	Required	
4.20		Winding material	MV Copper LV Copper	
4.21		Manufacturer of the distribution transformer	Required	
5		MV compartment		
5.1		Equipment in MV compartment	SF6 FREE Ring Main Unit (CP_TSSPEC_006)	
5.2		Ring Main Unit manufacturer	Required	
5.3		Incoming MV cable requirements		
		a) 185 mm ² 3 core Cu or 300 mm ² 3C Al XLPE	Required	
		b) Cable support (clamping) required	Required	
		c) Minimum distance from cable clamp to centre-line of RMU bushings mm	800	
		d) Type of connection	Screened	
5.4		Mini-sub earth bar (accessible in front of RMU)	Required	
5.5		Interconnection arrangement between RMU and transformer MV bushings	Required	
5.6		Unscreened interconnecting equipment and connections between ring main unit and transformer to be barricaded	Required	
5.7		Type of earth fault indicator	Required	
5.8		Voltage detecting system (VDS)	Required	

Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA [“To Be Advice”] will not be accepted.

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Annex C - Technical schedules A and B for

**MSS TB 315KVA SR DYN11 3MM THICK AV SF6 FREE RMU OIL TYPE TRFR
(SAP 4375)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
6	4.2.8	LV Compartment		
6.1		Bus-bar-rating (see Table 2)	A	1,2 times the kVA capacity
6.2		Bus-bar-insulation		Air insulated
6.3		Bus-bars	Ø	3 + one identical neutral-earth bus-bar (insulated from frame)
6.4		Current density of bus-bars	A/mm ²	1,8 maximum
6.5		Rated withstand current – 1 s (25 kA for up to 630 kVA & 45 kA for 1000 kVA)	kA _{rms}	As per rating.
6.6		Min clearance to earth and between phases	mm	20
6.7		Provision of a LV neutral surge arrester fitted between mini-sub earth bar and LV neutral-earth bus-bar		Required
6.8		LV neutral-earth bus-bar to be earthed (via an electrical bridge to the mini-sub earth bar)		Required
6.9		Neutral isolating links		Not Required
6.10		Provision of LV main isolating switch		Not Required
6.11		Number of outgoing LV feeders to be provided for (drill bus-bar Ø14mm holes)		6
6.12		Spacing between holes (see Figure 1)	mm	110
6.13		LV panel designed for large frame MCCBs		Required
		Spacing (vertical): Between phase bus-bars	mm	185
		Between lowest LV bus-bar and LV neutral	mm	300
		Minimum distance between LV neutral and uni-strut	mm	200

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**MSS TB 315KVA SR DYN11 3MM THICK AV SF6 FREE RMU OIL TYPE TRFR
(SAP 4375)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
6.14		LV maximum demand ammeters	On all three phases	
6.15		Ammeter type	Thermal integrating over 15 min period	
6.16		LV indicating voltmeter with a selector switch	Required	
6.17		Ammeter and voltmeter size and display mm	96 × 96, 90°	
6.18		Ammeter and voltmeter position	Top right hand side in LV compartment	
6.19		Electronic meter capable of reading current and voltage	Required	
6.20		Provision of removable non flammable barrier to separate LV end compartment and front LV compartment	Required	
6.21		Main MCCB manufacturer	Required	
6.22		Catalogue/model code of main MCCB	Required	
6.23		Size of main MCCB A	As per table 2	

Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Annex C - Technical schedules A and B for

**MSS TB 315KVA SR DYN11 3MM THICK AV SF6 FREE RMU OIL TYPE TRFR
(SAP 4375)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
7	4.2.6	LV auxiliaries		
7.1		Provision of three point socket outlet and 60W bulkhead fitting in LV compartment (with instantaneous-trip earth leakage unit [20 A; 5 kA rupturing capacity; 30 mA sensitivity] and 20 A HRC fuse with neutral fuse link)	Required	
7.2		Numbering ferrules for auxiliary wiring	Required	
7.3		Push-button fitted to shunt trip RMU tee-off	Required	
8	4.3.2	Materials and corrosion protection		
8.1		Mini-sub enclosure and transformer tank thickness 6(mm) or 3 mm	Mild steel	
8.2		Radiator	Mild steel	
8.3		Tinned copper bus-bars	Required	
8.4		Mini-sub base:Material	Steel	
8.5		Uni-strut clamping bar:Material	Required	
8.6		5mm cork packing (between ends and tank, base and ends, base and tank, and base and plinth)	Required	
8.7		Final colour	Avocado Green (12)	

Note: Ticks, Cross [√, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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**Annex C - Technical schedules A and B for
MSS TB 315KVA SR DYN11 3MM THICK AV SF6 FREE RMU OIL TYPE TRFR
(SAP 4375)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
9	4.6.2	Notices, signs and labels		
9.1		Transformer rating plate	Required	
9.2		Treatment and Full First Aid Instructions on inside of MV and LV compartment doors	Required	
9.3		Elec. warning signs on all doors and barriers	Required	
9.4		Transformer phase labels below bushings	Required	
9.5		Colour-coded LV bus-bars	Required	
9.6		Stenciled labeling of MV and LV compartment doors (both inside and outside)	Required	
9.7		kVA, Prim V, Sec V & Corrosion Class	Required	
9.8		ID markings linking roof to body per batch	Required	
9.9		Provision for the safe-keeping of documents	Required	
10	4.7	Documentation		
10.1		Type test reportss (provide ref. numbers of reports)	Sets 1	
10.2		Routine test reportss	Sets 1	
10.3		Drawings	Sets 2	
10.4		Circuit diagrams (LV auxiliary wiring and equipment)	Sets 2	

Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Technical schedules A and B Deviation schedule for

**MSS TB 315KVA SR DYN11 3MM THICK AV SF6 FREE RMU OIL TYPE
TRFR (SAP 4375)**

Any deviations offered to this specification shall be listed below with reasons for deviation. In addition, evidence shall be provided that the proposed deviation will at least be more cost-effective than that specified by City Power.

Item	Sub clause of CP_TSSPEC_005	Proposed deviation

Note: Ticks, Cross [√, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Annex C - Technical schedules A and B for

**MSS TB 315KVA SR DYN11 6MM THICK AV SF6 FREE RMU OIL TYPE TRFR
(SAP 4376)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
1		Standard operating conditions		
1.1		n) Altitude m	1800	
1.2		b) Ambient air temperature °C	-5 to +40	
1.3		c) Lightning ground flash density Flashes/ km ² /year	> 10	
1.4		d) Maximum solar radiation W/m ²	1000	
1.5		e) Ultraviolet radiation	High	
1.6		f) Relative humidity %	10 to 95	
1.7		g) Corrosive conditions (inland therefore non-corrosive)	Non- corrosive	
1.8		h) wind pressure Pa	700	
2	4.2.1	Ratings		
2.1		Transformer power rating kVA	315	
2.2		Nominal voltage of system (Single ratio) kV _{rms}	11	
2.3		System frequency Hz	50	
2.4		Number of phases	3	
2.5		Rated no-load secondary voltage V _{rms}	415	
2.6		Rated power-frequency voltage kV _{rms}	12	
2.7		Rated lightning impulse withstand voltage kV _{peak}	95	
2.8		Rated short-duration power frequency withstand voltage [50Hz: 1 min] kV _{rms}	28	
2.9		Induced voltage withstand level kV _{rms}	22	
2.10		Internal arc classification	AB-FLR	
2.11		Internal arc current and duration	20KA/500 ms	

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Annex C - Technical schedules A and B for

**MSS TB 315KVA SR DYN11 6MM THICK AV SF6 FREE RMU OIL TYPE TRFR
(SAP 4376)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
3	4.3.1	Construction design		
3.1		Layout	Type B	
3.2		Construction	Modular	
3.3		Removable base sections adjacent to MV compartment (sections to lap bolted with nuts on the inside of the channel and housing)	Required	
3.4		All doors shall be a manual three point locking mechanism, capable of being secured by a padlock, having a shackle diameter of 8mm.	Required	
3.5		Compartment lock protection facility (with welded mesh top with inside visibility)	Required	
3.6		Total mass of miniature substation Kg	Required	
3.7		Overall maximum dimensions	Required	
3.8		a) MV compartment length mm	Required	
		b) LV compartment length mm	Required	
		c) LV metering compartment mm	400 x 400	
		d) Overall length mm	3000	
		e) Overall width mm	1650	
		f) Overall height mm	2000	
		g)Base width mm	1200	
		h)Thickness mm	6	
		Provision for lifting of complete mini-sub onto a concrete plinth without need for dismantling	Required	
3.9		Provision of lifting lugs on roof for ease of removal	Required	
3.10		MV switchgear, LV panel, LV metering and transformer confined to separate compartments	Required	
3.11		Mini-sub housing sections and doors bonded	Required	

Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Annex C - Technical schedules A and B for

**MSS TB 315KVA SR DYN11 6MM THICK AV SF6 FREE RMU OIL TYPE TRFR
(SAP 4376)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
4	4.2.1	Transformer unit (Oil immersed)		
4.1		Electrical requirements	As per SANS 780	
4.2		Vector group	Dyn 11	
4.3		MV system earthing	Effective	
4.4		LV transformer neutral earthing	Solid – connection to insulated LV neutral/earth bar	
4.5		MV system fault level	kA 25	
4.6		Temperature rise limits	As per SANS 780	
4.7		Secondary voltage regulation (Off-load on the 11 kV supply voltage windings)	% +6.0, + 3.0, 0, –3.0, –6.0	
4.8		No-load losses	W Required	
4.9		Load losses	W Required	
4.10		Impedance	% SANS 780	
4.11		Cost /kW of no-load losses (Jul 2002)	R/kW 13 669	
4.12		Cost /kW of load losses (Jul 2002)	R/kW 1 623	
4.13		X/R	SANS 780	
4.14		Audio-sound level – maximum	dB(A) Required	
4.15		Sealed transformer unit	Required	

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Annex C - Technical schedules A and B for

**MSS TB 315KVA SR DYN11 6MM THICK AV SF6 FREE RMU OIL TYPE TRFR
(SAP 4376)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
4.16	4.4.2	Transformer MV bushings (NB internal screen to be earthed)	BS 7215 –Type C with M16x2 thread	
4.17		MV bushing-centre clearances (minimum) mm	135	
4.18		Clearances between outer bushing-centres and mini-sub metal enclosure (minimum) mm	90	
4.19		Transformer overload protection facility	Required	
4.20		Winding material	MV Copper LV Copper	
4.21		Manufacturer of the distribution transformer	Required	
5		MV compartment		
5.1		Equipment in MV compartment	SF6 FREE Ring Main Unit (CP_TSSPEC_006)	
5.2		Ring Main Unit manufacturer	Required	
5.3		Incoming MV cable requirements		
		a) 185 mm ² 3 core Cu or 300 mm ² 3C Al XLPE	Required	
		b) Cable support (clamping) required	Required	
		c) Minimum distance from cable clamp to centre-line of RMU bushings mm	800	
		d) Type of connection	Screened	
5.4		Mini-sub earth bar (accessible in front of RMU)	Required	
5.5		Interconnection arrangement between RMU and transformer MV bushings	Required	
5.6		Unscreened interconnecting equipment and connections between ring main unit and transformer to be barricaded	Required	
5.7		Type of earth fault indicator	Required	
5.8		Voltage detecting system (VDS)	Required	

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Annex C - Technical schedules A and B for

**MSS TB 315KVA SR DYN11 6MM THICK AV SF6 FREE RMU OIL TYPE TRFR
(SAP 4376)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
6	4.2.8	LV Compartment		
6.1		Bus-bar-rating (see Table 2)	A	1,2 times the kVA capacity
6.2		Bus-bar-insulation		Air insulated
6.3		Bus-bars	Ø	3 + one identical neutral-earth bus-bar (insulated from frame)
6.4		Current density of bus-bars	A/mm ²	1,8 maximum
6.5		Rated withstand current – 1 s (25 kA for up to 630 kVA & 45 kA for 1000 kVA)	kA _{rms}	As per rating.
6.6		Min clearance to earth and between phases	mm	20
6.7		Provision of a LV neutral surge arrester fitted between mini-sub earth bar and LV neutral-earth bus-bar		Required
6.8		LV neutral-earth bus-bar to be earthed (via an electrical bridge to the mini-sub earth bar)		Required
6.9		Neutral isolating links		Not Required
6.10		Provision of LV main isolating switch		Not Required
6.11		Number of outgoing LV feeders to be provided for (drill bus-bar Ø14mm holes)		6
6.12		Spacing between holes (see Figure 1)	mm	110
6.13		LV panel designed for large frame MCCBs		Required
		Spacing (vertical): Between phase bus-bars	mm	185
		Between lowest LV bus-bar and LV neutral	mm	300
		Minimum distance between LV neutral and uni-strut	mm	200

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Annex C - Technical schedules A and B for

**MSS TB 315KVA SR DYN11 6MM THICK AV SF6 FREE RMU OIL TYPE TRFR
(SAP 4376)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
6.14		LV maximum demand ammeters	On all three phases	
6.15		Ammeter type	Thermal integrating over 15 min period	
6.16		LV indicating voltmeter with a selector switch	Required	
6.17		Ammeter and voltmeter size and display mm	96 × 96, 90°	
6.18		Ammeter and voltmeter position	Top right hand side in LV compartment	
6.19		Electronic meter capable of reading current and voltage	Required	
6.20		Provision of removable non flammable barrier to separate LV end compartment and front LV compartment	Required	
6.21		Main MCCB manufacturer	Required	
6.22		Catalogue/model code of main MCCB	Required	
6.23		Size of main MCCB A	As per table 2	

Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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**MSS TB 315KVA SR DYN11 6MM THICK AV SF6 FREE RMU OIL TYPE TRFR
(SAP 4376)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
7	4.2.6	LV auxiliaries		
7.1		Provision of three point socket outlet and 60W bulkhead fitting in LV compartment (with instantaneous-trip earth leakage unit [20 A; 5 kA rupturing capacity; 30 mA sensitivity] and 20 A HRC fuse with neutral fuse link)	Required	
7.2		Numbering ferrules for auxiliary wiring	Required	
7.3		Push-button fitted to shunt trip RMU tee-off	Required	
8	4.3.2	Materials and corrosion protection		
8.1		Mini-sub enclosure and transformer tank thickness 6(mm) or 3 mm	Mild steel	
8.2		Radiator	Mild steel	
8.3		Tinned copper bus-bars	Required	
8.4		Mini-sub base:Material	Steel	
8.5		Uni-strut clamping bar:Material	Required	
8.6		5mm cork packing (between ends and tank, base and ends, base and tank, and base and plinth)	Required	
8.7		Final colour	Avocado Green (12)	

Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Annex C - Technical schedules A and B for

**MSS TB 315KVA SR DYN11 6MM THICK AV SF6 FREE RMU OIL TYPE TRFR
(SAP 4376)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
9	4.6.2	Notices, signs and labels		
9.1		Transformer rating plate	Required	
9.2		Treatment and Full First Aid Instructions on inside of MV and LV compartment doors	Required	
9.3		Elec. warning signs on all doors and barriers	Required	
9.4		Transformer phase labels below bushings	Required	
9.5		Colour-coded LV bus-bars	Required	
9.6		Stenciled labeling of MV and LV compartment doors (both inside and outside)	Required	
9.7		kVA, Prim V, Sec V & Corrosion Class	Required	
9.8		ID markings linking roof to body per batch	Required	
9.9		Provision for the safe-keeping of documents	Required	
10	4.7	Documentation		
10.1		Type test reportss (provide ref. numbers of reports)	Sets 1	
10.2		Routine test reportss	Sets 1	
10.3		Drawings	Sets 2	
10.4		Circuit diagrams (LV auxiliary wiring and equipment)	Sets 2	

Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Technical schedules A and B Deviation schedule for

**MSS TB 315KVA SR DYN11 6MM THICK AV SF6 FREE RMU OIL TYPE TRFR
(SAP 4376)**

Any deviations offered to this specification shall be listed below with reasons for deviation. In addition, evidence shall be provided that the proposed deviation will at least be more cost-effective than that specified by City Power.

Item	Sub clause of CP_TSSPEC_005	Proposed deviation

Note: Ticks, Cross [√, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Annex C - Technical schedules A and B for

**MSS TB 315KVA SR DYN11 3MM THICK AV SF6 FREE RMU DRY TYPE TRFR
(SAP 4377)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
1		Standard operating conditions		
1.1		a) Altitude m	1800	
1.2		b) Ambient air temperature °C	-5 to +40	
1.3		c) Lightning ground flash density Flashes/ km ² /year	> 10	
1.4		d) Maximum solar radiation W/m ²	1000	
1.5		e) Ultraviolet radiation	High	
1.6		f) Relative humidity %	10 to 95	
1.7		g) Corrosive conditions (inland therefore non-corrosive)	Non- corrosive	
1.8		h) wind pressure Pa	700	
2	4.2.1	Ratings		
2.1		Transformer power rating kVA	315	
2.2		Nominal voltage of system (Single ratio) kV _{rms}	11	
2.3		System frequency Hz	50	
2.4		Number of phases	3	
2.5		Rated no-load secondary voltage V _{rms}	415	
2.6		Rated power-frequency voltage kV _{rms}	12	
2.7		Rated lightning impulse withstand voltage kV _{peak}	95	
2.8		Rated short-duration power frequency withstand voltage [50Hz: 1 min] kV _{rms}	28	
2.9		Induced voltage withstand level kV _{rms}	22	
2.10		Internal arc classification	AB-FLR	
2.11		Internal arc current and duration	20KA/500 ms	

Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Annex C - Technical schedules A and B for

**MSS TB 315KVA SR DYN11 3MM THICK AV SF6 FREE RMU DRY TYPE TRFR
(SAP 4377)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
3	4.3.1	Construction design		
3.1		Layout	Type B	
3.2		Construction	Modular	
3.3		Removable base sections adjacent to MV compartment (sections to lap bolted with nuts on the inside of the channel and housing)	Required	
3.4		All doors shall be a manual three point locking mechanism, capable of being secured by a padlock, having a shackle diameter of 8mm.	Required	
3.5		Compartment lock protection facility (with welded mesh top with inside visibility)	Required	
3.6		Total mass of miniature substation Kg	Required	
3.7		Overall maximum dimensions	Required	
3.8		a) MV compartment length mm	Required	
		b) LV compartment length mm	Required	
		c) LV metering compartment mm	400 x 400	
		d) Overall length mm	3000	
		e) Overall width mm	1650	
		f) Overall height mm	2000	
		g)Base width mm	1200	
		h)Thickness mm	3	
		Provision for lifting of complete mini-sub onto a concrete plinth without need for dismantling	Required	
3.9		Provision of lifting lugs on roof for ease of removal	Required	
3.10		MV switchgear, LV panel, LV metering and transformer confined to separate compartments	Required	
3.11		Mini-sub housing sections and doors bonded	Required	

Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Annex C - Technical schedules A and B for

**MSS TB 315KVA SR DYN11 3MM THICK AV SF6 FREE RMU DRY TYPE TRFR
(SAP 4377)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
4	4.2.1	Transformer unit (Dry-Type)		
4.1		Electrical requirements	As per SANS 60076	
4.2		Vector group	Dyn 11	
4.3		MV system earthing	Effective	
4.4		LV transformer neutral earthing	Solid – connection to insulated LV neutral/earth bar	
4.5		MV system fault level	kA 25	
4.6		Temperature rise limits	As per SANS 60076	
4.7		Secondary voltage regulation (Off-load on the 11 kV supply voltage windings)	% +6.0, + 3.0, 0, –3.0, –6.0	
4.8		No-load losses	W Required	
4.9		Load losses	W Required	
4.10		Impedance	% SANS 60076	
4.11		Cost /kW of no-load losses (Jul 2002)	R/kW 13 669	
4.12		Cost /kW of load losses (Jul 2002)	R/kW 1 623	
4.13		X/R	SANS 60076	
4.14		Audio-sound level – maximum	dB(A) Required	
4.15		Sealed transformer unit	Required	

Note: Ticks, Cross [√, X], Asterick [∗], Word [Noted] or TBA [“To Be Advice”] will not be accepted.

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Annex C - Technical schedules A and B for

**MSS TB 315KVA SR DYN11 3MM THICK AV SF6 FREE RMU DRY TYPE TRFR
(SAP 4377)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
4.16	4.4.2	Transformer MV bushings (NB internal screen to be earthed)	BS 7215 –Type C with M16x2 thread	
4.17		MV bushing-centre clearances (minimum) mm	135	
4.18		Clearances between outer bushing-centres and mini-sub metal enclosure (minimum) mm	90	
4.19		Transformer overload protection facility	Required	
4.20		Winding material	MV Copper LV Copper	
4.21		Manufacturer of the distribution transformer	Required	
5		MV compartment		
5.1		Equipment in MV compartment	SF6 FREE Ring Main Unit (CP_TSSPEC_006)	
5.2		Ring Main Unit manufacturer	Required	
5.3		Incoming MV cable requirements		
		a) 185 mm ² 3 core Cu or 300 mm ² 3C Al XLPE	Required	
		b) Cable support (clamping) required	Required	
		c) Minimum distance from cable clamp to centre-line of RMU bushings mm	800	
		d) Type of connection	Screened	
5.4		Mini-sub earth bar (accessible in front of RMU)	Required	
5.5		Interconnection arrangement between RMU and transformer MV bushings	Required	
5.6		Unscreened interconnecting equipment and connections between ring main unit and transformer to be barricaded	Required	
5.7		Type of earth fault indicator	Required	
5.8		Voltage detecting system (VDS)	Required	

Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA [“To Be Advice”] will not be accepted.

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Annex C - Technical schedules A and B for

**MSS TB 315KVA SR DYN11 3MM THICK AV SF6 FREE RMU DRY TYPE TRFR
(SAP 4377)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
6	4.2.8	LV Compartment		
6.1		Bus-bar-rating (see Table 2)	A	1,2 times the kVA capacity
6.2		Bus-bar-insulation		Air insulated
6.3		Bus-bars	Ø	3 + one identical neutral-earth bus-bar (insulated from frame)
6.4		Current density of bus-bars	A/mm ²	1,8 maximum
6.5		Rated withstand current – 1 s (25 kA for up to 630 kVA & 45 kA for 1000 kVA)	kA _{rms}	As per rating.
6.6		Min clearance to earth and between phases	mm	20
6.7		Provision of a LV neutral surge arrester fitted between mini-sub earth bar and LV neutral-earth bus-bar		Required
6.8		LV neutral-earth bus-bar to be earthed (via an electrical bridge to the mini-sub earth bar)		Required
6.9		Neutral isolating links		Not Required
6.10		Provision of LV main isolating switch		Not Required
6.11		Number of outgoing LV feeders to be provided for (drill bus-bar Ø14mm holes)		6
6.12		Spacing between holes (see Figure 1)	mm	110
6.13		LV panel designed for large frame MCCBs		Required
		Spacing (vertical): Between phase bus-bars	mm	185
		Between lowest LV bus-bar and LV neutral	mm	300
		Minimum distance between LV neutral and uni-strut	mm	200

Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Annex C - Technical schedules A and B for

**M MSS TB 315KVA SR DYN11 3MM THICK AV SF6 FREE RMU DRY TYPE TRFR
(SAP 4377)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
6.14		LV maximum demand ammeters	On all three phases	
6.15		Ammeter type	Thermal integrating over 15 min period	
6.16		LV indicating voltmeter with a selector switch	Required	
6.17		Ammeter and voltmeter size and display mm	96 × 96, 90°	
6.18		Ammeter and voltmeter position	Top right hand side in LV compartment	
6.19		Electronic meter capable of reading current and voltage	Required	
6.20		Provision of removable non flammable barrier to separate LV end compartment and front LV compartment	Required	
6.21		Main MCCB manufacturer	Required	
6.22		Catalogue/model code of main MCCB	Required	
6.23		Size of main MCCB A	As per table 2	

Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Annex C - Technical schedules A and B for

**MSS TB 315KVA SR DYN11 3MM THICK AV SF6 FREE RMU DRY TYPE TRFR
(SAP 4377)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
7	4.2.6	LV auxiliaries		
7.1		Provision of three point socket outlet and 60W bulkhead fitting in LV compartment (with instantaneous-trip earth leakage unit [20 A; 5 kA rupturing capacity; 30 mA sensitivity] and 20 A HRC fuse with neutral fuse link)	Required	
7.2		Numbering ferrules for auxiliary wiring	Required	
7.3		Push-button fitted to shunt trip RMU tee-off	Required	
8	4.3.2	Materials and corrosion protection		
8.1		Mini-sub enclosure and transformer tank thickness 6(mm) or 3 mm	Mild steel	
8.2		Radiator	Mild steel	
8.3		Tinned copper bus-bars	Required	
8.4		Mini-sub base:Material	Steel	
8.5		Uni-strut clamping bar:Material	Required	
8.6		5mm cork packing (between ends and tank, base and ends, base and tank, and base and plinth)	Required	
8.7		Final colour	Avocado Green (12)	

Note: Ticks, Cross [√, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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**Annex C - Technical schedules A and B for
MSS TB 315KVA SR DYN11 3MM THICK AV SF6 FREE RMU DRY TYPE TRFR
(SAP 4377)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
9	4.6.2	Notices, signs and labels		
9.1		Transformer rating plate	Required	
9.2		Treatment and Full First Aid Instructions on inside of MV and LV compartment doors	Required	
9.3		Elec. warning signs on all doors and barriers	Required	
9.4		Transformer phase labels below bushings	Required	
9.5		Colour-coded LV bus-bars	Required	
9.6		Stenciled labeling of MV and LV compartment doors (both inside and outside)	Required	
9.7		kVA, Prim V, Sec V & Corrosion Class	Required	
9.8		ID markings linking roof to body per batch	Required	
9.9		Provision for the safe-keeping of documents	Required	
10	4.7	Documentation		
10.1		Type test reportss (provide ref. numbers of reports)	Sets 1	
10.2		Routine test reportss	Sets 1	
10.3		Drawings	Sets 2	
10.4		Circuit diagrams (LV auxiliary wiring and equipment)	Sets 2	

Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Technical schedules A and B Deviation schedule for

**MSS TB 315KVA SR DYN11 3MM THICK AV SF6 FREE RMU DRY TYPE
TRFR (SAP 4377)**

Any deviations offered to this specification shall be listed below with reasons for deviation. In addition, evidence shall be provided that the proposed deviation will at least be more cost-effective than that specified by City Power.

Item	Sub clause of CP_TSSPEC_005	Proposed deviation

Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Annex C - Technical schedules A and B for

**MSS TB 315KVA SR DYN11 6MM THICK AV SF6 RMU DRY TYPE TRFR
(SAP 4378)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
1		Standard operating conditions		
1.1		p) Altitude m	1800	
1.2		b) Ambient air temperature °C	-5 to +40	
1.3		c) Lightning ground flash density Flashes/ km ² /year	> 10	
1.4		d) Maximum solar radiation W/m ²	1000	
1.5		e) Ultraviolet radiation	High	
1.6		f) Relative humidity %	10 to 95	
1.7		g) Corrosive conditions (inland therefore non-corrosive)	Non- corrosive	
1.8		h) wind pressure Pa	700	
2	4.2.1	Ratings		
2.1		Transformer power rating kVA	315	
2.2		Nominal voltage of system (Sige ratio) kV _{rms}	6,6 & 11	
2.3		System frequency Hz	50	
2.4		Number of phases	3	
2.5		Rated no-load secondary voltage V _{rms}	415	
2.6		Rated power-frequency voltage kV _{rms}	12	
2.7		Rated lightning impulse withstand voltage kV _{peak}	95	
2.8		Rated short-duration power frequency withstand voltage [50Hz: 1 min] kV _{rms}	28	
2.9		Induced voltage withstand level kV _{rms}	22	
2.10		Internal arc classification	AB-FLR	
2.11		Internal arc current and duration	20KA/500 ms	

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Annex C - Technical schedules A and B for

MSS TB 315KVA SR DYN11 6MM THICK AV SF6 RMU DRY TYPE TRFR (SAP 4378)

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
3	4.3.1	Construction design		
3.1		Layout	Type B	
3.2		Construction	Modular	
3.3		Removable base sections adjacent to MV compartment (sections to lap bolted with nuts on the inside of the channel and housing)	Required	
3.4		All doors shall be a manual three point locking mechanism, capable of being secured by a padlock, having a shackle diameter of 8mm.	Required	
3.5		Compartment lock protection facility (with welded mesh top with inside visibility)	Required	
3.6		Total mass of miniature substation Kg	Required	
3.7		Overall maximum dimensions		
3.8		a) MV compartment length mm	Required	
		b) LV compartment length mm	Required	
		c) LV metering compartment mm	400 x 400	
		d) Overall length mm	3000	
		e) Overall width mm	1650	
		f) Overall height mm	2000	
		g)Base width mm	1200	
		h)Thickness mm	6	
		Provision for lifting of complete mini-sub onto a concrete plinth without need for dismantling	Required	
3.9		Provision of lifting lugs on roof for ease of removal	Required	
3.10		MV switchgear, LV panel, LV metering and transformer confined to separate compartments	Required	
3.11		Mini-sub housing sections and doors bonded	Required	

Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Annex C - Technical schedules A and B for

MSS TB 315KVA SR DYN11 6MM THICK AV SF6 RMU DRY TYPE TRFR (SAP 4378)

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
4	4.2.1	Transformer unit (Dry-Type)		
4.1		Electrical requirements	As per SANS 60076	
4.2		Vector group	Dyn 11	
4.3		MV system earthing	Effective	
4.4		LV transformer neutral earthing	Solid – connection to insulated LV neutral/earth bar	
4.5		MV system fault level	kA 25	
4.6		Temperature rise limits	As per SANS 60076	
4.7		Secondary voltage regulation (Off-load on the 11 kV supply voltage windings)	% +6.0, + 3.0, 0, –3.0, –6.0	
4.8		No-load losses	W Required	
4.9		Load losses	W Required	
4.10		Impedance	% SANS 780	
4.11		Cost /kW of no-load losses (Jul 2002)	R/kW 13 669	
4.12		Cost /kW of load losses (Jul 2002)	R/kW 1 623	
4.13		X/R	SANS 60076	
4.14		Audio-sound level – maximum	dB(A) Required	
4.15		Sealed transformer unit	Required	

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Annex C - Technical schedules A and B for

MSS TB 315KVA SR DYN11 6MM THICK AV SF6 RMU DRY TYPE TRFR (SAP 4378)

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
4.16	4.4.2	Transformer MV bushings (NB internal screen to be earthed)	BS 7215 –Type C with M16x2 thread	
4.17		MV bushing-centre clearances (minimum) mm	135	
4.18		Clearances between outer bushing-centres and mini-sub metal enclosure (minimum) mm	90	
4.19		Transformer overload protection facility	Required	
4.20		Winding material MV	Copper	
		LV	Copper	
4.21		Manufacturer of the distribution transformer	Required	
5		MV compartment		
5.1		Equipment in MV compartment	SF6 FREE Ring Main Unit (CP_TSSPEC_006)	
5.2		Ring Main Unit manufacturer	Required	
5.3		Incoming MV cable requirements		
		a) 185 mm ² 3 core Cu or 300 mm ² 3C Al XLPE	Required	
		b) Cable support (clamping) required	Required	
		c) Minimum distance from cable clamp to centre-line of RMU bushings mm	800	
		d) Type of connection	Screened	
5.4		Mini-sub earth bar (accessible in front of RMU)	Required	
5.5		Interconnection arrangement between RMU and transformer MV bushings	Required	
5.6		Unscreened interconnecting equipment and connections between ring main unit and transformer to be barricaded	Required	
5.7		Type of earth fault indicator	Required	
5.8		Voltage detecting system (VDS)	Required	

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Annex C - Technical schedules A and B for

MSS TB 315KVA SR DYN11 6MM THICK AV SF6 RMU DRY TYPE TRFR (SAP 4378)

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
6	4.2.8	LV Compartment		
6.1		Bus-bar-rating (see Table 2)	A	1,2 times the kVA capacity
6.2		Bus-bar-insulation		Air insulated
6.3		Bus-bars	Ø	3 + one identical neutral-earth bus-bar (insulated from frame)
6.4		Current density of bus-bars	A/mm ²	1,8 maximum
6.5		Rated withstand current – 1 s (25 kA for up to 630 kVA & 45 kA for 1000 kVA)	kA _{rms}	As per rating.
6.6		Min clearance to earth and between phases	mm	20
6.7		Provision of a LV neutral surge arrester fitted between mini-sub earth bar and LV neutral-earth bus-bar		Required
6.8		LV neutral-earth bus-bar to be earthed (via an electrical bridge to the mini-sub earth bar)		Required
6.9		Neutral isolating links		Not Required
6.10		Provision of LV main isolating switch		Not Required
6.11		Number of outgoing LV feeders to be provided for (drill bus-bar Ø14mm holes)		6
6.12		Spacing between holes (see Figure 1)	mm	110
6.13		LV panel designed for large frame MCCBs		Required
		Spacing (vertical): Between phase bus-bars	mm	185
		Between lowest LV bus-bar and LV neutral	mm	300
		Minimum distance between LV neutral and uni-strut	mm	200

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Annex C - Technical schedules A and B for

**MSS TB 315KVA SR DYN11 6MM THICK AV SF6 RMU DRY TYPE TRFR (SAP
4378)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
6.14		LV maximum demand ammeters	On all three phases	
6.15		Ammeter type	Thermal integrating over 15 min period	
6.16		LV indicating voltmeter with a selector switch	Required	
6.17		Ammeter and voltmeter size and display mm	96 × 96, 90°	
6.18		Ammeter and voltmeter position	Top right hand side in LV compartment	
6.19		Electronic meter capable of reading current and voltage	Required	
6.20		Provision of removable non flammable barrier to separate LV end compartment and front LV compartment	Required	
6.21		Main MCCB manufacturer	Required	
6.22		Catalogue/model code of main MCCB	Required	
6.23		Size of main MCCB A	As per table 2	

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Annex C - Technical schedules A and B for

MSS TB 315KVA SR DYN11 6MM THICK AV SF6 RMU DRY TYPE TRFR (SAP 4378)

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
7	4.2.6	LV auxiliaries		
7.1		Provision of three point socket outlet and 60W bulkhead fitting in LV compartment (with instantaneous-trip earth leakage unit [20 A; 5 kA rupturing capacity; 30 mA sensitivity] and 20 A HRC fuse with neutral fuse link)	Required	
7.2		Numbering ferrules for auxiliary wiring	Required	
7.3		Push-button fitted to shunt trip RMU tee-off	Required	
8	4.3.2	Materials and corrosion protection		
8.1		Mini-sub enclosure and transformer tank thickness 6(mm) or 3 mm	Mild steel	
8.2		Radiator	Mild steel	
8.3		Tinned copper bus-bars	Required	
8.4		Mini-sub base:Material	Steel	
8.5		Uni-strut clamping bar:Material	Required	
8.6		5mm cork packing (between ends and tank, base and ends, base and tank, and base and plinth)	Required	
8.7		Final colour	Avocado Green (12)	

Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Annex C - Technical schedules A and B for

MSS TB 315KVA SR DYN11 6MM THICK AV SF6 RMU DRY TYPE TRFR (SAP 4378)

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
9	4.6.2	Notices, signs and labels		
9.1		Transformer rating plate	Required	
9.2		Treatment and Full First Aid Instructions on inside of MV and LV compartment doors	Required	
9.3		Elec. warning signs on all doors and barriers	Required	
9.4		Transformer phase labels below bushings	Required	
9.5		Colour-coded LV bus-bars	Required	
9.6		Stenciled labeling of MV and LV compartment doors (both inside and outside)	Required	
9.7		kVA, Prim V, Sec V & Corrosion Class	Required	
9.8		ID markings linking roof to body per batch	Required	
9.9		Provision for the safe-keeping of documents	Required	
10	4.7	Documentation		
10.1		Type test reportss (provide ref. numbers of reports) Sets	1	
10.2		Routine test reportss Sets	1	
10.3		Drawings Sets	2	
10.4		Circuit diagrams (LV auxiliary wiring and equipment) Sets	2	

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Technical schedules A and B Deviation schedule for

**MSS TB 315KVA SR DYN11 6MM THICK AV SF6 RMU DRY TYPE TRFR (SAP
4378)**

Any deviations offered to this specification shall be listed below with reasons for deviation. In addition, evidence shall be provided that the proposed deviation will at least be more cost-effective than that specified by City Power.

Item	Sub clause of CP_TSSPEC_005	Proposed deviation

Note: Ticks, Cross [√, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Annex C - Technical schedules A and B for

**MSS TB 500KVA SR DYN11 3MM THICK AV SF6 RMU OIL TYPE TRFR
(SAP 3582)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
1		Standard operating conditions		
1.1		q) Altitude m	1800	
1.2		b) Ambient air temperature °C	-5 to +40	
1.3		c) Lightning ground flash density Flashes/ km ² /year	> 10	
1.4		d) Maximum solar radiation W/m ²	1000	
1.5		e) Ultraviolet radiation	High	
1.6		f) Relative humidity %	10 to 95	
1.7		g) Corrosive conditions (inland therefore non-corrosive)	Non- corrosive	
1.8		h) wind pressure Pa	700	
2	4.2.1	Ratings		
2.1		Transformer power rating kVA	500	
2.2		Nominal voltage of system (Single ratio) kV _{rms}	11	
2.3		System frequency Hz	50	
2.4		Number of phases	3	
2.5		Rated no-load secondary voltage V _{rms}	415	
2.6		Rated power-frequency voltage kV _{rms}	12	
2.7		Rated lightning impulse withstand voltage kV _{peak}	95	
2.8		Rated short-duration power frequency withstand voltage [50Hz: 1 min] kV _{rms}	28	
2.9		Induced voltage withstand level kV _{rms}	22	
2.10		Internal arc classification	AB-FLR	
2.11		Internal arc current and duration	20KA/500 ms	

Note: Ticks, Cross [√, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Full name of company: _____

Annex C - Technical schedules A and B for

**MSS TB 500KVA SR DYN11 3MM THICK AV SF6 RMU OIL TYPE TRFR (SAP
3582)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
3	4.3.1	Construction design		
3.1		Layout	Type B	
3.2		Construction	Modular	
3.3		Removable base sections adjacent to MV compartment (sections to lap bolted with nuts on the inside of the channel and housing)	Required	
3.4		All doors shall be a manual three point locking mechanism, capable of being secured by a padlock, having a shackle diameter of 8mm.	Required	
3.5		Compartment lock protection facility (with welded mesh top with inside visibility)	Required	
3.6		Total mass of miniature substation Kg	Required	
3.7		Overall maximum dimensions		
3.8		a) MV compartment length mm	Required	
		b) LV compartment length mm	Required	
		c) LV metering compartment mm	400 x 400	
		d) Overall length mm	3000	
		e) Overall width mm	1650	
		f) Overall height mm	2000	
		g) Base width mm	1200	
		h) Thickness mm	3	
		Provision for lifting of complete mini-sub onto a concrete plinth without need for dismantling	Required	
3.9		Provision of lifting lugs on roof for ease of removal	Required	
3.10		MV switchgear, LV panel, LV metering and transformer confined to separate compartments	Required	
3.11		Mini-sub housing sections and doors bonded	Required	

Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Annex C - Technical schedules A and B for

**MSS TB 500KVA SR DYN11 3MM THICK AV SF6 RMU OIL TYPE TRFR (SAP
3582)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
4	4.2.1	Transformer unit(Oil immersed Type)		
4.1		Electrical requirements	As per SANS 780	
4.2		Vector group	Dyn 11	
4.3		MV system earthing	Effective	
4.4		LV transformer neutral earthing	Solid – connection to insulated LV neutral/earth bar	
4.5		MV system fault level	kA 25	
4.6		Temperature rise limits	As per SANS 780 Table 6	
4.7		Secondary voltage regulation (Off-load on the 11 kV supply voltage windings)	% +6.0, + 3.0, 0, –3.0, –6.0	
4.8		No-load losses	W Required	
4.9		Load losses	W Required	
4.10		Impedance	% SANS780	
4.11		Cost /kW of no-load losses (Jul 2002)	R/kW 13 669	
4.12		Cost /kW of load losses (Jul 2002)	R/kW 1 623	
4.13		X/R	SANS780	
4.14		Audio-sound level – maximum (see table 6)	dB(A) Table 6	
4.15		Sealed transformer unit	Required	

**Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA [“To Be Advice”] will not be
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Annex C - Technical schedules A and B for

**MSS TB 500KVA SR DYN11 3MM THICK AV SF6 RMU OIL TYPE TRFR (SAP
3582)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
4.16	4.4.2	Transformer MV bushings (NB internal screen to be earthed)	BS 7215 –Type C with M16x2 thread	
4.17		MV bushing-centre clearances (minimum) mm	135	
4.18		Clearances between outer bushing-centres and mini-sub metal enclosure (minimum) mm	90	
4.19		Transformer overload protection facility	Required	
4.20		Winding material	MV Copper LV Copper	
4.21		Manufacturer of the distribution transformer	Required	
5		MV compartment		
5.1		Equipment in MV compartment	Ring Main Unit (CP_TSSPEC_006)	
5.2		Ring Main Unit manufacturer	Required	
5.5		Incoming MV cable requirements		
		a) 185 mm ² 3 core Cu or 300 mm ² 3C Al XLPE	Required	
		b) Cable support (clamping) required	Required	
		c) Minimum distance from cable clamp to centre-line of RMU bushings mm	800	
		d) Type of connection	Screened	
5.6		Mini-sub earth bar (accessible in front of RMU)	Required	
5.7		Interconnection arrangement between RMU and transformer MV bushings	Required	
5.8		Unscreened interconnecting equipment and connections between ring main unit and transformer to be barricaded	Required	
5.9		Type of earth fault indicator	Required	
5.10		Voltage detecting system (VDS)	Required	

Note: Ticks, Cross [√, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Annex C - Technical schedules A and B for

**MSS TB 500KVA SR DYN11 3MM THICK AV SF6 RMU OIL TYPE TRFR (SAP
3582)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
6	4.2.8	LV Compartment		
6.1		Bus-bar-rating (see Table 2)	A	1,2 times the kVA capacity
6.2		Bus-bar-insulation		Air insulated
6.3		Bus-bars	Ø	3 + one identical neutral-earth bus-bar (insulated from frame)
6.4		Current density of bus-bars	A/mm ²	1,8 maximum
6.5		Rated withstand current – 1 s (25 kA for up to 630 kVA & 45 kA for 1000 kVA)	kA _{rms}	As per rating.
6.6		Min clearance to earth and between phases	mm	20
6.7		Provision of a LV neutral surge armineral fitted between mini-sub earth bar and LV neutral-earth bus-bar		Required
6.8		LV neutral-earth bus-bar to be earthed (via an electrical bridge to the mini-sub earth bar)		Required
6.9		Neutral isolating links		Not Required
6.10		Provision of LV main isolating switch		Not Required
6.11		Number of outgoing LV feeders to be provided for (drill bus-bar Ø14mm holes)		6
6.12		Spacing between holes (see Figure 1)	mm	110
6.13		LV panel designed for large frame MCCBs		Required
		Spacing (vertical): Between phase bus-bars	mm	185
		Between lowest LV bus-bar and LV neutral	mm	300
		Minimum distance between LV neutral and uni-strut	mm	200

**Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be
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Full name of company: _____

Annex C - Technical schedules A and B for

**MSS TB 500KVA SR DYN11 3MM THICK AV SF6 RMU OIL TYPE TRFR (SAP
3582)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
6.14		LV maximum demand ammeters	On all three phases	
6.15		Ammeter type	Thermal integrating over 15 min period	
6.16		LV indicating voltmeter with a selector switch	Required	
6.17		Ammeter and voltmeter size and display mm	96 × 96, 90°	
6.18		Ammeter and voltmeter position	Top right hand side in LV compartment	
6.19		Analogue meter capable of reading current and voltage	Required	
6.20		Provision of removable non flammable barrier to separate LV end compartment and front LV compartment	Required	
6.21		Main MCCB manufacturer	Required	
6.22		Catalogue/model code of main MCCB	Required	
6.23		Size of main MCCB A	As per table 2	

**Note: Ticks, Cross [√, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be
accepted.**

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Full name of company: _____

Annex C - Technical schedules A and B for

**MSS TB 500KVA SR DYN11 3MM THICK AV SF6 RMU OIL TYPE TRFR (SAP
3582)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
7	4.2.6	LV auxiliaries		
7.1		Provision of three point socket outlet and 60W bulkhead fitting in LV compartment (with instantaneous-trip earth leakage unit [20 A; 5 kA rupturing capacity; 30 mA sensitivity] and 20 A HRC fuse with neutral fuse link)	Required	
7.2		Numbering ferrules for auxiliary wiring	Required	
7.3		Push-button fitted to shunt trip RMU tee-off	Required	
8	4.3.2	Materials and corrosion protection		
8.1		Mini-sub enclosure and transformer tank thickness 3 or 6(mm)	Mild steel	
8.2		Radiator thickness	Mild steel	
8.3		Tinned copper bus-bars	Required	
8.4		Mini-sub base:Material	Steel	
8.5		5mm cork packing (between ends and tank, base and ends, base and tank, and base and plinth)	Required	
8.6		Final colour	Avocado Green (12)	

Note: Ticks, Cross [√, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Annex C - Technical schedules A and B for

**MSS TB 500KVA SR DYN11 3MM THICK AV SF6 RMU OIL TYPE TRFR (SAP
3582)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
19	4.6.2	Notices, signs and labels		
9.1		Transformer rating plate	Required	
9.2		Treatment and Full First Aid Instructions on inside of MV and LV compartment doors	Required	
9.3		Elec. warning signs on all doors and barriers	Required	
9.4		Transformer phase labels below bushings	Required	
9.5		Colour-coded LV bus-bars	Required	
9.6		Stenciled labeling of MV and LV compartment doors (both inside and outside)	Required	
9.7		kVA, Prim V, Sec V & Corrosion Class	Required	
9.8		ID markings linking roof to body per batch	Required	
9.9		Provision for the safe-keeping of documents	Required	
10	4.7	Documentation		
10.1		Type test reportss (provide ref. numbers of reports)	Sets 1	
10.2		Routine test reportss	Sets 1	
10.3		Drawings	Sets 2	
10.4		Circuit diagrams (LV auxiliary wiring and equipment)	Sets 2	

**Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be
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Technical schedules A and B Deviation schedule for

**MSS TB 500KVA SR DYN11 3MM THICK AV SF6 RMU OIL TYPE TRFR (SAP
3582)**

Any deviations offered to this specification shall be listed below with reasons for deviation. In addition, evidence shall be provided that the proposed deviation will at least be more cost-effective than that specified by City Power.

Item	Sub clause of CP_TSSPEC_005	Proposed deviation

Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

Tender Number: _____

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Annex C - Technical schedules A and B for

**MSS TB 500KVA DR DYN11 3MM THICK AV SF6 RMU OIL TYPE TRFR
(SAP 425)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
1		Standard operating conditions		
1.1		r) Altitude m	1800	
1.2		b) Ambient air temperature °C	–5 to +40	
1.3		c) Lightning ground flash density Flashes/ km ² /year	> 10	
1.4		d) Maximum solar radiation W/m ²	1000	
1.5		e) Ultraviolet radiation	High	
1.6		f) Relative humidity %	10 to 95	
1.7		g) Corrosive conditions (inland therefore non-corrosive)	Non- corrosive	
1.8		h) wind pressure Pa	700	
2	4.2.1	Ratings		
2.1		Transformer power rating kVA	500	
2.2		Nominal voltage of system (Dual ratio) kV _{rms}	6,6 & 11	
2.3		System frequency Hz	50	
2.4		Number of phases	3	
2.5		Rated no-load secondary voltage V _{rms}	415	
2.6		Rated power-frequency voltage kV _{rms}	12	
2.7		Rated lightning impulse withstand voltage kV _{peak}	95	
2.8		Rated short-duration power frequency withstand voltage [50Hz: 1 min] kV _{rms}	28	
2.9		Induced voltage withstand level kV _{rms}	22	
2.10		Internal arc classification	AB-FLR	
2.11		Internal arc current and duration	20KA/500 ms	

Note: Ticks, Cross [√, X], Asterick [*], Word [Noted] or TBA [“To Be Advice”] will not be accepted.

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Full name of company: _____

Annex C - Technical schedules A and B for

**MSS TB 500KVA DR DYN11 3MM THICK AV SF6 RMU OIL TYPE TRFR (SAP
425)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
3	4.3.1	Construction design		
3.1		Layout	Type B	
3.2		Construction	Modular	
3.3		Removable base sections adjacent to MV compartment (sections to lap bolted with nuts on the inside of the channel and housing)	Required	
3.4		All doors shall be a manual three point locking mechanism, capable of being secured by a padlock, having a shackle diameter of 8mm.	Required	
3.5		Compartment lock protection facility (with welded mesh top with inside visibility)	Required	
3.6		Total mass of miniature substation Kg	Required	
3.7		Overall maximum dimensions		
3.8		a) MV compartment length mm	Required	
		b) LV compartment length mm	Required	
		c) LV metering compartment mm	400 x 400	
		d) Overall length mm	3000	
		e) Overall width mm	1650	
		f) Overall height mm	2000	
		g)Base width Mm	1200	
		h)Thickness mm	3	
		Provision for lifting of complete mini-sub onto a concrete plinth without need for dismantling	Required	
3.9		Provision of lifting lugs on roof for ease of removal	Required	
3.10		MV switchgear, LV panel, LV metering and transformer confined to separate compartments	Required	
3.11		Mini-sub housing sections and doors bonded	Required	

Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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**MSS TB 500KVA DR DYN11 3MM THICK AV SF6 RMU OIL TYPE TRFR (SAP
425)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
4	4.2.1	Transformer unit(Oil immersed)		
4.1		Electrical requirements	As per SANS 780	
4.2		Vector group	Dyn 11	
4.3		MV system earthing	Effective	
4.4		LV transformer neutral earthing	Solid – connection to insulated LV neutral/earth bar	
4.5		MV system fault level	kA 25	
4.6		Temperature rise limits	As per SANS 780 Table 6	
4.7		Secondary voltage regulation (Off-load on the 11 kV supply voltage windings)	% +6.0, + 3.0, 0, –3.0, –6.0	
4.8		No-load losses	W Required	
4.9		Load losses	W Required	
4.10		Impedance	% SANS780	
4.11		Cost /kW of no-load losses (Jul 2002)	R/kW 13 669	
4.12		Cost /kW of load losses (Jul 2002)	R/kW 1 623	
4.13		X/R	SANS780	
4.14		Audio-sound level – maximum (see table 6)	dB(A) Table 6	
4.15		Sealed transformer unit	Required	

**Note: Ticks, Cross [√, X], Asterick [∗], Word [Noted] or TBA [“To Be Advice”] will not be
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Annex C - Technical schedules A and B for

MSS TB 500KVA DR DYN11 3MM THICK AV SF6 RMU OIL TYPE TRFR (SAP 425)

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
4.16	4.4.2	Transformer MV bushings (NB internal screen to be earthed)	BS 7215 –Type C with M16x2 thread	
4.17		MV bushing-centre clearances (minimum) mm	135	
4.18		Clearances between outer bushing-centres and mini-sub metal enclosure (minimum) mm	90	
4.19		Transformer overload protection facility	Required	
4.20		Winding material	MV Copper LV Copper	
4.21		Manufacturer of the distribution transformer	Required	
5		MV compartment		
5.1		Equipment in MV compartment	Ring Main Unit (CP_TSSPEC_006)	
5.2		Ring Main Unit manufacturer	Required	
5.5		Incoming MV cable requirements		
		a) 185 mm ² 3 core Cu or 300 mm ² 3C Al XLPE	Required	
		b) Cable support (clamping) required	Required	
		c) Minimum distance from cable clamp to centre-line of RMU bushings mm	800	
		d) Type of connection	Screened	
5.6		Mini-sub earth bar (accessible in front of RMU)	Required	
5.7		Interconnection arrangement between RMU and transformer MV bushings	Required	
5.8		Unscreened interconnecting equipment and connections between ring main unit and transformer to be barricaded	Required	
5.9		Type of earth fault indicator	Required	
5.10		Voltage detecting system (VDS)	Required	

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Annex C - Technical schedules A and B for

**MSS TB 500KVA DR DYN11 3MM THICK AV SF6 RMU OIL TYPE TRFR (SAP
425)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
6	4.2.8	LV Compartment		
6.1		Bus-bar-rating (see Table 2)	A	1,2 times the kVA capacity
6.2		Bus-bar-insulation		Air insulated
6.3		Bus-bars	Ø	3 + one identical neutral-earth bus-bar (insulated from frame)
6.4		Current density of bus-bars	A/mm ²	1,8 maximum
6.5		Rated withstand current – 1 s (25 kA for up to 630 kVA & 45 kA for 1000 kVA)	kA _{rms}	As per rating.
6.6		Min clearance to earth and between phases	mm	20
6.7		Provision of a LV neutral surge armineral fitted between mini-sub earth bar and LV neutral-earth bus-bar		Required
6.8		LV neutral-earth bus-bar to be earthed (via an electrical bridge to the mini-sub earth bar)		Required
6.9		Neutral isolating links		Not Required
6.10		Provision of LV main isolating switch		Not Required
6.11		Number of outgoing LV feeders to be provided for (drill bus-bar Ø14mm holes)		6
6.12		Spacing between holes (see Figure 1)	mm	110
6.13		LV panel designed for large frame MCCBs		Required
		Spacing (vertical): Between phase bus-bars	mm	185
		Between lowest LV bus-bar and LV neutral	mm	300
		Minimum distance between LV neutral and uni-strut	mm	200

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Annex C - Technical schedules A and B for

**MSS TB 500KVA DR DYN11 3MM THICK AV SF6 RMU OIL TYPE TRFR (SAP
425)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
6.14		LV maximum demand ammeters	On all three phases	
6.15		Ammeter type	Thermal integrating over 15 min period	
6.16		LV indicating voltmeter with a selector switch	Required	
6.17		Ammeter and voltmeter size and display mm	96 × 96, 90°	
6.18		Ammeter and voltmeter position	Top right hand side in LV compartment	
6.19		Analogue meter capable of reading current and voltage	Required	
6.20		Provision of removable non flammable barrier to separate LV end compartment and front LV compartment	Required	
6.21		Main MCCB manufacturer	Required	
6.22		Catalogue/model code of main MCCB	Required	
6.23		Size of main MCCB A	As per table 2	

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Annex C - Technical schedules A and B for

**MSS TB 500KVA DR DYN11 3MM THICK AV SF6 RMU OIL TYPE TRFR (SAP
425)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
7	4.2.6	LV auxiliaries		
7.1		Provision of three point socket outlet and 60Wbulkhead fitting in LV compartment (with instantaneous-trip earth leakage unit [20 A; 5 kA rupturing capacity; 30 mA sensitivity] and 20 A HRC fuse with neutral fuse link)	Required	
7.2		Numbering ferrules for auxiliary wiring	Required	
7.3		Push-button fitted to shunt trip RMU tee-off	Required	
8	4.3.2	Materials and corrosion protection		
8.1		Mini-sub enclosure and transformer tank thickness 6(mm)or 3 mm	Mild steel	
8.2		Radiator thickness	Mild steel	
8.3		Tinned copper bus-bars	Required	
8.4		Mini-sub base:Material	Steel	
8.5		5mm cork packing (between ends and tank, base and ends, base and tank, and base and plinth)	Required	
8.6		Final colour	Avocado Green (12)	

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Annex C - Technical schedules A and B for

**MSS TB 500KVA DR DYN11 3MM THICK AV SF6 RMU OIL TYPE TRFR (SAP
425)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
9	4.6.2	Notices, signs and labels		
9.1		Transformer rating plate	Required	
9.2		Treatment and Full First Aid Instructions on inside of MV and LV compartment doors	Required	
9.3		Elec. warning signs on all doors and barriers	Required	
9.4		Transformer phase labels below bushings	Required	
9.5		Colour-coded LV bus-bars	Required	
9.6		Stenciled labeling of MV and LV compartment doors (both inside and outside)	Required	
9.7		kVA, Prim V, Sec V & Corrosion Class	Required	
9.8		ID markings linking roof to body per batch	Required	
9.9		Provision for the safe-keeping of documents	Required	
10	4.7	Documentation		
10.1		Type test reportss (provide ref. numbers of reports) Sets	1	
10.2		Routine test reportss Sets	1	
10.3		Drawings Sets	2	
10.4		Circuit diagrams (LV auxiliary wiring and equipment) Sets	2	

Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Technical schedules A and B Deviation schedule for

**MSS TB 500KVA DR DYN11 3MM THICK AV SF6 RMU OIL TYPE TRFR (SAP
425)**

Any deviations offered to this specification shall be listed below with reasons for deviation. In addition, evidence shall be provided that the proposed deviation will at least be more cost-effective than that specified by City Power.

Item	Sub clause of CP_TSSPEC_005	Proposed deviation

Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Annex C - Technical schedules A and B for

**MSS TB 500KVA SR DYN11 6MM THICK AV SF6 RMU OIL TYPE TRFR
(SAP 3584)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
1		Standard operating conditions		
1.1		s) Altitude m	1800	
1.2		b) Ambient air temperature °C	-5 to +40	
1.3		c) Lightning ground flash density Flashes/ km ² /year	> 10	
1.4		d) Maximum solar radiation W/m ²	1000	
1.5		e) Ultraviolet radiation	High	
1.6		f) Relative humidity %	10 to 95	
1.7		g) Corrosive conditions (inland therefore non-corrosive)	Non- corrosive	
1.8		h) wind pressure Pa	700	
2	4.2.1	Ratings		
2.1		Transformer power rating kVA	500	
2.2		Nominal voltage of system (Single ratio) kV _{rms}	11	
2.3		System frequency Hz	50	
2.4		Number of phases	3	
2.5		Rated no-load secondary voltage V _{rms}	415	
2.6		Rated power-frequency voltage kV _{rms}	12	
2.7		Rated lightning impulse withstand voltage kV _{peak}	95	
2.8		Rated short-duration power frequency withstand voltage [50Hz: 1 min] kV _{rms}	28	
2.9		Induced voltage withstand level kV _{rms}	22	
2.10		Internal arc classification	AB-FLR	
2.11		Internal arc current and duration	20KA/500 ms	

Note: Ticks, Cross [√, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Full name of company: _____

Annex C - Technical schedules A and B for

**MSS TB 500KVA SR DYN11 6MM THICK AV SF6 RMU OIL TYPE TRFR (SAP
3584)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
3	4.3.1	Construction design		
3.1		Layout	Type B	
3.2		Construction	Modular	
3.3		Removable base sections adjacent to MV compartment (sections to lap bolted with nuts on the inside of the channel and housing)	Required	
3.4		All doors shall be a manual three point locking mechanism, capable of being secured by a padlock, having a shackle diameter of 8mm.	Required	
3.5		Compartment lock protection facility (with welded mesh top with inside visibility)	Required	
3.6		Total mass of miniature substation Kg	Required	
3.7		Overall maximum dimensions	Required	
3.8		a) MV compartment length mm	Required	
		b) LV compartment length mm	Required	
		c) LV metering compartment mm	400 x 400	
		d) Overall length mm	3000	
		e) Overall width mm	1650	
		f) Overall height mm	2000	
		g) Base width mm	1200	
		h) Thickness mm	6	
		Provision for lifting of complete mini-sub onto a concrete plinth without need for dismantling	Required	
3.9		Provision of lifting lugs on roof for ease of removal	Required	
3.10		MV switchgear, LV panel, LV metering and transformer confined to separate compartments	Required	
3.11		Mini-sub housing sections and doors bonded	Required	

Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Name in block letters

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Full name of company: _____

Annex C - Technical schedules A and B for

**MSS TB 500KVA SR DYN11 6MM THICK AV SF6 RMU OIL TYPE TRFR (SAP
3584)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
4	4.2.1	Transformer unit(Oil immersed)		
4.1		Electrical requirements	As per SANS 780	
4.2		Vector group	Dyn 11	
4.3		MV system earthing	Effective	
4.4		LV transformer neutral earthing	Solid – connection to insulated LV neutral/earth bar	
4.5		MV system fault level	kA 25	
4.6		Temperature rise limits	As per SANS 780 Table 6	
4.7		Secondary voltage regulation (Off-load on the 11 kV supply voltage windings)	% +6.0, + 3.0, 0, –3.0, –6.0	
4.8		No-load losses	W Required	
4.9		Load losses	W Required	
4.10		Impedance	% SANS780	
4.11		Cost /kW of no-load losses (Jul 2002)	R/kW 13 669	
4.12		Cost /kW of load losses (Jul 2002)	R/kW 1 623	
4.13		X/R	SANS780	
4.14		Audio-sound level – maximum (see table 6)	dB(A) Table 6	
4.15		Sealed transformer unit	Required	

**Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA [“To Be Advice”] will not be
accepted.**

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Annex C - Technical schedules A and B for

**MSS TB 500KVA SR DYN11 6MM THICK AV SF6 RMU OIL TYPE TRFR (SAP
3584)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
4.16	4.4.2	Transformer MV bushings (NB internal screen to be earthed)	BS 7215 –Type C with M16x2 thread	
4.17		MV bushing-centre clearances (minimum) mm	135	
4.18		Clearances between outer bushing-centres and mini-sub metal enclosure (minimum) mm	90	
4.19		Transformer overload protection facility	Required	
4.20		Winding material MV	Required	
			LV	Required
4.21		Manufacturer of the distribution transformer	Required	
5		MV compartment		
5.1		Equipment in MV compartment	Ring Main Unit (CP_TSSPEC_006)	
5.2		Ring Main Unit manufacturer	Required	
5.5		Incoming MV cable requirements		
		a) 185 mm ² 3 core Cu or 300 mm ² 3C Al XLPE	Required	
		b) Cable support (clamping) required	Required	
		c) Minimum distance from cable clamp to centre-line of RMU bushings mm	800	
		d) Type of connection	Screened	
5.6		Mini-sub earth bar (accessible in front of RMU)	Required	
5.7		Interconnection arrangement between RMU and transformer MV bushings	Required	
5.8		Unscreened interconnecting equipment and connections between ring main unit and transformer to be barricaded	Required	
5.9		Type of earth fault indicator	Required	
5.10		Voltage detecting system (VDS)	Required	

Note: Ticks, Cross [√, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Annex C - Technical schedules A and B for

**MSS TB 500KVA SR DYN11 6MM THICK AV SF6 RMU OIL TYPE TRFR (SAP
3584)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
6	4.2.8	LV Compartment		
6.1		Bus-bar-rating (see Table 2)	A	1,2 times the kVA capacity
6.2		Bus-bar-insulation		Air insulated
6.3		Bus-bars	Ø	3 + one identical neutral-earth bus-bar (insulated from frame)
6.4		Current density of bus-bars	A/mm ²	1,8 maximum
6.5		Rated withstand current – 1 s (25 kA for up to 630 kVA & 45 kA for 1000 kVA)	kA _{rms}	As per rating.
6.6		Min clearance to earth and between phases	mm	20
6.7		Provision of a LV neutral surge armineral fitted between mini-sub earth bar and LV neutral-earth bus-bar		Required
6.8		LV neutral-earth bus-bar to be earthed (via an electrical bridge to the mini-sub earth bar)		Required
6.9		Neutral isolating links		Not Required
6.10		Provision of LV main isolating switch		Not Required
6.11		Number of outgoing LV feeders to be provided for (drill bus-bar Ø14mm holes)		6
6.12		Spacing between holes (see Figure 1)	mm	110
6.13		LV panel designed for large frame MCCBs		Required
		Spacing (vertical): Between phase bus-bars	mm	185
		Between lowest LV bus-bar and LV neutral	mm	300
		Minimum distance between LV neutral and uni-strut	mm	200

**Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be
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Annex C - Technical schedules A and B for

**MSS TB 500KVA SR DYN11 6MM THICK AV SF6 RMU OIL TYPE TRFR (SAP
3584)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
6.14		LV maximum demand ammeters	On all three phases	
6.15		Ammeter type	Thermal integrating over 15 min period	
6.16		LV indicating voltmeter with a selector switch	Required	
6.17		Ammeter and voltmeter size and display mm	96 × 96, 90°	
6.18		Ammeter and voltmeter position	Top right hand side in LV compartment	
6.19		Analogue meter capable of reading current and voltage	Required	
6.20		Provision of removable non flammable barrier to separate LV end compartment and front LV compartment	Required	
6.21		Main MCCB manufacturer	Required	
6.22		Catalogue/model code of main MCCB	Required	
6.23		Size of main MCCB A	As per table 2	

Note: Ticks, Cross [√, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Annex C - Technical schedules A and B for

**MSS TB 500KVA SR DYN11 6MM THICK AV SF6 RMU OIL TYPE TRFR (SAP
3584)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
7	4.2.6	LV auxiliaries		
7.1		Provision of three point socket outlet and 60W bulkhead fitting in LV compartment (with instantaneous-trip earth leakage unit [20 A; 5 kA rupturing capacity; 30 mA sensitivity] and 20 A HRC fuse with neutral fuse link)	Required	
7.2		Numbering ferrules for auxiliary wiring	Required	
7.3		Push-button fitted to shunt trip RMU tee-off	Required	
8	4.3.2	Materials and corrosion protection		
8.1		Mini-sub enclosure and transformer tank thickness 6(mm) or 3 mm	Mild steel	
8.2		Radiator thickness	Mild steel	
8.3		Tinned copper bus-bars	Required	
8.4		Mini-sub base:Material	Steel	
8.5		5mm cork packing (between ends and tank, base and ends, base and tank, and base and plinth)	Required	
8.6		Final colour	Avocado Green (12)	

Note: Ticks, Cross [√, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Annex C - Technical schedules A and B for

**MSS TB 500KVA SR DYN11 6MM THICK AV SF6 RMU OIL TYPE TRFR (SAP
3584)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
9	4.6.2	Notices, signs and labels		
9.1		Transformer rating plate	Required	
9.2		Treatment and Full First Aid Instructions on inside of MV and LV compartment doors	Required	
9.3		Elec. warning signs on all doors and barriers	Required	
9.4		Transformer phase labels below bushings	Required	
9.5		Colour-coded LV bus-bars	Required	
9.6		Stenciled labeling of MV and LV compartment doors (both inside and outside)	Required	
9.7		kVA, Prim V, Sec V & Corrosion Class	Required	
9.8		ID markings linking roof to body per batch	Required	
9.9		Provision for the safe-keeping of documents	Required	
10	4.7	Documentation		
10.1		Type test reportss (provide ref. numbers of reports)	Sets 1	
10.2		Routine test reportss	Sets 1	
10.3		Drawings	Sets 2	
10.4		Circuit diagrams (LV auxiliary wiring and equipment)	Sets 2	

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Technical schedules A and B Deviation schedule for

**MSS TB 500KVA SR DYN11 6MM THICK AV SF6 RMU OIL TYPE TRFR (SAP
3584)**

Any deviations offered to this specification shall be listed below with reasons for deviation. In addition, evidence shall be provided that the proposed deviation will at least be more cost-effective than that specified by City Power.

Item	Sub clause of CP_TSSPEC_005	Proposed deviation

Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Annex C - Technical schedules A and B for

**MSS TB 500KVA DR DYN11 6MM THICK AV SF6 RMU OIL TYPE TRFR
(SAP 3585)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
1		Standard operating conditions		
1.1		t) Altitude m	1800	
1.2		b) Ambient air temperature °C	-5 to +40	
1.3		c) Lightning ground flash density Flashes/ km ² /year	> 10	
1.4		d) Maximum solar radiation W/m ²	1000	
1.5		e) Ultraviolet radiation	High	
1.6		f) Relative humidity %	10 to 95	
1.7		g) Corrosive conditions (inland therefore non-corrosive)	Non- corrosive	
1.8		h) wind pressure Pa	700	
2	4.2.1	Ratings		
2.1		Transformer power rating kVA	500	
2.2		Nominal voltage of system (Dual ratio) kV _{rms}	6,6 & 11	
2.3		System frequency Hz	50	
2.4		Number of phases	3	
2.5		Rated no-load secondary voltage V _{rms}	415	
2.6		Rated power-frequency voltage kV _{rms}	2	
2.7		Rated lightning impulse withstand voltage kV _{peak}	95	
2.8		Rated short-duration power frequency withstand voltage [50Hz: 1 min] kV _{rms}	28	
2.9		Induced voltage withstand level kV _{rms}	22	
2.10		Internal arc classification	AB-FLR	
2.11		Internal arc current and duration	20KA/500 ms	

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Annex C - Technical schedules A and B for

**MSS TB 500KVA DR DYN11 6MM THICK AV SF6 RMU OIL TYPE TRFR (SAP
3585)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
3	4.3.1	Construction design		
3.1		Layout	Type B	
3.2		Construction	Modular	
3.3		Removable base sections adjacent to MV compartment (sections to lap bolted with nuts on the inside of the channel and housing)	Required	
3.4		All doors shall be a manual three point locking mechanism, capable of being secured by a padlock, having a shackle diameter of 8mm.	Required	
3.5		Compartment lock protection facility (with welded mesh top with inside visibility)	Required	
3.6		Total mass of miniature substation Kg	Required	
3.7		Overall maximum dimensions	Required	
3.8		a) MV compartment length mm	Required	
		b) LV compartment length mm	Required	
		c) LV metering compartment mm	400 x 400	
		d) Overall length mm	3000	
		e) Overall width mm	1650	
		f) Overall height mm	2000	
		g)Base width Mm	1200	
		h)Thickness mm	6	
		Provision for lifting of complete mini-sub onto a concrete plinth without need for dismantling	Required	
3.9		Provision of lifting lugs on roof for ease of removal	Required	
3.10		MV switchgear, LV panel, LV metering and transformer confined to separate compartments	Required	
3.11		Mini-sub housing sections and doors bonded	Required	

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Annex C - Technical schedules A and B for

**MSS TB 500KVA DR DYN11 6MM THICK AV SF6 RMU OIL TYPE TRFR (SAP
3585)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
4	4.2.1	Transformer unit(Oil immersed)		
4.1		Electrical requirements	As per SANS 780	
4.2		Vector group	Dyn 11	
4.3		MV system earthing	Effective	
4.4		LV transformer neutral earthing	Solid – connection to insulated LV neutral/earth bar	
4.5		MV system fault level	kA 25	
4.6		Temperature rise limits	As per SANS 780 Table 6	
4.7		Secondary voltage regulation (Off-load on the 11 kV supply voltage windings)	% +6.0, + 3.0, 0, –3.0, –6.0	
4.8		No-load losses	W Required	
4.9		Load losses	W Required	
4.10		Impedance	% SANS780	
4.11		Cost /kW of no-load losses (Jul 2002)	R/kW 13 669	
4.12		Cost /kW of load losses (Jul 2002)	R/kW 1 623	
4.13		X/R	SANS780	
4.14		Audio-sound level – maximum (see table 6)	dB(A) Table 6	
4.15		Sealed transformer unit	Required	

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Annex C - Technical schedules A and B for

MSS TB 500KVA DR DYN11 6MM THICK AV SF6 RMU OIL TYPE TRFR (SAP 3585)

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
4.16	4.4.2	Transformer MV bushings (NB internal screen to be earthed)	BS 7215 –Type C with M16x2 thread	
4.17		MV bushing-centre clearances (minimum) mm	135	
4.18		Clearances between outer bushing-centres and mini-sub metal enclosure (minimum) mm	90	
4.19		Transformer overload protection facility	Required	
4.20		Winding material	MV Copper LV Copper	
4.21		Manufacturer of the distribution transformer	Required	
5		MV compartment		
5.1		Equipment in MV compartment	Ring Main Unit (CP_TSSPEC_006)	
5.2		Ring Main Unit manufacturer	Required	
5.5		Incoming MV cable requirements		
		a) 185 mm ² 3 core Cu or 300 mm ² 3C Al XLPE	Required	
		b) Cable support (clamping) required	Required	
		c) Minimum distance from cable clamp to centre-line of RMU bushings mm	800	
		d) Type of connection	Screened	
5.6		Mini-sub earth bar (accessible in front of RMU)	Required	
5.7		Interconnection arrangement between RMU and transformer MV bushings	Required	
5.8		Unscreened interconnecting equipment and connections between ring main unit and transformer to be barricaded	Required	
5.9		Type of earth fault indicator	Required	
5.10		Voltage detecting system (VDS)	Required	

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Annex C - Technical schedules A and B for

MSS TB 500KVA DR DYN11 6MM THICK AV SF6 RMU OIL TYPE TRFR (SAP 3585)

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
6	4.2.8	LV Compartment		
6.1		Bus-bar-rating (see Table 2)	A	1,2 times the kVA capacity
6.2		Bus-bar-insulation		Air insulated
6.3		Bus-bars	Ø	3 + one identical neutral-earth bus-bar (insulated from frame)
6.4		Current density of bus-bars	A/mm ²	1,8 maximum
6.5		Rated withstand current – 1 s (25 kA for up to 630 kVA & 45 kA for 1000 kVA)	kA _{rms}	As per rating.
6.6		Min clearance to earth and between phases	mm	20
6.7		Provision of a LV neutral surge arrester fitted between mini-sub earth bar and LV neutral-earth bus-bar		Required
6.8		LV neutral-earth bus-bar to be earthed (via an electrical bridge to the mini-sub earth bar)		Required
6.9		Neutral isolating links		Not Required
6.10		Provision of LV main isolating switch		Not Required
6.11		Number of outgoing LV feeders to be provided for (drill bus-bar Ø14mm holes)		6
6.12		Spacing between holes (see Figure 1)	mm	110
6.13		LV panel designed for large frame MCCBs		Required
		Spacing (vertical): Between phase bus-bars	mm	185
		Between lowest LV bus-bar and LV neutral	mm	300
		Minimum distance between LV neutral and uni-strut	mm	200

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Annex C - Technical schedules A and B for

**MSS TB 500KVA DR DYN11 6MM THICK AV SF6 RMU OIL TYPE TRFR (SAP
3585)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
6.14		LV maximum demand ammeters	On all three phases	
6.15		Ammeter type	Thermal integrating over 15 min period	
6.16		LV indicating voltmeter with a selector switch	Required	
6.17		Ammeter and voltmeter size and display mm	96 × 96, 90°	
6.18		Ammeter and voltmeter position	Top right hand side in LV compartment	
6.19		Analogue meter capable of reading current and voltage	Required	
6.20		Provision of removable non flammable barrier to separate LV end compartment and front LV compartment	Required	
6.21		Main MCCB manufacturer	Required	
6.22		Catalogue/model code of main MCCB	Required	
6.23		Size of main MCCB A	As per table 2	

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Annex C - Technical schedules A and B for

**MSS TB 500KVA DR DYN11 6MM THICK AV SF6 RMU OIL TYPE TRFR (SAP
3585)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
7	4.2.6	LV auxiliaries		
7.1		Provision of three point socket outlet and 60Wbulkhead fitting in LV compartment (with instantaneous-trip earth leakage unit [20 A; 5 kA rupturing capacity; 30 mA sensitivity] and 20 A HRC fuse with neutral fuse link)	Required	
7.2		Numbering ferrules for auxiliary wiring	Required	
7.3		Push-button fitted to shunt trip RMU tee-off	Required	
8	4.3.2	Materials and corrosion protection		
8.1		Mini-sub enclosure and transformer tank thickness 6(mm) or 3 mm	Mild steel	
8.2		Radiator thickness	Mild steel	
8.3		Tinned copper bus-bars	Required	
8.4		Mini-sub base:Material	Steel	
8.5		5mm cork packing (between ends and tank, base and ends, base and tank, and base and plinth)	Required	
8.6		Final colour	Avocado Green (12)	

Note: Ticks, Cross [√, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Annex C - Technical schedules A and B for

**MSS TB 500KVA DR DYN11 6MM THICK AV SF6 RMU OIL TYPE TRFR (SAP
3585)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
9	4.6.2	Notices, signs and labels		
9.1		Transformer rating plate	Required	
9.2		Treatment and Full First Aid Instructions on inside of MV and LV compartment doors	Required	
9.3		Elec. warning signs on all doors and barriers	Required	
9.4		Transformer phase labels below bushings	Required	
9.5		Colour-coded LV bus-bars	Required	
9.6		Stenciled labeling of MV and LV compartment doors (both inside and outside)	Required	
9.7		kVA, Prim V, Sec V & Corrosion Class	Required	
9.8		ID markings linking roof to body per batch	Required	
9.9		Provision for the safe-keeping of documents	Required	
10	4.7	Documentation		
10.1		Type test reportss (provide ref. numbers of reports)	Sets 1	
10.2		Routine test reportss	Sets 1	
10.3		Drawings	Sets 2	
10.4		Circuit diagrams (LV auxiliary wiring and equipment)	Sets 2	

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Technical schedules A and B Deviation schedule for

**MSS TB 500KVA DR DYN11 6MM THICK AV SF6 RMU OIL TYPE TRFR (SAP
3585)**

Any deviations offered to this specification shall be listed below with reasons for deviation. In addition, evidence shall be provided that the proposed deviation will at least be more cost-effective than that specified by City Power.

Item	Sub clause of CP_TSSPEC_005	Proposed deviation

Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Annex C - Technical schedules A and B for

**MSS TB 500KVA SR DYN11 3MM THICK AV SF6 RMU DRY TYPE TRFR
(SAP 3708)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
1		Standard operating conditions		
1.1		u) Altitude m	1800	
1.2		b) Ambient air temperature °C	-5 to +40	
1.3		c) Lightning ground flash density Flashes/ km ² /year	> 10	
1.4		d) Maximum solar radiation W/m ²	1000	
1.5		e) Ultraviolet radiation	High	
1.6		f) Relative humidity %	10 to 95	
1.7		g) Corrosive conditions (inland therefore non-corrosive)	Non- corrosive	
1.8		h) wind pressure Pa	700	
2	4.2.1	Ratings		
2.1		Transformer power rating kVA	500	
2.2		Nominal voltage of system (Single ratio) kV _{rms}	11	
2.3		System frequency Hz	50	
2.4		Number of phases	3	
2.5		Rated no-load secondary voltage V _{rms}	415	
2.6		Rated power-frequency voltage kV _{rms}	12	
2.7		Rated lightning impulse withstand voltage kV _{peak}	95	
2.8		Rated short-duration power frequency withstand voltage [50Hz: 1 min] kV _{rms}	28	
2.9		Induced voltage withstand level kV _{rms}	22	
2.10		Internal arc classification	AB-FLR	
2.11		Internal arc current and duration	20KA/500 ms	

Note: Ticks, Cross [√, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Annex C - Technical schedules A and B for

MSS TB 500KVA SR DYN11 3MM THICK AV SF6 RMU DRY TYPE TRFR (SAP 3708)

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
3	4.3.1	Construction design		
3.1		Layout	Type B	xxxxxxxxxx
3.2		Construction	Modular	xxxxxxxxxx
3.3		Removable base sections adjacent to MV compartment (sections to lap bolted with nuts on the inside of the channel and housing)	Required	
3.4		All doors shall be a manual three point locking mechanism, capable of being secured by a padlock, having a shackle diameter of 8mm.	Required	
3.5		Compartment lock protection facility (with welded mesh top with inside visibility)	Required	
3.6		Total mass of miniature substation Kg	Required	
3.7		Overall maximum dimensions	Required	
3.8		a) MV compartment length mm	Required	
		b) LV compartment length mm	Required	
		c) LV metering compartment mm	400 x 400	
		d) Overall length mm	3000	
		e) Overall width mm	1650	
		f) Overall height mm	2000	
		g)Base width mm	1200	
		h)Thickness mm	3	
		Provision for lifting of complete mini-sub onto a concrete plinth without need for dismantling	Required	
3.9		Provision of lifting lugs on roof for ease of removal	Required	
3.10		MV switchgear, LV panel, LV metering and transformer confined to separate compartments	Required	
3.11		Mini-sub housing sections and doors bonded	Required	

Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Full name of company: _____

Annex C - Technical schedules A and B for

MSS TB 500KVA SR DYN11 3MM THICK AV SF6 RMU DRY TYPE TRFR (SAP 3708)

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
4	4.2.1	Transformer unit (Dry-Type)		
4.1		Electrical requirements	As per SANS 60076	
4.2		Vector group	Dyn 11	
4.3		MV system earthing	Effective	
4.4		LV transformer neutral earthing	Solid – connection to insulated LV neutral/earth bar	
4.5		MV system fault level	kA 25	
4.6		Temperature rise limits	As per SANS 60076	
4.7		Secondary voltage regulation (Off-load on the 11 kV supply voltage windings)	% +6.0, + 3.0, 0, –3.0, –6.0	
4.8		No-load losses	W Required	
4.9		Load losses	W Required	
4.10		Impedance	% SANS 780	
4.11		Cost /kW of no-load losses (Jul 2002)	R/kW 13 669	
4.12		Cost /kW of load losses (Jul 2002)	R/kW 1 623	
4.13		X/R	SANS 60076	
4.14		Audio-sound level – maximum	dB(A) Required	
4.15		Sealed transformer unit	Required	

Note: Ticks, Cross [√, X], Asterick [∗], Word [Noted] or TBA [“To Be Advice”] will not be accepted.

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Annex C - Technical schedules A and B for

MSS TB 500KVA SR DYN11 3MM THICK AV SF6 RMU DRY TYPE TRFR (SAP 3708)

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
4.16	4.4.2	Transformer MV bushings (NB internal screen to be earthed)	BS 7215 –Type C with M16x2 thread	
4.17		MV bushing-centre clearances (minimum) mm	135	
4.18		Clearances between outer bushing-centres and mini-sub metal enclosure (minimum) mm	90	
4.19		Transformer overload protection facility	Required	
4.20		Winding material	MV Copper LV Copper	
4.21		Manufacturer of the distribution transformer	Required	
5		MV compartment		
5.1		Equipment in MV compartment	Ring Main Unit (CP_TSSPEC_006)	
5.2		Ring Main Unit manufacturer	Required	
5.3		Incoming MV cable requirements		
		a) 185 mm ² 3 core Cu or 300 mm ² 3C Al XLPE	Required	
		b) Cable support (clamping) required	Required	
		c) Minimum distance from cable clamp to centre-line of RMU bushings mm	800	
		d) Type of connection	Screened	
5.4		Mini-sub earth bar (accessible in front of RMU)	Required	
5.5		Interconnection arrangement between RMU and transformer MV bushings	Required	
5.6		Unscreened interconnecting equipment and connections between ring main unit and transformer to be barricaded	Required	
5.7		Type of earth fault indicator	Required	
5.8		Voltage detecting system (VDS)	Required	

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Full name of company: _____

Annex C - Technical schedules A and B for

MSS TB 500KVA SR DYN11 3MM THICK AV SF6 RMU DRY TYPE TRFR (SAP 3708)

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
6	4.2.8	LV Compartment		
6.1		Bus-bar-rating (see Table 2)	A	1,2 times the kVA capacity
6.2		Bus-bar-insulation		Air insulated
6.3		Bus-bars	Ø	3 + one identical neutral-earth bus-bar (insulated from frame)
6.4		Current density of bus-bars	A/mm ²	1,8 maximum
6.5		Rated withstand current – 1 s (25 kA for up to 630 kVA & 45 kA for 1000 kVA)	kA _{rms}	As per rating.
6.6		Min clearance to earth and between phases	mm	20
6.7		Provision of a LV neutral surge arrester fitted between mini-sub earth bar and LV neutral-earth bus-bar		Required
6.8		LV neutral-earth bus-bar to be earthed (via an electrical bridge to the mini-sub earth bar)		Required
6.9		Neutral isolating links		Not Required
6.10		Provision of LV main isolating switch		Not Required
6.11		Number of outgoing LV feeders to be provided for (drill bus-bar Ø14mm holes)		6
		Spacing between holes (see Figure 1)	mm	110
6.12		LV panel designed for large frame MCCBs		Required
6.13		Spacing (vertical): Between phase bus-bars	mm	185
		Between lowest LV bus-bar and LV neutral	mm	300
		Minimum distance between LV neutral and uni-strut	mm	200

Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

Tender Number: _____

Tenderer's Authorised Signatory: _____

Name in block letters

Signature

Full name of company: _____

Annex C - Technical schedules A and B for

MSS TB 500KVA SR DYN11 3MM THICK AV SF6 RMU DRY TYPE TRFR (SAP 3708)

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
6.14		LV maximum demand ammeters	On all three phases	
6.15		Ammeter type	Thermal integrating over 15 min period	
6.16		LV indicating voltmeter with a selector switch	Required	
6.17		Ammeter and voltmeter size and display mm	96 × 96, 90°	
6.18		Ammeter and voltmeter position	Top right hand side in LV compartment	
6.19		Electronic meter capable of reading current and voltage	Required	
6.20		Provision of removable non flammable barrier to separate LV end compartment and front LV compartment	Required	
6.21		Main MCCB manufacturer	Required	
6.22		Catalogue/model code of main MCCB	Required	
6.23		Size of main MCCB A	As per table 2	

Note: Ticks, Cross [√, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Name in block letters Signature

Full name of company: _____

Annex C - Technical schedules A and B for

MSS TB 500KVA SR DYN11 3MM THICK AV SF6 RMU DRY TYPE TRFR (SAP 3708)

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
7	4.2.6	LV auxiliaries		
7.1		Provision of three point socket outlet and 60W bulkhead fitting in LV compartment (with instantaneous-trip earth leakage unit [20 A; 5 kA rupturing capacity; 30 mA sensitivity] and 20 A HRC fuse with neutral fuse link)	Required	
7.2		Numbering ferrules for auxiliary wiring	Required	
7.3		Push-button fitted to shunt trip RMU tee-off	Required	
8	4.3.2	Materials and corrosion protection		
8.1		Mini-sub enclosure and transformer tank thickness 6(mm) or 3 mm	Mild steel	
8.2		Radiator	Mild steel	
8.3		Tinned copper bus-bars	Required	
8.4		Mini-sub base:Material	Steel	
8.5		Uni-strut clamping bar:Material	Required	
8.6		5mm cork packing (between ends and tank, base and ends, base and tank, and base and plinth)	Required	
8.7		Final colour	Avocado Green (12)	

Note: Ticks, Cross [√, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

Tender Number: _____

Tenderer's Authorised Signatory: _____
Name in block letters Signature

Full name of company: _____

Annex C - Technical schedules A and B for

MSS TB 500KVA SR DYN11 3MM THICK AV SF6 RMU DRY TYPE TRFR (SAP 3708)

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
9	4.6.2	Notices, signs and labels		
9.1		Transformer rating plate	Required	
9.2		Treatment and Full First Aid Instructions on inside of MV and LV compartment doors	Required	
9.3		Elec. warning signs on all doors and barriers	Required	
9.4		Transformer phase labels below bushings	Required	
9.5		Colour-coded LV bus-bars	Required	
9.6		Stenciled labeling of MV and LV compartment doors (both inside and outside)	Required	
9.7		kVA, Prim V, Sec V & Corrosion Class	Required	
9.8		ID markings linking roof to body per batch	Required	
9.9		Provision for the safe-keeping of documents	Required	
10	4.7	Documentation		
10.1		Type test reportss (provide ref. numbers of reports)	Sets 1	
10.2		Routine test reportss	Sets 1	
10.3		Drawings	Sets 2	
10.4		Circuit diagrams (LV auxiliary wiring and equipment)	Sets 2	

Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

Tender Number: _____

Tenderer's Authorised Signatory: _____
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Full name of company: _____

Technical schedules A and B Deviation schedule for

**MSS TB 500KVA SR DYN11 3MM THICK AV SF6 RMU DRY TYPE TRFR (SAP
3708)**

Any deviations offered to this specification shall be listed below with reasons for deviation. In addition, evidence shall be provided that the proposed deviation will at least be more cost-effective than that specified by City Power.

Item	Sub clause of CP_TSSPEC_005	Proposed deviation

Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

Tender Number: _____

Tenderer's Authorised Signatory: _____
Name in block lettersSignature

Full name of company: _____

Annex C - Technical schedules A and B for

MSS TB 500KVA DR DYN11 3MM THICK AV SF6 RMU DRY TYPE TRFR (SAP 3703)

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
1		Standard operating conditions		
1.1		v) Altitude m	1800	
1.2		b) Ambient air temperature °C	-5 to +40	
1.3		c) Lightning ground flash density Flashes/km ² /year	> 10	
1.4		d) Maximum solar radiation W/m ²	1000	
1.5		e) Ultraviolet radiation	High	
1.6		f) Relative humidity %	10 to 95	
1.7		g) Corrosive conditions (inland therefore non-corrosive)	Non-corrosive	
1.8		h) wind pressure Pa	700	
2	4.2.1	Ratings		
2.1		Transformer power rating kVA	500	
2.2		Nominal voltage of system (Dual ratio) kV _{rms}	6,6 & 11	
2.3		System frequency Hz	50	
2.4		Number of phases	3	
2.5		Rated no-load secondary voltage V _{rms}	415	
2.6		Rated power-frequency voltage kV _{rms}	12	
2.7		Rated lightning impulse withstand voltage kV _{peak}	95	
2.8		Rated short-duration power frequency withstand voltage [50Hz: 1 min] kV _{rms}	28	
2.9		Induced voltage withstand level kV _{rms}	22	
2.10		Internal arc classification	AB-FLR	
2.11		Internal arc current and duration	20KA/500 ms	

Note: Ticks, Cross [√, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Tenderer's Authorised Signatory: _____
Name in block letters Signature

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Annex C - Technical schedules A and B for

MSS TB 500KVA DR DYN11 3MM THICK AV SF6 RMU DRY TYPE TRFR (SAP 3703)

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
3	4.3.1	Construction design		
3.1		Layout	Type B	
3.2		Construction	Modular	
3.3		Removable base sections adjacent to MV compartment (sections to lap bolted with nuts on the inside of the channel and housing)	Required	
3.4		All doors shall be a manual three point locking mechanism, capable of being secured by a padlock, having a shackle diameter of 8mm.	Required	
3.5		Compartment lock protection facility (with welded mesh top with inside visibility)	Required	
3.6		Total mass of miniature substation Kg	Required	
3.7		Overall maximum dimensions	Required	
3.8		a) MV compartment length mm	Required	
		b) LV compartment length mm	Required	
		c) LV metering compartment mm	400 x 400	
		d) Overall length mm	3000	
		e) Overall width mm	1650	
		f) Overall height mm	2000	
		g)Base width mm	1200	
		h)Thickness mm	3	
		Provision for lifting of complete mini-sub onto a concrete plinth without need for dismantling	Required	
3.9		Provision of lifting lugs on roof for ease of removal	Required	
3.10		MV switchgear, LV panel, LV metering and transformer confined to separate compartments	Required	
3.11		Mini-sub housing sections and doors bonded	Required	

Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Tenderer's Authorised Signatory: _____

Name in block letters

Signature

Full name of company: _____

Annex C - Technical schedules A and B for

MSS TB 500KVA DR DYN11 3MM THICK AV SF6 RMU DRY TYPE TRFR (SAP 3703)

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
4	4.2.1	Transformer unit (Dry-Type)		
4.1		Electrical requirements	As per SANS 60076	
4.2		Vector group	Dyn 11	
4.3		MV system earthing	Effective	
4.4		LV transformer neutral earthing	Solid – connection to insulated LV neutral/earth bar	
4.5		MV system fault level	kA 25	
4.6		Temperature rise limits	As per SANS 60076	
4.7		Secondary voltage regulation (Off-load on the 11 kV supply voltage windings)	% +6.0, + 3.0, 0, –3.0, –6.0	
4.8		No-load losses	W Required	
4.9		Load losses	W Required	
4.10		Impedance	% SANS 60076	
4.11		Cost /kW of no-load losses (Jul 2002)	R/kW 13 669	
4.12		Cost /kW of load losses (Jul 2002)	R/kW 1 623	
4.13		X/R	SANS 60076	
4.14		Audio-sound level – maximum	dB(A) Required	
4.15		Sealed transformer unit	Required	

Note: Ticks, Cross [√, X], Asterick [*], Word [Noted] or TBA [“To Be Advice”] will not be accepted.

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Tenderer's Authorised Signatory: _____
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Full name of company: _____

Annex C - Technical schedules A and B for

MSS TB 500KVA DR DYN11 3MM THICK AV SF6 RMU DRY TYPE TRFR (SAP 3703)

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
4.16	4.4.2	Transformer MV bushings (NB internal screen to be earthed)	BS 7215 –Type C with M16x2 thread	
4.17		MV bushing-centre clearances (minimum) mm	135	
4.18		Clearances between outer bushing-centres and mini-sub metal enclosure (minimum) mm	90	
4.19		Transformer overload protection facility	Required	
4.20		Winding material MV	Copper	
		LV	Copper	
4.21		Manufacturer of the distribution transformer	Required	
5		MV compartment		
5.1		Equipment in MV compartment	Ring Main Unit (CP_TSSPEC_006)	
5.2		Ring Main Unit manufacturer	Required	
5.3		Incoming MV cable requirements		
		a) 185 mm ² 3 core Cu or 300 mm ² 3C Al XLPE	Required	
		b) Cable support (clamping) required	Required	
		c) Minimum distance from cable clamp to centre-line of RMU bushings mm	800	
		d) Type of connection	Screened	
5.4		Mini-sub earth bar (accessible in front of RMU)	Required	
5.5		Interconnection arrangement between RMU and transformer MV bushings	Required	
5.6		Unscreened interconnecting equipment and connections between ring main unit and transformer to be barricaded	Required	
5.7		Type of earth fault indicator	Required	
5.8		Voltage detecting system (VDS)	Required	

Note: Ticks, Cross [√, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Tenderer's Authorised Signatory: _____

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Full name of company: _____

Annex C - Technical schedules A and B for

MSS TB 500KVA DR DYN11 3MM THICK AV SF6 RMU DRY TYPE TRFR (SAP 3703)

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
6	4.2.8	LV Compartment		
6.1		Bus-bar-rating (see Table 2)	A	1,2 times the kVA capacity
6.2		Bus-bar-insulation		Air insulated
6.3		Bus-bars	Ø	3 + one identical neutral-earth bus-bar (insulated from frame)
6.4		Current density of bus-bars	A/mm ²	1,8 maximum
6.5		Rated withstand current – 1 s (25 kA for up to 630 kVA & 45 kA for 1000 kVA)	kA _{rms}	As per rating.
6.6		Min clearance to earth and between phases	mm	20
6.7		Provision of a LV neutral surge arrester fitted between mini-sub earth bar and LV neutral-earth bus-bar		Required
6.8		LV neutral-earth bus-bar to be earthed (via an electrical bridge to the mini-sub earth bar)		Required
6.9		Neutral isolating links		Not Required
6.10		Provision of LV main isolating switch		Not Required
6.11		Number of outgoing LV feeders to be provided for (drill bus-bar Ø14mm holes)		6
6.12		Spacing between holes (see Figure 1)	mm	110
6.13		LV panel designed for large frame MCCBs		Required
		Spacing (vertical): Between phase bus-bars	mm	185
		Between lowest LV bus-bar and LV neutral	mm	300
		Minimum distance between LV neutral and uni-strut	mm	200

Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

Tender Number: _____

Tenderer's Authorised Signatory: _____
Name in block letters Signature

Full name of company: _____

Annex C - Technical schedules A and B for

MSS TB 500KVA DR DYN11 3MM THICK AV SF6 RMU DRY TYPE TRFR (SAP 3703)

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
6.14		LV maximum demand ammeters	On all three phases	
6.15		Ammeter type	Thermal integrating over 15 min period	
6.16		LV indicating voltmeter with a selector switch	Required	
6.17		Ammeter and voltmeter size and display mm	96 × 96, 90°	
6.18		Ammeter and voltmeter position	Top right hand side in LV compartment	
6.19		Electronic meter capable of reading current and voltage	Required	
6.20		Provision of removable non flammable barrier to separate LV end compartment and front LV compartment	Required	
6.21		Main MCCB manufacturer	Required	
6.22		Catalogue/model code of main MCCB	Required	
6.23		Size of main MCCB A	As per table 2	

Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Full name of company: _____

Annex C - Technical schedules A and B for

MSS TB 500KVA DR DYN11 3MM THICK AV SF6 RMU DRY TYPE TRFR (SAP 3703)

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
7	4.2.6	LV auxiliaries		
7.1		Provision of three point socket outlet and 60W bulkhead fitting in LV compartment (with instantaneous-trip earth leakage unit [20 A; 5 kA rupturing capacity; 30 mA sensitivity] and 20 A HRC fuse with neutral fuse link)	Required	
7.2		Numbering ferrules for auxiliary wiring	Required	
7.3		Push-button fitted to shunt trip RMU tee-off	Required	
8	4.3.2	Materials and corrosion protection		
8.1		Mini-sub enclosure and transformer tank thickness 6(mm) or 3 mm	Mild steel	
8.2		Radiator	Mild steel	
8.3		Tinned copper bus-bars	Required	
8.4		Mini-sub base:Material	Steel	
8.5		Uni-strut clamping bar:Material	Required	
8.6		5mm cork packing (between ends and tank, base and ends, base and tank, and base and plinth)	Required	
8.7		Final colour	Avocado Green (12)	

Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

Tender Number: _____

Tenderer's Authorised Signatory: _____
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Full name of company: _____

**Annex C - Technical schedules A and B for
Miniature Substation Type B 500 kVA DRY TYPE (SAP 3703)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
9	4.6.2	Notices, signs and labels		
9.1		Transformer rating plate	Required	
9.2		Treatment and Full First Aid Instructions on inside of MV and LV compartment doors	Required	
9.3		Elec. warning signs on all doors and barriers	Required	
9.4		Transformer phase labels below bushings	Required	
9.5		Colour-coded LV bus-bars	Required	
9.6		Stenciled labeling of MV and LV compartment doors (both inside and outside)	Required	
9.7		kVA, Prim V, Sec V & Corrosion Class	Required	
9.8		ID markings linking roof to body per batch	Required	
9.9		Provision for the safe-keeping of documents	Required	
10	4.7	Documentation		
10.1		Type test reportss (provide ref. numbers of reports) Sets	1	
10.2		Routine test reportss Sets	1	
10.3		Drawings Sets	2	
10.4		Circuit diagrams (LV auxiliary wiring and equipment) Sets	2	

Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

Tender Number: _____

Tenderer's Authorised Signatory: _____
Name in block lettersSignature

Full name of company: _____

Technical schedules A and B Deviation schedule for

**MSS TB 500KVA DR DYN11 3MM THICK AV SF6 RMU DRY TYPE TRFR (SAP
3703)**

Any deviations offered to this specification shall be listed below with reasons for deviation. In addition, evidence shall be provided that the proposed deviation will at least be more cost-effective than that specified by City Power.

Item	Sub clause of CP_TSSPEC_005	Proposed deviation

Note: Ticks, Cross [√, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

Tender Number: _____

Tenderer's Authorised Signatory: _____
Name in block lettersSignature

Full name of company: _____

Annex C - Technical schedules A and B for

MSS TB 500KVA SR DYN11 6MM THICK AV SF6 RMU DRY TYPE TRFR (SAP 3711)

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
1		Standard operating conditions		
1.1		w) Altitude m	1800	
1.2		b) Ambient air temperature °C	-5 to +40	
1.3		c) Lightning ground flash density Flashes/km ² /year	> 10	
1.4		d) Maximum solar radiation W/m ²	1000	
1.5		e) Ultraviolet radiation	High	
1.6		f) Relative humidity %	10 to 95	
1.7		g) Corrosive conditions (inland therefore non-corrosive)	Non-corrosive	
1.8		h) wind pressure Pa	700	
2	4.2.1	Ratings		
2.1		Transformer power rating kVA	500	
2.2		Nominal voltage of system (Single ratio) kV _{rms}	11	
2.3		System frequency Hz	50	
2.4		Number of phases	3	
2.5		Rated no-load secondary voltage V _{rms}	415	
2.6		Rated power-frequency voltage kV _{rms}	12	
2.7		Rated lightning impulse withstand voltage kV _{peak}	95	
2.8		Rated short-duration power frequency withstand voltage [50Hz: 1 min] kV _{rms}	28	
2.9		Induced voltage withstand level kV _{rms}	22	
2.10		Internal arc classification	AB-FLR	
2.11		Internal arc current and duration	20KA/500 ms	

Note: Ticks, Cross [√, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

Tender Number: _____

Tenderer's Authorised Signatory: _____
Name in block letters Signature

Full name of company: _____

Annex C - Technical schedules A and B for

MSS TB 500KVA SR DYN11 6MM THICK AV SF6 RMU DRY TYPE TRFR (SAP 3711)

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
3	4.3.1	Construction design		
3.1		Layout	Type B	
3.2		Construction	Modular	
3.3		Removable base sections adjacent to MV compartment (sections to lap bolted with nuts on the inside of the channel and housing)	Required	
3.4		All doors shall be a manual three point locking mechanism, capable of being secured by a padlock, having a shackle diameter of 8mm.	Required	
3.5		Compartment lock protection facility (with welded mesh top with inside visibility)	Required	
3.6		Total mass of miniature substation Kg	Required	
3.7		Overall maximum dimensions	Required	
3.8		a) MV compartment length mm	Required	
		b) LV compartment length mm	Required	
		c) LV metering compartment mm	400 x 400	
		d) Overall length mm	3000	
		e) Overall width mm	1650	
		f) Overall height mm	2000	
		g)Base width mm	1200	
		h)Thickness mm	6	
		Provision for lifting of complete mini-sub onto a concrete plinth without need for dismantling	Required	
3.9		Provision of lifting lugs on roof for ease of removal	Required	
3.10		MV switchgear, LV panel, LV metering and transformer confined to separate compartments	Required	
3.11		Mini-sub housing sections and doors bonded	Required	

Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

Tender Number: _____

Tenderer's Authorised Signatory: _____

Name in block letters

Signature

Full name of company: _____

Annex C - Technical schedules A and B for

MSS TB 500KVA SR DYN11 6MM THICK AV SF6 RMU DRY TYPE TRFR (SAP 3711)

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
4	4.2.1	Transformer unit (Oil immersed/Dry-Type)		
4.1		Electrical requirements	As per SANS 60076	
4.2		Vector group	Dyn 11	
4.3		MV system earthing	Effective	
4.4		LV transformer neutral earthing	Solid – connection to insulated LV neutral/earth bar	
4.5		MV system fault level	kA 25	
4.6		Temperature rise limits	As per SANS 60076	
4.7		Secondary voltage regulation (Off-load on the 11 kV supply voltage windings)	% +6.0, + 3.0, 0, –3.0, –6.0	
4.8		No-load losses	W Required	
4.9		Load losses	W Required	
4.10		Impedance	% SANS 60076	
4.11		Cost /kW of no-load losses (Jul 2002)	R/kW 13 669	
4.12		Cost /kW of load losses (Jul 2002)	R/kW 1 623	
4.13		X/R	SANS 60076	
4.14		Audio-sound level – maximum (see table 6)	dB(A) Table 6	
4.15		Sealed transformer unit	Required	

Note: Ticks, Cross [√, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

Tender Number: _____

Tenderer's Authorised Signatory: _____
Name in block letters Signature

Full name of company: _____

Annex C - Technical schedules A and B for

MSS TB 500KVA SR DYN11 6MM THICK AV SF6 RMU DRY TYPE TRFR (SAP 3711)

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
4.16	4.4.2	Transformer MV bushings (NB internal screen to be earthed)	BS 7215 –Type C with M16x2 thread	
4.17		MV bushing-centre clearances (minimum) mm	135	
4.18		Clearances between outer bushing-centres and mini-sub metal enclosure (minimum) mm	90	
4.19		Transformer overload protection facility	Required	
4.20		Winding material MV	Copper	
		LV	Copper	
4.21		Manufacturer of the distribution transformer	Required	
5		MV compartment		
5.1		Equipment in MV compartment	Ring Main Unit (CP_TSSPEC_006)	
5.2		Ring Main Unit manufacturer	Required	
5.3		Incoming MV cable requirements		
		a) 185 mm ² 3 core Cu or 300 mm ² 3C Al XLPE	Required	
		b) Cable support (clamping) required	Required	
		c) Minimum distance from cable clamp to centre-line of RMU bushings mm	800	
		d) Type of connection	Screened	
5.4		Mini-sub earth bar (accessible in front of RMU)	Required	
5.5		Interconnection arrangement between RMU and transformer MV bushings	Required	
5.6		Unscreened interconnecting equipment and connections between ring main unit and transformer to be barricaded	Required	
5.7		Type of earth fault indicator	Required	
5.8		Voltage detecting system (VDS)	Required	

Note: Ticks, Cross [√, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Annex C - Technical schedules A and B for

MSS TB 500KVA SR DYN11 6MM THICK AV SF6 RMU DRY TYPE TRFR (SAP 3711)

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
6	4.2.8	LV Compartment		
6.1		Bus-bar-rating (see Table 2)	A	1,2 times the kVA capacity
6.2		Bus-bar-insulation		Air insulated
6.3		Bus-bars	Ø	3 + one identical neutral-earth bus-bar (insulated from frame)
6.4		Current density of bus-bars	A/mm ²	1,8 maximum
6.5		Rated withstand current – 1 s (25 kA for up to 630 kVA & 45 kA for 1000 kVA)	kA _{rms}	As per rating.
6.6		Min clearance to earth and between phases	mm	20
6.7		Provision of a LV neutral surge arrester fitted between mini-sub earth bar and LV neutral-earth bus-bar		Required
6.8		LV neutral-earth bus-bar to be earthed (via an electrical bridge to the mini-sub earth bar)		Required
6.9		Neutral isolating links		Not Required
6.10		Provision of LV main isolating switch		Not Required
6.11		Number of outgoing LV feeders to be provided for (drill bus-bar Ø14mm holes)		6
6.12		Spacing between holes (see Figure 1)	mm	110
6.13		LV panel designed for large frame MCCBs		Required
		Spacing (vertical): Between phase bus-bars	mm	185
		Between lowest LV bus-bar and LV neutral	mm	300
		Minimum distance between LV neutral and uni-strut	mm	200

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Annex C - Technical schedules A and B for

**MSS TB 500KVA SR DYN11 6MM THICK AV SF6 RMU DRY TYPE TRFR (SAP
3711)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
6.14		LV maximum demand ammeters	On all three phases	
6.15		Ammeter type	Thermal integrating over 15 min period	
6.16		LV indicating voltmeter with a selector switch	Required	
6.17		Ammeter and voltmeter size and display mm	96 × 96, 90°	
6.18		Ammeter and voltmeter position	Top right hand side in LV compartment	
6.19		Electronic meter capable of reading current and voltage	Required	
6.20		Provision of removable non flammable barrier to separate LV end compartment and front LV compartment	Required	
6.21		Main MCCB manufacturer	Required	
6.22		Catalogue/model code of main MCCB	Required	
6.23		Size of main MCCB A	As per table 2	

**Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be
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Annex C - Technical schedules A and B for

MSS TB 500KVA SR DYN11 6MM THICK AV SF6 RMU DRY TYPE TRFR (SAP 3711)

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
7	4.2.6	LV auxiliaries		
7.1		Provision of three point socket outlet and 60W bulkhead fitting in LV compartment (with instantaneous-trip earth leakage unit [20 A; 5 kA rupturing capacity; 30 mA sensitivity] and 20 A HRC fuse with neutral fuse link)	Required	
7.2		Numbering ferrules for auxiliary wiring	Required	
7.3		Push-button fitted to shunt trip RMU tee-off	Required	
8	4.3.2	Materials and corrosion protection		
8.1		Mini-sub enclosure and transformer tank thickness 6(mm) or 3 mm	Mild steel	
8.2		Radiator	Mild steel	
8.3		Tinned copper bus-bars	Required	
8.4		Mini-sub base:Material	Steel	
8.5		Uni-strut clamping bar:Material	Required	
8.6		5mm cork packing (between ends and tank, base and ends, base and tank, and base and plinth)	Required	
8.7		Final colour	Avocado Green (12)	

Note: Ticks, Cross [√, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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**Annex C - Technical schedules A and B for
MSS TB 500KVA SR DYN11 6MM THICK AV SF6 RMU DRY TYPE TRFR (SAP
3711)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
9	4.6.2	Notices, signs and labels		
9.1		Transformer rating plate	Required	
9.2		Treatment and Full First Aid Instructions on inside of MV and LV compartment doors	Required	
9.3		Elec. warning signs on all doors and barriers	Required	
9.4		Transformer phase labels below bushings	Required	
9.5		Colour-coded LV bus-bars	Required	
9.6		Stenciled labeling of MV and LV compartment doors (both inside and outside)	Required	
9.7		kVA, Prim V, Sec V & Corrosion Class	Required	
9.8		ID markings linking roof to body per batch	Required	
9.9		Provision for the safe-keeping of documents	Required	
10	4.7	Documentation		
10.1		Type test reportss (provide ref. numbers of reports)	Sets 1	
10.2		Routine test reportss	Sets 1	
10.3		Drawings	Sets 2	
10.4		Circuit diagrams (LV auxiliary wiring and equipment)	Sets 2	

Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Technical schedules A and B Deviation schedule for

**MSS TB 500KVA SR DYN11 6MM THICK AV SF6 RMU DRY TYPE TRFR (SAP
3711)**

Any deviations offered to this specification shall be listed below with reasons for deviation. In addition, evidence shall be provided that the proposed deviation will at least be more cost-effective than that specified by City Power.

Item	Sub clause of CP_TSSPEC_005	Proposed deviation

Note: Ticks, Cross [√, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Annex C - Technical schedules A and B for

MSS TB 500KVA DR DYN11 6MM THICK AV SF6 RMU DRY TYPE TRFR (SAP 3712)

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
1		Standard operating conditions		
1.1		x) Altitude m	1800	
1.2		b) Ambient air temperature °C	-5 to +40	
1.3		c) Lightning ground flash density Flashes/km ² /year	> 10	
1.4		d) Maximum solar radiation W/m ²	1000	
1.5		e) Ultraviolet radiation	High	
1.6		f) Relative humidity %	10 to 95	
1.7		g) Corrosive conditions (inland therefore non-corrosive)	Non-corrosive	
1.8		h) wind pressure Pa	700	
2	4.2.1	Ratings		
2.1		Transformer power rating kVA	500	
2.2		Nominal voltage of system (Dual ratio) kV _{rms}	6,6 & 11	
2.3		System frequency Hz	50	
2.4		Number of phases	3	
2.5		Rated no-load secondary voltage V _{rms}	415	
2.6		Rated power-frequency voltage kV _{rms}	12	
2.7		Rated lightning impulse withstand voltage kV _{peak}	95	
2.8		Rated short-duration power frequency withstand voltage [50Hz: 1 min] kV _{rms}	28	
2.9		Induced voltage withstand level kV _{rms}	22	
2.10		Internal arc classification	AB-FLR	
2.11		Internal arc current and duration	20KA/500 ms	

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Annex C - Technical schedules A and B for

MSS TB 500KVA DR DYN11 6MM THICK AV SF6 RMU DRY TYPE TRFR (SAP 3712)

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
3	4.3.1	Construction design		
3.1		Layout	Type B	
3.2		Construction	Modular	
3.3		Removable base sections adjacent to MV compartment (sections to lap bolted with nuts on the inside of the channel and housing)	Required	
3.4		All doors shall be a manual three point locking mechanism, capable of being secured by a padlock, having a shackle diameter of 8mm.	Required	
3.5		Compartment lock protection facility (with welded mesh top with inside visibility)	Required	
3.6		Total mass of miniature substation Kg	Required	
3.7		Overall maximum dimensions	Required	
3.8		a) MV compartment length mm	Required	
		b) LV compartment length mm	Required	
		c) LV metering compartment mm	400 x 400	
		d) Overall length mm	3000	
		e) Overall width mm	1650	
		f) Overall height mm	2000	
		g)Base width mm	1200	
		h)Thickness mm	6	
		Provision for lifting of complete mini-sub onto a concrete plinth without need for dismantling	Required	
3.9		Provision of lifting lugs on roof for ease of removal	Required	
3.10		MV switchgear, LV panel, LV metering and transformer confined to separate compartments	Required	
3.11		Mini-sub housing sections and doors bonded	Required	

Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Annex C - Technical schedules A and B for

MSS TB 500KVA DR DYN11 6MM THICK AV SF6 RMU DRY TYPE TRFR (SAP 3712)

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
4	4.2.1	Transformer unit Dry-Type)		
4.1		Electrical requirements	As per SANS 60076	
4.2		Vector group	Dyn 11	
4.3		MV system earthing	Effective	
4.4		LV transformer neutral earthing	Solid – connection to insulated LV neutral/earth bar	
4.5		MV system fault level	kA 25	
4.6		Temperature rise limits	As per SANS 60076	
4.7		Secondary voltage regulation (Off-load on the 11 kV supply voltage windings)	% +6.0, + 3.0, 0, –3.0, –6.0	
4.8		No-load losses	W Required	
4.9		Load losses	W Required	
4.10		Impedance	% SANS 780	
4.11		Cost /kW of no-load losses (Jul 2002)	R/kW 13 669	
4.12		Cost /kW of load losses (Jul 2002)	R/kW 1 623	
4.13		X/R	SANS 60076	
4.14		Audio-sound level – maximum (see table 6)	dB(A) Table 6	
4.15		Sealed transformer unit	Required	

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Annex C - Technical schedules A and B for

MSS TB 500KVA DR DYN11 6MM THICK AV SF6 RMU DRY TYPE TRFR (SAP 3712)

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
4.16	4.4.2	Transformer MV bushings (NB internal screen to be earthed)	BS 7215 –Type C with M16x2 thread	
4.17		MV bushing-centre clearances (minimum) mm	135	
4.18		Clearances between outer bushing-centres and mini-sub metal enclosure (minimum) mm	90	
4.19		Transformer overload protection facility	Required	
4.20		Winding material MV	Copper	
		LV	Copper	
4.21		Manufacturer of the distribution transformer	Required	
5		MV compartment		
5.1		Equipment in MV compartment	Ring Main Unit (CP_TSSPEC_006)	
5.2		Ring Main Unit manufacturer	Required	
5.3		Incoming MV cable requirements		
		a) 185 mm ² 3 core Cu or 300 mm ² 3C Al XLPE	Required	
		b) Cable support (clamping) required	Required	
		c) Minimum distance from cable clamp to centre-line of RMU bushings mm	800	
		d) Type of connection	Screened	
5.4		Mini-sub earth bar (accessible in front of RMU)	Required	
5.5		Interconnection arrangement between RMU and transformer MV bushings	Required	
5.6		Unscreened interconnecting equipment and connections between ring main unit and transformer to be barricaded	Required	
5.7		Type of earth fault indicator	Required	
5.8		Voltage detecting system (VDS)	Required	

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Annex C - Technical schedules A and B for

MSS TB 500KVA DR DYN11 6MM THICK AV SF6 RMU DRY TYPE TRFR (SAP 3712)

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
6	4.2.8	LV Compartment		
6.1		Bus-bar-rating (see Table 2)	A	1,2 times the kVA capacity
6.2		Bus-bar-insulation		Air insulated
6.3		Bus-bars	Ø	3 + one identical neutral-earth bus-bar (insulated from frame)
6.4		Current density of bus-bars	A/mm ²	1,8 maximum
6.5		Rated withstand current – 1 s (25 kA for up to 630 kVA & 45 kA for 1000 kVA)	kA _{rms}	As per rating.
6.6		Min clearance to earth and between phases	mm	20
6.7		Provision of a LV neutral surge arrester fitted between mini-sub earth bar and LV neutral-earth bus-bar		Required
6.8		LV neutral-earth bus-bar to be earthed (via an electrical bridge to the mini-sub earth bar)		Required
6.9		Neutral isolating links		Not Required
6.10		Provision of LV main isolating switch		Not Required
6.11		Number of outgoing LV feeders to be provided for (drill bus-bar Ø14mm holes)		6
6.12		Spacing between holes (see Figure 1)	mm	110
6.13		LV panel designed for large frame MCCBs		Required
		Spacing (vertical): Between phase bus-bars	mm	185
		Between lowest LV bus-bar and LV neutral	mm	300
		Minimum distance between LV neutral and uni-strut	mm	200

Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Annex C - Technical schedules A and B for

MSS TB 500KVA DR DYN11 6MM THICK AV SF6 RMU DRY TYPE TRFR (SAP 3712)

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
6.14		LV maximum demand ammeters	On all three phases	
6.15		Ammeter type	Thermal integrating over 15 min period	
6.16		LV indicating voltmeter with a selector switch	Required	
6.17		Ammeter and voltmeter size and display mm	96 × 96, 90°	
6.18		Ammeter and voltmeter position	Top right hand side in LV compartment	
6.19		Electronic meter capable of reading current and voltage	Required	
6.20		Provision of removable non flammable barrier to separate LV end compartment and front LV compartment	Required	
6.21		Main MCCB manufacturer	Required	
6.22		Catalogue/model code of main MCCB	Required	
6.23		Size of main MCCB A	As per table 2	

Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Annex C - Technical schedules A and B for

MSS TB 500KVA DR DYN11 6MM THICK AV SF6 RMU DRY TYPE TRFR (SAP 3712)

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
7	4.2.6	LV auxiliaries		
7.1		Provision of three point socket outlet and 60W bulkhead fitting in LV compartment (with instantaneous-trip earth leakage unit [20 A; 5 kA rupturing capacity; 30 mA sensitivity] and 20 A HRC fuse with neutral fuse link)	Required	
7.2		Numbering ferrules for auxiliary wiring	Required	
7.3		Push-button fitted to shunt trip RMU tee-off	Required	
8	4.3.2	Materials and corrosion protection		
8.1		Mini-sub enclosure and transformer tank thickness 6(mm) or 3 mm	Mild steel	
8.2		Radiator	Mild steel	
8.3		Tinned copper bus-bars	Required	
8.4		Mini-sub base:Material	Steel	
8.5		Uni-strut clamping bar:Material	Required	
8.6		5mm cork packing (between ends and tank, base and ends, base and tank, and base and plinth)	Required	
8.7		Final colour	Avocado Green (12)	

Note: Ticks, Cross [√, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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**Annex C - Technical schedules A and B for
MSS TB 500KVA DR DYN11 6MM THICK AV SF6 RMU DRY TYPE TRFR (SAP
3712)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
9	4.6.2	Notices, signs and labels		
9.1		Transformer rating plate	Required	
9.2		Treatment and Full First Aid Instructions on inside of MV and LV compartment doors	Required	
9.3		Elec. warning signs on all doors and barriers	Required	
9.4		Transformer phase labels below bushings	Required	
9.5		Colour-coded LV bus-bars	Required	
9.6		Stenciled labeling of MV and LV compartment doors (both inside and outside)	Required	
9.7		kVA, Prim V, Sec V & Corrosion Class	Required	
9.8		ID markings linking roof to body per batch	Required	
9.9		Provision for the safe-keeping of documents	Required	
10	4.7	Documentation		
10.1		Type test reportss (provide ref. numbers of reports) Sets	1	
10.2		Routine test reportss Sets	1	
10.3		Drawings Sets	2	
10.4		Circuit diagrams (LV auxiliary wiring and equipment) Sets	2	

Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Technical schedules A and B Deviation schedule for

**MSS TB 500KVA DR DYN11 6MM THICK AV SF6 RMU DRY TYPE TRFR (SAP
3712)**

Any deviations offered to this specification shall be listed below with reasons for deviation. In addition, evidence shall be provided that the proposed deviation will at least be more cost-effective than that specified by City Power.

Item	Sub clause of CP_TSSPEC_005	Proposed deviation

Note: Ticks, Cross [√, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

Tender Number: _____

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Annex C - Technical schedules A and B for

**MSS TB 500KVA SR DYN11 3MM THICK AV SF6 FREE RMU OIL TYPE TRFR
(SAP 4364)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
1		Standard operating conditions		
1.1		y) Altitude m	1800	
1.2		b) Ambient air temperature °C	-5 to +40	
1.3		c) Lightning ground flash density Flashes/ km ² /year	> 10	
1.4		d) Maximum solar radiation W/m ²	1000	
1.5		e) Ultraviolet radiation	High	
1.6		f) Relative humidity %	10 to 95	
1.7		g) Corrosive conditions (inland therefore non-corrosive)	Non- corrosive	
1.8		h) wind pressure Pa	700	
2	4.2.1	Ratings		
2.1		Transformer power rating kVA	500	
2.2		Nominal voltage of system (Single ratio) kV _{rms}	11	
2.3		System frequency Hz	50	
2.4		Number of phases	3	
2.5		Rated no-load secondary voltage V _{rms}	415	
2.6		Rated power-frequency voltage kV _{rms}	12	
2.7		Rated lightning impulse withstand voltage kV _{peak}	95	
2.8		Rated short-duration power frequency withstand voltage [50Hz: 1 min] kV _{rms}	28	
2.9		Induced voltage withstand level kV _{rms}	22	
2.10		Internal arc classification	AB-FLR	
2.11		Internal arc current and duration	20KA/500 ms	

Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Full name of company: _____

Annex C - Technical schedules A and B for

**MSS TB 500KVA SR DYN11 3MM THICK AV SF6 FREE RMU OIL TYPE TRFR
(SAP 4364)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
3	4.3.1	Construction design		
3.1		Layout	Type B	
3.2		Construction	Modular	
3.3		Removable base sections adjacent to MV compartment (sections to lap bolted with nuts on the inside of the channel and housing)	Required	
3.4		All doors shall be a manual three point locking mechanism, capable of being secured by a padlock, having a shackle diameter of 8mm.	Required	
3.5		Compartment lock protection facility (with welded mesh top with inside visibility)	Required	
3.6		Total mass of miniature substation Kg	Required	
3.7		Overall maximum dimensions	Required	
3.8		a) MV compartment length mm	Required	
		b) LV compartment length mm	Required	
		c) LV metering compartment mm	400 x 400	
		d) Overall length mm	3000	
		e) Overall width mm	1650	
		f) Overall height mm	2000	
		g) Base width mm	1200	
		h) Thickness mm	3	
		Provision for lifting of complete mini-sub onto a concrete plinth without need for dismantling	Required	
3.9		Provision of lifting lugs on roof for ease of removal	Required	
3.10		MV switchgear, LV panel, LV metering and transformer confined to separate compartments	Required	
3.11		Mini-sub housing sections and doors bonded	Required	

Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Annex C - Technical schedules A and B for

**MSS TB 500KVA SR DYN11 3MM THICK AV SF6 FREE RMU OIL TYPE TRFR
(SAP 4364)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
4	4.2.1	Transformer unit(Oil immersed)		
4.1		Electrical requirements	As per SANS 780	
4.2		Vector group	Dyn 11	
4.3		MV system earthing	Effective	
4.4		LV transformer neutral earthing	Solid – connection to insulated LV neutral/earth bar	
4.5		MV system fault level	kA 25	
4.6		Temperature rise limits	As per SANS 780 Table 6	
4.7		Secondary voltage regulation (Off-load on the 11 kV supply voltage windings)	% +6.0, + 3.0, 0, –3.0, –6.0	
4.8		No-load losses	W Required	
4.9		Load losses	W Required	
4.10		Impedance	% SANS780	
4.11		Cost /kW of no-load losses (Jul 2002)	R/kW 13 669	
4.12		Cost /kW of load losses (Jul 2002)	R/kW 1 623	
4.13		X/R	SANS780	
4.14		Audio-sound level – maximum (see table 6)	dB(A) Table 6	
4.15		Sealed transformer unit	Required	

Note: Ticks, Cross [√, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Annex C - Technical schedules A and B for

**MSS TB 500KVA SR DYN11 3MM THICK AV SF6 FREE RMU OIL TYPE TRFR
(SAP 4364)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
4.16	4.4.2	Transformer MV bushings (NB internal screen to be earthed)	BS 7215 –Type C with M16x2 thread	
4.17		MV bushing-centre clearances (minimum) mm	135	
4.18		Clearances between outer bushing-centres and mini-sub metal enclosure (minimum) mm	90	
4.19		Transformer overload protection facility	Required	
4.20		Winding material	MV Copper LV Copper	
4.21		Manufacturer of the distribution transformer	Required	
5		MV compartment		
5.1		Equipment in MV compartment	SF6 FREE Ring Main Unit (CP_TSSPEC_006)	
5.2		Ring Main Unit manufacturer	Required	
5.5		Incoming MV cable requirements		
		a) 185 mm ² 3 core Cu or 300 mm ² 3C Al XLPE	Required	
		b) Cable support (clamping) required	Required	
		c) Minimum distance from cable clamp to centre-line of RMU bushings mm	800	
		d) Type of connection	Screened	
5.6		Mini-sub earth bar (accessible in front of RMU)	Required	
5.7		Interconnection arrangement between RMU and transformer MV bushings	Required	
5.8		Unscreened interconnecting equipment and connections between ring main unit and transformer to be barricaded	Required	
5.9		Type of earth fault indicator	Required	
5.10		Voltage detecting system (VDS)	Required	

Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA [“To Be Advice”] will not be accepted.

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Full name of company: _____

Annex C - Technical schedules A and B for

**MSS TB 500KVA SR DYN11 3MM THICK AV SF6 FREE RMU OIL TYPE TRFR
(SAP 4364)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
6	4.2.8	LV Compartment		
6.1		Bus-bar-rating (see Table 2)	A	1,2 times the kVA capacity
6.2		Bus-bar-insulation		Air insulated
6.3		Bus-bars	Ø	3 + one identical neutral-earth bus-bar (insulated from frame)
6.4		Current density of bus-bars	A/mm ²	1,8 maximum
6.5		Rated withstand current – 1 s (25 kA for up to 630 kVA & 45 kA for 1000 kVA)	kA _{rms}	As per rating.
6.6		Min clearance to earth and between phases	mm	20
6.7		Provision of a LV neutral surge armineral fitted between mini-sub earth bar and LV neutral-earth bus-bar		Required
6.8		LV neutral-earth bus-bar to be earthed (via an electrical bridge to the mini-sub earth bar)		Required
6.9		Neutral isolating links		Not Required
6.10		Provision of LV main isolating switch		Not Required
6.11		Number of outgoing LV feeders to be provided for (drill bus-bar Ø14mm holes)		6
		Spacing between holes (see Figure 1)	mm	110
6.12		LV panel designed for large frame MCCBs		Required
6.13		Spacing (vertical): Between phase bus-bars	mm	185
		Between lowest LV bus-bar and LV neutral	mm	300
		Minimum distance between LV neutral and uni-strut	mm	200

**Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be
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Annex C - Technical schedules A and B for

**MSS TB 500KVA SR DYN11 3MM THICK AV SF6 FREE RMU OIL TYPE TRFR
(SAP 4364)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
6.14		LV maximum demand ammeters	On all three phases	
6.15		Ammeter type	Thermal integrating over 15 min period	
6.16		LV indicating voltmeter with a selector switch	Required	
6.17		Ammeter and voltmeter size and display mm	96 × 96, 90°	
6.18		Ammeter and voltmeter position	Top right hand side in LV compartment	
6.19		Analogue meter capable of reading current and voltage	Required	
6.20		Provision of removable non flammable barrier to separate LV end compartment and front LV compartment	Required	
6.21		Main MCCB manufacturer	Required	
6.22		Catalogue/model code of main MCCB	Required	
6.23		Size of main MCCB A	As per table 2	

Note: Ticks, Cross [√, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Annex C - Technical schedules A and B for

**MSS TB 500KVA SR DYN11 3MM THICK AV SF6 FREE RMU OIL TYPE TRFR
(SAP 4364)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
7	4.2.6	LV auxiliaries		
7.1		Provision of three point socket outlet and 60W bulkhead fitting in LV compartment (with instantaneous-trip earth leakage unit [20 A; 5 kA rupturing capacity; 30 mA sensitivity] and 20 A HRC fuse with neutral fuse link)	Required	
7.2		Numbering ferrules for auxiliary wiring	Required	
7.3		Push-button fitted to shunt trip RMU tee-off	Required	
8	4.3.2	Materials and corrosion protection		
8.1		Mini-sub enclosure and transformer tank thickness 3 or 6(mm)	Mild steel	
8.2		Radiator thickness	Mild steel	
8.3		Tinned copper bus-bars	Required	
8.4		Mini-sub base:Material	Steel	
8.5		5mm cork packing (between ends and tank, base and ends, base and tank, and base and plinth)	Required	
8.6		Final colour	Avocado Green (12)	

Note: Ticks, Cross [√, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Annex C - Technical schedules A and B for

**MSS TB 500KVA SR DYN11 3MM THICK AV SF6 FREE RMU OIL TYPE TRFR
(SAP 4364)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
19	4.6.2	Notices, signs and labels		
9.1		Transformer rating plate	Required	
9.2		Treatment and Full First Aid Instructions on inside of MV and LV compartment doors	Required	
9.3		Elec. warning signs on all doors and barriers	Required	
9.4		Transformer phase labels below bushings	Required	
9.5		Colour-coded LV bus-bars	Required	
9.6		Stenciled labeling of MV and LV compartment doors (both inside and outside)	Required	
9.7		kVA, Prim V, Sec V & Corrosion Class	Required	
9.8		ID markings linking roof to body per batch	Required	
9.9		Provision for the safe-keeping of documents	Required	
10	4.7	Documentation		
10.1		Type test reportss (provide ref. numbers of reports)	Sets 1	
10.2		Routine test reportss	Sets 1	
10.3		Drawings	Sets 2	
10.4		Circuit diagrams (LV auxiliary wiring and equipment)	Sets 2	

Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Technical schedules A and B Deviation schedule for

**MSS TB 500KVA SR DYN11 3MM THICK AV SF6 FREE RMU OIL TYPE TRFR
(SAP 4364)**

Any deviations offered to this specification shall be listed below with reasons for deviation. In addition, evidence shall be provided that the proposed deviation will at least be more cost-effective than that specified by City Power.

Item	Sub clause of CP_TSSPEC_005	Proposed deviation

Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

Tender Number: _____

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Annex C - Technical schedules A and B for

**MSS TB 500KVA DR DYN11 3MM THICK AV SF6 FREE RMU OIL TYPE
TRFR (SAP 4365)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
1		Standard operating conditions		
1.1		z) Altitude m	1800	
1.2		b) Ambient air temperature °C	-5 to +40	
1.3		c) Lightning ground flash density Flashes/ km ² /year	> 10	
1.4		d) Maximum solar radiation W/m ²	1000	
1.5		e) Ultraviolet radiation	High	
1.6		f) Relative humidity %	10 to 95	
1.7		g) Corrosive conditions (inland therefore non-corrosive)	Non- corrosive	
1.8		h) wind pressure Pa	700	
2	4.2.1	Ratings		
2.1		Transformer power rating kVA	500	
2.2		Nominal voltage of system (Dual ratio) kV _{rms}	6,6 & 11	
2.3		System frequency Hz	50	
2.4		Number of phases	3	
2.5		Rated no-load secondary voltage V _{rms}	415	
2.6		Rated power-frequency voltage kV _{rms}	12	
2.7		Rated lightning impulse withstand voltage kV _{peak}	95	
2.8		Rated short-duration power frequency withstand voltage [50Hz: 1 min] kV _{rms}	28	
2.9		Induced voltage withstand level kV _{rms}	22	
2.10		Internal arc classification	AB-FLR	
2.11		Internal arc current and duration	20KA/500 ms	

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Annex C - Technical schedules A and B for

**MSS TB 500KVA DR DYN11 3MM THICK AV SF6 FREE RMU OIL TYPE TRFR
(SAP 4365)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
3	4.3.1	Construction design		
3.1		Layout	Type B	
3.2		Construction	Modular	
3.3		Removable base sections adjacent to MV compartment (sections to lap bolted with nuts on the inside of the channel and housing)	Required	
3.4		All doors shall be a manual three point locking mechanism, capable of being secured by a padlock, having a shackle diameter of 8mm.	Required	
3.5		Compartment lock protection facility (with welded mesh top with inside visibility)	Required	
3.6		Total mass of miniature substation Kg	Required	
3.7		Overall maximum dimensions	Required	
3.8		a) MV compartment length mm	Required	
		b) LV compartment length mm	Required	
		c) LV metering compartment mm	400 x 400	
		d) Overall length mm	3000	
		e) Overall width mm	1650	
		f) Overall height mm	2000	
		g)Base width Mm	1200	
		h)Thickness mm	3	
		Provision for lifting of complete mini-sub onto a concrete plinth without need for dismantling	Required	
3.9		Provision of lifting lugs on roof for ease of removal	Required	
3.10		MV switchgear, LV panel, LV metering and transformer confined to separate compartments	Required	
3.11		Mini-sub housing sections and doors bonded	Required	

Note: Ticks, Cross [√, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Annex C - Technical schedules A and B for

**MSS TB 500KVA DR DYN11 3MM THICK AV SF6 FREE RMU OIL TYPE TRFR
(SAP 4365)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
4	4.2.1	Transformer unit(Oil immersed)		
4.1		Electrical requirements	As per SANS 780	
4.2		Vector group	Dyn 11	
4.3		MV system earthing	Effective	
4.4		LV transformer neutral earthing	Solid – connection to insulated LV neutral/earth bar	
4.5		MV system fault level	kA 25	
4.6		Temperature rise limits	As per SANS 780 Table 6	
4.7		Secondary voltage regulation (Off-load on the 11 kV supply voltage windings)	% +6.0, + 3.0, 0, –3.0, –6.0	
4.8		No-load losses	W Required	
4.9		Load losses	W Required	
4.10		Impedance	% SANS780	
4.11		Cost /kW of no-load losses (Jul 2002)	R/kW 13 669	
4.12		Cost /kW of load losses (Jul 2002)	R/kW 1 623	
4.13		X/R	SANS780	
4.14		Audio-sound level – maximum (see table 6)	dB(A) Table 6	
4.15		Sealed transformer unit	Required	

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Annex C - Technical schedules A and B for

**MSS TB 500KVA DR DYN11 3MM THICK AV SF6 FREE RMU OIL TYPE TRFR
(SAP 4365)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
4.16	4.4.2	Transformer MV bushings (NB internal screen to be earthed)	BS 7215 –Type C with M16x2 thread	
4.17		MV bushing-centre clearances (minimum) mm	135	
4.18		Clearances between outer bushing-centres and mini-sub metal enclosure (minimum) mm	90	
4.19		Transformer overload protection facility	Required	
4.20		Winding material	MV Copper LV Copper	
4.21		Manufacturer of the distribution transformer	Required	
5		MV compartment		
5.1		Equipment in MV compartment	SF6 FREE Ring Main Unit (CP_TSSPEC_006)	
5.2		Ring Main Unit manufacturer	Required	
5.5		Incoming MV cable requirements		
		a) 185 mm ² 3 core Cu or 300 mm ² 3C Al XLPE	Required	
		b) Cable support (clamping) required	Required	
		c) Minimum distance from cable clamp to centre-line of RMU bushings mm	800	
		d) Type of connection	Screened	
5.6		Mini-sub earth bar (accessible in front of RMU)	Required	
5.7		Interconnection arrangement between RMU and transformer MV bushings	Required	
5.8		Unscreened interconnecting equipment and connections between ring main unit and transformer to be barricaded	Required	
5.9		Type of earth fault indicator	Required	
5.10		Voltage detecting system (VDS)	Required	

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Annex C - Technical schedules A and B for

**MSS TB 500KVA DR DYN11 3MM THICK AV SF6 FREE RMU OIL TYPE TRFR
(SAP 4365)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
6	4.2.8	LV Compartment		
6.1		Bus-bar-rating (see Table 2)	A	1,2 times the kVA capacity
6.2		Bus-bar-insulation		Air insulated
6.3		Bus-bars	Ø	3 + one identical neutral-earth bus-bar (insulated from frame)
6.4		Current density of bus-bars	A/mm ²	1,8 maximum
6.5		Rated withstand current – 1 s (25 kA for up to 630 kVA & 45 kA for 1000 kVA)	kA _{rms}	As per rating.
6.6		Min clearance to earth and between phases	mm	20
6.7		Provision of a LV neutral surge armineral fitted between mini-sub earth bar and LV neutral-earth bus-bar		Required
6.8		LV neutral-earth bus-bar to be earthed (via an electrical bridge to the mini-sub earth bar)		Required
6.9		Neutral isolating links		Not Required
6.10		Provision of LV main isolating switch		Not Required
6.11		Number of outgoing LV feeders to be provided for (drill bus-bar Ø14mm holes)		6
6.12		Spacing between holes (see Figure 1)	mm	110
6.13		LV panel designed for large frame MCCBs		Required
		Spacing (vertical): Between phase bus-bars	mm	185
		Between lowest LV bus-bar and LV neutral	mm	300
		Minimum distance between LV neutral and uni-strut	mm	200

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Annex C - Technical schedules A and B for

TB 500KVA DR DYN11 3MM THICK AV SF6 FREE RMU OIL TYPE TRFR (SAP 4365)

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
6.14		LV maximum demand ammeters	On all three phases	
6.15		Ammeter type	Thermal integrating over 15 min period	
6.16		LV indicating voltmeter with a selector switch	Required	
6.17		Ammeter and voltmeter size and display mm	96 × 96, 90°	
6.18		Ammeter and voltmeter position	Top right hand side in LV compartment	
6.19		Analogue meter capable of reading current and voltage	Required	
6.20		Provision of removable non flammable barrier to separate LV end compartment and front LV compartment	Required	
6.21		Main MCCB manufacturer	Required	
6.22		Catalogue/model code of main MCCB	Required	
6.23		Size of main MCCB A	As per table 2	

Note: Ticks, Cross [√, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Annex C - Technical schedules A and B for

**MSS TB 500KVA DR DYN11 3MM THICK AV SF6 FREE RMU OIL TYPE TRFR
(SAP 4365)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
7	4.2.6	LV auxiliaries		
7.1		Provision of three point socket outlet and 60Wbulkhead fitting in LV compartment (with instantaneous-trip earth leakage unit [20 A; 5 kA rupturing capacity; 30 mA sensitivity] and 20 A HRC fuse with neutral fuse link)	Required	
7.2		Numbering ferrules for auxiliary wiring	Required	
7.3		Push-button fitted to shunt trip RMU tee-off	Required	
8	4.3.2	Materials and corrosion protection		
8.1		Mini-sub enclosure and transformer tank thickness 6(mm)or 3 mm	Mild steel	
8.2		Radiator thickness	Mild steel	
8.3		Tinned copper bus-bars	Required	
8.4		Mini-sub base:Material	Steel	
8.5		5mm cork packing (between ends and tank, base and ends, base and tank, and base and plinth)	Required	
8.6		Final colour	Avocado Green (12)	

Note: Ticks, Cross [√, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Annex C - Technical schedules A and B for

**MSS TB 500KVA DR DYN11 3MM THICK AV SF6 FREE RMU OIL TYPE TRFR
(SAP 4365)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
9	4.6.2	Notices, signs and labels		
9.1		Transformer rating plate	Required	
9.2		Treatment and Full First Aid Instructions on inside of MV and LV compartment doors	Required	
9.3		Elec. warning signs on all doors and barriers	Required	
9.4		Transformer phase labels below bushings	Required	
9.5		Colour-coded LV bus-bars	Required	
9.6		Stenciled labeling of MV and LV compartment doors (both inside and outside)	Required	
9.7		kVA, Prim V, Sec V & Corrosion Class	Required	
9.8		ID markings linking roof to body per batch	Required	
9.9		Provision for the safe-keeping of documents	Required	
10	4.7	Documentation		
10.1		Type test reportss (provide ref. numbers of reports)	Sets 1	
10.2		Routine test reportss	Sets 1	
10.3		Drawings	Sets 2	
10.4		Circuit diagrams (LV auxiliary wiring and equipment)	Sets 2	

Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Technical schedules A and B Deviation schedule for

**MSS TB 500KVA DR DYN11 3MM THICK AV SF6 FREE RMU OIL TYPE TRFR
(SAP 4365)**

Any deviations offered to this specification shall be listed below with reasons for deviation. In addition, evidence shall be provided that the proposed deviation will at least be more cost-effective than that specified by City Power.

Item	Sub clause of CP_TSSPEC_005	Proposed deviation

Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Annex C - Technical schedules A and B for

**MSS TB 500KVA SR DYN11 6MM THICK AV SF6 FREE RMU OIL TYPE
TRFR (SAP 4369)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
1		Standard operating conditions		
1.1		aa) Altitude m	1800	
1.2		b) Ambient air temperature °C	-5 to +40	
1.3		c) Lightning ground flash density Flashes/ km ² /year	> 10	
1.4		d) Maximum solar radiation W/m ²	1000	
1.5		e) Ultraviolet radiation	High	
1.6		f) Relative humidity %	10 to 95	
1.7		g) Corrosive conditions (inland therefore non-corrosive)	Non- corrosive	
1.8		h) wind pressure Pa	700	
2	4.2.1	Ratings		
2.1		Transformer power rating kVA	500	
2.2		Nominal voltage of system (Single ratio) kV _{rms}	11	
2.3		System frequency Hz	50	
2.4		Number of phases	3	
2.5		Rated no-load secondary voltage V _{rms}	415	
2.6		Rated power-frequency voltage kV _{rms}	12	
2.7		Rated lightning impulse withstand voltage kV _{peak}	95	
2.8		Rated short-duration power frequency withstand voltage [50Hz: 1 min] kV _{rms}	28	
2.9		Induced voltage withstand level kV _{rms}	22	
2.10		Internal arc classification	AB-FLR	
2.11		Internal arc current and duration	20KA/500 ms	

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Annex C - Technical schedules A and B for

**MSS TB 500KVA SR DYN11 6MM THICK AV SF6 FREE RMU OIL TYPE TRFR
(SAP 4369)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
3	4.3.1	Construction design		
3.1		Layout	Type B	
3.2		Construction	Modular	
3.3		Removable base sections adjacent to MV compartment (sections to lap bolted with nuts on the inside of the channel and housing)	Required	
3.4		All doors shall be a manual three point locking mechanism, capable of being secured by a padlock, having a shackle diameter of 8mm.	Required	
3.5		Compartment lock protection facility (with welded mesh top with inside visibility)	Required	
3.6		Total mass of miniature substation Kg	Required	
3.7		Overall maximum dimensions		
3.8		a) MV compartment length mm	Required	
		b) LV compartment length mm	Required	
		c) LV metering compartment mm	400 x 400	
		d) Overall length mm	3000	
		e) Overall width mm	1650	
		f) Overall height mm	2000	
		g) Base width mm	1200	
		h) Thickness mm	6	
		Provision for lifting of complete mini-sub onto a concrete plinth without need for dismantling	Required	
3.9		Provision of lifting lugs on roof for ease of removal	Required	
3.10		MV switchgear, LV panel, LV metering and transformer confined to separate compartments	Required	
3.11		Mini-sub housing sections and doors bonded	Required	

Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Annex C - Technical schedules A and B for

**MSS TB 500KVA SR DYN11 6MM THICK AV SF6 FREE RMU OIL TYPE TRFR
(SAP 4369)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
4	4.2.1	Transformer unit(Oil immersed)		
4.1		Electrical requirements	As per SANS 780	
4.2		Vector group	Dyn 11	
4.3		MV system earthing	Effective	
4.4		LV transformer neutral earthing	Solid – connection to insulated LV neutral/earth bar	
4.5		MV system fault level	kA 25	
4.6		Temperature rise limits	As per SANS 780 Table 6	
4.7		Secondary voltage regulation (Off-load on the 11 kV supply voltage windings)	% +6.0, + 3.0, 0, –3.0, –6.0	
4.8		No-load losses	W Required	
4.9		Load losses	W Required	
4.10		Impedance	% SANS780	
4.11		Cost /kW of no-load losses (Jul 2002)	R/kW 13 669	
4.12		Cost /kW of load losses (Jul 2002)	R/kW 1 623	
4.13		X/R	SANS780	
4.14		Audio-sound level – maximum (see table 6)	dB(A) Table 6	
4.15		Sealed transformer unit	Required	

Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA [“To Be Advice”] will not be accepted.

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Annex C - Technical schedules A and B for

**MSS TB 500KVA SR DYN11 6MM THICK AV SF6 FREE RMU OIL TYPE TRFR
(SAP 4369)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
4.16	4.4.2	Transformer MV bushings (NB internal screen to be earthed)	BS 7215 –Type C with M16x2 thread	
4.17		MV bushing-centre clearances (minimum) mm	135	
4.18		Clearances between outer bushing-centres and mini-sub metal enclosure (minimum) mm	90	
4.19		Transformer overload protection facility	Required	
4.20		Winding material	MV Copper LV Copper	
4.21		Manufacturer of the distribution transformer	Required	
5		MV compartment		
5.1		Equipment in MV compartment	SF6 FREE Ring Main Unit (CP_TSSPEC_006)	
5.2		Ring Main Unit manufacturer	Required	
5.5		Incoming MV cable requirements		
		a) 185 mm ² 3 core Cu or 300 mm ² 3C Al XLPE	Required	
		b) Cable support (clamping) required	Required	
		c) Minimum distance from cable clamp to centre-line of RMU bushings mm	800	
		d) Type of connection	Screened	
5.6		Mini-sub earth bar (accessible in front of RMU)	Required	
5.7		Interconnection arrangement between RMU and transformer MV bushings	Required	
5.8		Unscreened interconnecting equipment and connections between ring main unit and transformer to be barricaded	Required	
5.9		Type of earth fault indicator	Required	
5.10		Voltage detecting system (VDS)	Required	

Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA [“To Be Advice”] will not be accepted.

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Annex C - Technical schedules A and B for

**MSS TB 500KVA SR DYN11 6MM THICK AV SF6 FREE RMU OIL TYPE TRFR
(SAP 4369)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
6	4.2.8	LV Compartment		
6.1		Bus-bar-rating (see Table 2)	A	1,2 times the kVA capacity
6.2		Bus-bar-insulation		Air insulated
6.3		Bus-bars	Ø	3 + one identical neutral-earth bus-bar (insulated from frame)
6.4		Current density of bus-bars	A/mm ²	1,8 maximum
6.5		Rated withstand current – 1 s (25 kA for up to 630 kVA & 45 kA for 1000 kVA)	kA _{rms}	As per rating.
6.6		Min clearance to earth and between phases	mm	20
6.7		Provision of a LV neutral surge armineral fitted between mini-sub earth bar and LV neutral-earth bus-bar		Required
6.8		LV neutral-earth bus-bar to be earthed (via an electrical bridge to the mini-sub earth bar)		Required
6.9		Neutral isolating links		Not Required
6.10		Provision of LV main isolating switch		Not Required
6.11		Number of outgoing LV feeders to be provided for (drill bus-bar Ø14mm holes)		6
6.12		Spacing between holes (see Figure 1)	mm	110
6.13		LV panel designed for large frame MCCBs		Required
		Spacing (vertical): Between phase bus-bars	mm	185
		Between lowest LV bus-bar and LV neutral	mm	300
		Minimum distance between LV neutral and uni-strut	mm	200

**Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be
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Annex C - Technical schedules A and B for

**MSS TB 500KVA SR DYN11 6MM THICK AV SF6 FREE RMU OIL TYPE TRFR
(SAP 4369)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
6.14		LV maximum demand ammeters	On all three phases	
6.15		Ammeter type	Thermal integrating over 15 min period	
6.16		LV indicating voltmeter with a selector switch	Required	
6.17		Ammeter and voltmeter size and display mm	96 × 96, 90°	
6.18		Ammeter and voltmeter position	Top right hand side in LV compartment	
6.19		Analogue meter capable of reading current and voltage	Required	
6.20		Provision of removable non flammable barrier to separate LV end compartment and front LV compartment	Required	
6.21		Main MCCB manufacturer	Required	
6.22		Catalogue/model code of main MCCB	Required	
6.23		Size of main MCCB A	As per table 2	

Note: Ticks, Cross [√, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Annex C - Technical schedules A and B for

**MSS TB 500KVA SR DYN11 6MM THICK AV SF6 FREE RMU OIL TYPE TRFR
(SAP 4369)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
7	4.2.6	LV auxiliaries		
7.1		Provision of three point socket outlet and 60W bulkhead fitting in LV compartment (with instantaneous-trip earth leakage unit [20 A; 5 kA rupturing capacity; 30 mA sensitivity] and 20 A HRC fuse with neutral fuse link)	Required	
7.2		Numbering ferrules for auxiliary wiring	Required	
7.3		Push-button fitted to shunt trip RMU tee-off	Required	
8	4.3.2	Materials and corrosion protection		
8.1		Mini-sub enclosure and transformer tank thickness 6(mm) or 3 mm	Mild steel	
8.2		Radiator thickness	Mild steel	
8.3		Tinned copper bus-bars	Required	
8.4		Mini-sub base:Material	Steel	
8.5		5mm cork packing (between ends and tank, base and ends, base and tank, and base and plinth)	Required	
8.6		Final colour	Avocado Green (12)	

Note: Ticks, Cross [√, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Annex C - Technical schedules A and B for

**MSS TB 500KVA SR DYN11 6MM THICK AV SF6 FREE RMU OIL TYPE TRFR
(SAP 4369)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
9	4.6.2	Notices, signs and labels		
9.1		Transformer rating plate	Required	
9.2		Treatment and Full First Aid Instructions on inside of MV and LV compartment doors	Required	
9.3		Elec. warning signs on all doors and barriers	Required	
9.4		Transformer phase labels below bushings	Required	
9.5		Colour-coded LV bus-bars	Required	
9.6		Stenciled labeling of MV and LV compartment doors (both inside and outside)	Required	
9.7		kVA, Prim V, Sec V & Corrosion Class	Required	
9.8		ID markings linking roof to body per batch	Required	
9.9		Provision for the safe-keeping of documents	Required	
10	4.7	Documentation		
10.1		Type test reportss (provide ref. numbers of reports) Sets	1	
10.2		Routine test reportss Sets	1	
10.3		Drawings Sets	2	
10.4		Circuit diagrams (LV auxiliary wiring and equipment) Sets	2	

Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Technical schedules A and B Deviation schedule for

**MSS TB 500KVA SR DYN11 6MM THICK AV SF6 FREE RMU OIL TYPE TRFR
(SAP 4369)**

Any deviations offered to this specification shall be listed below with reasons for deviation. In addition, evidence shall be provided that the proposed deviation will at least be more cost-effective than that specified by City Power.

Item	Sub clause of CP_TSSPEC_005	Proposed deviation

Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Annex C - Technical schedules A and B for

**MSS TB 500KVA DR DYN11 6MM THICK AV SF6 FREE RMU OIL TYPE
TRFR (SAP 4370)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
1		Standard operating conditions		
1.1		bb) Altitude m	1800	
1.2		b) Ambient air temperature °C	-5 to +40	
1.3		c) Lightning ground flash density Flashes/ km ² /year	> 10	
1.4		d) Maximum solar radiation W/m ²	1000	
1.5		e) Ultraviolet radiation	High	
1.6		f) Relative humidity %	10 to 95	
1.7		g) Corrosive conditions (inland therefore non-corrosive)	Non- corrosive	
1.8		h) wind pressure Pa	700	
2	4.2.1	Ratings		
2.1		Transformer power rating kVA	500	
2.2		Nominal voltage of system (Dual ratio) kV _{rms}	6,6 & 11	
2.3		System frequency Hz	50	
2.4		Number of phases	3	
2.5		Rated no-load secondary voltage V _{rms}	415	
2.6		Rated power-frequency voltage kV _{rms}	2	
2.7		Rated lightning impulse withstand voltage kV _{peak}	95	
2.8		Rated short-duration power frequency withstand voltage [50Hz: 1 min] kV _{rms}	28	
2.9		Induced voltage withstand level kV _{rms}	22	
2.10		Internal arc classification	AB-FLR	
2.11		Internal arc current and duration	20KA/500 ms	

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Annex C - Technical schedules A and B for

**MSS TB 500KVA DR DYN11 6MM THICK AV SF6 FREE RMU OIL TYPE TRFR
(SAP 4370)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
3	4.3.1	Construction design		
3.1		Layout	Type B	
3.2		Construction	Modular	
3.3		Removable base sections adjacent to MV compartment (sections to lap bolted with nuts on the inside of the channel and housing)	Required	
3.4		All doors shall be a manual three point locking mechanism, capable of being secured by a padlock, having a shackle diameter of 8mm.	Required	
3.5		Compartment lock protection facility (with welded mesh top with inside visibility)	Required	
3.6		Total mass of miniature substation Kg	Required	
3.7		Overall maximum dimensions	Required	
3.8		a) MV compartment length mm	Required	
		b) LV compartment length mm	Required	
		c) LV metering compartment mm	400 x 400	
		d) Overall length mm	3000	
		e) Overall width mm	1650	
		f) Overall height mm	2000	
		g)Base width Mm	1200	
		h)Thickness mm	6	
		Provision for lifting of complete mini-sub onto a concrete plinth without need for dismantling	Required	
3.9		Provision of lifting lugs on roof for ease of removal	Required	
3.10		MV switchgear, LV panel, LV metering and transformer confined to separate compartments	Required	
3.11		Mini-sub housing sections and doors bonded	Required	

Note: Ticks, Cross [√, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Annex C - Technical schedules A and B for

**MSS TB 500KVA DR DYN11 6MM THICK AV SF6 FREE RMU OIL TYPE TRFR
(SAP 4370)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
4	4.2.1	Transformer unit(Oil immersed)		
4.1		Electrical requirements	As per SANS 780	
4.2		Vector group	Dyn 11	
4.3		MV system earthing	Effective	
4.4		LV transformer neutral earthing	Solid – connection to insulated LV neutral/earth bar	
4.5		MV system fault level	kA 25	
4.6		Temperature rise limits	As per SANS 780 Table 6	
4.7		Secondary voltage regulation (Off-load on the 11 kV supply voltage windings)	% +6.0, + 3.0, 0, –3.0, –6.0	
4.8		No-load losses	W Required	
4.9		Load losses	W Required	
4.10		Impedance	% SANS780	
4.11		Cost /kW of no-load losses (Jul 2002)	R/kW 13 669	
4.12		Cost /kW of load losses (Jul 2002)	R/kW 1 623	
4.13		X/R	SANS780	
4.14		Audio-sound level – maximum (see table 6)	dB(A) Table 6	
4.15		Sealed transformer unit	Required	

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**MSS TB 500KVA DR DYN11 6MM THICK AV SF6 FREE RMU OIL TYPE TRFR
(SAP 4370)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
4.16	4.4.2	Transformer MV bushings (NB internal screen to be earthed)	BS 7215 –Type C with M16x2 thread	
4.17		MV bushing-centre clearances (minimum) mm	135	
4.18		Clearances between outer bushing-centres and mini-sub metal enclosure (minimum) mm	90	
4.19		Transformer overload protection facility	Required	
4.20		Winding material	MV Copper LV Copper	
4.21		Manufacturer of the distribution transformer	Required	
5		MV compartment		
5.1		Equipment in MV compartment	SF6 FREE Ring Main Unit (CP_TSSPEC_006)	
5.2		Ring Main Unit manufacturer	Required	
5.5		Incoming MV cable requirements		
		a) 185 mm ² 3 core Cu or 300 mm ² 3C Al XLPE	Required	
		b) Cable support (clamping) required	Required	
		c) Minimum distance from cable clamp to centre-line of RMU bushings mm	800	
		d) Type of connection	Screened	
5.6		Mini-sub earth bar (accessible in front of RMU)	Required	
5.7		Interconnection arrangement between RMU and transformer MV bushings	Required	
5.8		Unscreened interconnecting equipment and connections between ring main unit and transformer to be barricaded	Required	
5.9		Type of earth fault indicator	Required	
5.10		Voltage detecting system (VDS)	Required	

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Annex C - Technical schedules A and B for

**MSS TB 500KVA DR DYN11 6MM THICK AV SF6 FREE RMU OIL TYPE TRFR
(SAP 4370)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
6	4.2.8	LV Compartment		
6.1		Bus-bar-rating (see Table 2)	A	1,2 times the kVA capacity
6.2		Bus-bar-insulation		Air insulated
6.3		Bus-bars	Ø	3 + one identical neutral-earth bus-bar (insulated from frame)
6.4		Current density of bus-bars	A/mm ²	1,8 maximum
6.5		Rated withstand current – 1 s (25 kA for up to 630 kVA & 45 kA for 1000 kVA)	kA _{rms}	As per rating.
6.6		Min clearance to earth and between phases	mm	20
6.7		Provision of a LV neutral surge armineral fitted between mini-sub earth bar and LV neutral-earth bus-bar		Required
6.8		LV neutral-earth bus-bar to be earthed (via an electrical bridge to the mini-sub earth bar)		Required
6.9		Neutral isolating links		Not Required
6.10		Provision of LV main isolating switch		Not Required
6.11		Number of outgoing LV feeders to be provided for (drill bus-bar Ø14mm holes)		6
6.12		Spacing between holes (see Figure 1)	mm	110
6.13		LV panel designed for large frame MCCBs		Required
		Spacing (vertical): Between phase bus-bars	mm	185
		Between lowest LV bus-bar and LV neutral	mm	300
		Minimum distance between LV neutral and uni-strut	mm	200

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Annex C - Technical schedules A and B for

**MSS TB 500KVA DR DYN11 6MM THICK AV SF6 FREE RMU OIL TYPE TRFR
(SAP 4370)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
6.14		LV maximum demand ammeters	On all three phases	
6.15		Ammeter type	Thermal integrating over 15 min period	
6.16		LV indicating voltmeter with a selector switch	Required	
6.17		Ammeter and voltmeter size and display mm	96 × 96, 90°	
6.18		Ammeter and voltmeter position	Top right hand side in LV compartment	
6.19		Analogue meter capable of reading current and voltage	Required	
6.20		Provision of removable non flammable barrier to separate LV end compartment and front LV compartment	Required	
6.21		Main MCCB manufacturer	Required	
6.22		Catalogue/model code of main MCCB	Required	
6.23		Size of main MCCB A	As per table 2	

Note: Ticks, Cross [√, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Annex C - Technical schedules A and B for

**MSS TB 500KVA DR DYN11 6MM THICK AV SF6 FREE RMU OIL TYPE TRFR
(SAP 4370)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
7	4.2.6	LV auxiliaries		
7.1		Provision of three point socket outlet and 60Wbulkhead fitting in LV compartment (with instantaneous-trip earth leakage unit [20 A; 5 kA rupturing capacity; 30 mA sensitivity] and 20 A HRC fuse with neutral fuse link)	Required	
7.2		Numbering ferrules for auxiliary wiring	Required	
7.3		Push-button fitted to shunt trip RMU tee-off	Required	
8	4.3.2	Materials and corrosion protection		
8.1		Mini-sub enclosure and transformer tank thickness 6(mm) or 3 mm	Mild steel	
8.2		Radiator thickness	Mild steel	
8.3		Tinned copper bus-bars	Required	
8.4		Mini-sub base:Material	Steel	
8.5		5mm cork packing (between ends and tank, base and ends, base and tank, and base and plinth)	Required	
8.6		Final colour	Avocado Green (12)	

Note: Ticks, Cross [√, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Annex C - Technical schedules A and B for

**MSS TB 500KVA DR DYN11 6MM THICK AV SF6 FREE RMU OIL TYPE TRFR
(SAP 4370)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
9	4.6.2	Notices, signs and labels		
9.1		Transformer rating plate	Required	
9.2		Treatment and Full First Aid Instructions on inside of MV and LV compartment doors	Required	
9.3		Elec. warning signs on all doors and barriers	Required	
9.4		Transformer phase labels below bushings	Required	
9.5		Colour-coded LV bus-bars	Required	
9.6		Stenciled labeling of MV and LV compartment doors (both inside and outside)	Required	
9.7		kVA, Prim V, Sec V & Corrosion Class	Required	
9.8		ID markings linking roof to body per batch	Required	
9.9		Provision for the safe-keeping of documents	Required	
10	4.7	Documentation		
10.1		Type test reportss (provide ref. numbers of reports)	Sets 1	
10.2		Routine test reportss	Sets 1	
10.3		Drawings	Sets 2	
10.4		Circuit diagrams (LV auxiliary wiring and equipment)	Sets 2	

Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Technical schedules A and B Deviation schedule for

**MSS TB 500KVA DR DYN11 6MM THICK AV SF6 FREE RMU OIL TYPE TRFR
(SAP 4370)**

Any deviations offered to this specification shall be listed below with reasons for deviation. In addition, evidence shall be provided that the proposed deviation will at least be more cost-effective than that specified by City Power.

Item	Sub clause of CP_TSSPEC_005	Proposed deviation

Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Annex C - Technical schedules A and B for

**MSS TB 500KVA SR DYN11 3MM THICK AV SF6 FREE RMU DRY TYPE TRFR
(SAP 4379)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
1		Standard operating conditions		
1.1		cc) Altitude m	1800	
1.2		b) Ambient air temperature °C	-5 to +40	
1.3		c) Lightning ground flash density Flashes/ km ² /year	> 10	
1.4		d) Maximum solar radiation W/m ²	1000	
1.5		e) Ultraviolet radiation	High	
1.6		f) Relative humidity %	10 to 95	
1.7		g) Corrosive conditions (inland therefore non-corrosive)	Non- corrosive	
1.8		h) wind pressure Pa	700	
2	4.2.1	Ratings		
2.1		Transformer power rating kVA	500	
2.2		Nominal voltage of system (Single ratio) kV _{rms}	11	
2.3		System frequency Hz	50	
2.4		Number of phases	3	
2.5		Rated no-load secondary voltage V _{rms}	415	
2.6		Rated power-frequency voltage kV _{rms}	12	
2.7		Rated lightning impulse withstand voltage kV _{peak}	95	
2.8		Rated short-duration power frequency withstand voltage [50Hz: 1 min] kV _{rms}	28	
2.9		Induced voltage withstand level kV _{rms}	22	
2.10		Internal arc classification	AB-FLR	
2.11		Internal arc current and duration	20KA/500 ms	

Note: Ticks, Cross [√, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Annex C - Technical schedules A and B for

**MSS TB 500KVA SR DYN11 3MM THICK AV SF6 FREE RMU DRY TYPE TRFR
(SAP 4379)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
3	4.3.1	Construction design		
3.1		Layout	Type B	
3.2		Construction	Modular	
3.3		Removable base sections adjacent to MV compartment (sections to lap bolted with nuts on the inside of the channel and housing)	Required	
3.4		All doors shall be a manual three point locking mechanism, capable of being secured by a padlock, having a shackle diameter of 8mm.	Required	
3.5		Compartment lock protection facility (with welded mesh top with inside visibility)	Required	
3.6		Total mass of miniature substation Kg	Required	
3.7		Overall maximum dimensions	Required	
3.8		a) MV compartment length mm	Required	
		b) LV compartment length mm	Required	
		c) LV metering compartment mm	400 x 400	
		d) Overall length mm	3000	
		e) Overall width mm	1650	
		f) Overall height mm	2000	
		g)Base width mm	1200	
		h)Thickness mm	3	
		Provision for lifting of complete mini-sub onto a concrete plinth without need for dismantling	Required	
3.9		Provision of lifting lugs on roof for ease of removal	Required	
3.10		MV switchgear, LV panel, LV metering and transformer confined to separate compartments	Required	
3.11		Mini-sub housing sections and doors bonded	Required	

Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Annex C - Technical schedules A and B for

**MSS TB 500KVA SR DYN11 3MM THICK AV SF6 FREE RMU DRY TYPE TRFR
(SAP 4379)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
4	4.2.1	Transformer unit (Dry-Type)		
4.1		Electrical requirements	As per SANS 60076	
4.2		Vector group	Dyn 11	
4.3		MV system earthing	Effective	
4.4		LV transformer neutral earthing	Solid – connection to insulated LV neutral/earth bar	
4.5		MV system fault level	kA 25	
4.6		Temperature rise limits	As per SANS 780 Table 6/60076	
4.7		Secondary voltage regulation (Off-load on the 11 kV supply voltage windings)	% +6.0, + 3.0, 0, –3.0, –6.0	
4.8		No-load losses	W Required	
4.9		Load losses	W Required	
4.10		Impedance	% SANS 780	
4.11		Cost /kW of no-load losses (Jul 2002)	R/kW 13 669	
4.12		Cost /kW of load losses (Jul 2002)	R/kW 1 623	
4.13		X/R	SANS 60076	
4.14		Audio-sound level – maximum	dB(A) Required	
4.15		Sealed transformer unit	Required	

Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA [“To Be Advice”] will not be accepted.

Tender Number: _____

Tenderer's Authorised Signatory: _____
Name in block letters Signature

Full name of company: _____

Annex C - Technical schedules A and B for

**MSS TB 500KVA SR DYN11 3MM THICK AV SF6 FREE RMU DRY TYPE TRFR
(SAP 4379)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
4.16	4.4.2	Transformer MV bushings (NB internal screen to be earthed)	BS 7215 –Type C with M16x2 thread	
4.17		MV bushing-centre clearances (minimum) mm	135	
4.18		Clearances between outer bushing-centres and mini-sub metal enclosure (minimum) mm	90	
4.19		Transformer overload protection facility	Required	
4.20		Winding material	MV Copper LV Copper	
4.21		Manufacturer of the distribution transformer	Required	
5		MV compartment		
5.1		Equipment in MV compartment	SF6 FREE Ring Main Unit (CP_TSSPEC_006)	
5.2		Ring Main Unit manufacturer	Required	
5.3		Incoming MV cable requirements		
		a) 185 mm ² 3 core Cu or 300 mm ² 3C Al XLPE	Required	
		b) Cable support (clamping) required	Required	
		c) Minimum distance from cable clamp to centre-line of RMU bushings mm	800	
		d) Type of connection	Screened	
5.4		Mini-sub earth bar (accessible in front of RMU)	Required	
5.5		Interconnection arrangement between RMU and transformer MV bushings	Required	
5.6		Unscreened interconnecting equipment and connections between ring main unit and transformer to be barricaded	Required	
5.7		Type of earth fault indicator	Required	
5.8		Voltage detecting system (VDS)	Required	

Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA [“To Be Advice”] will not be accepted.

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Annex C - Technical schedules A and B for

**MSS TB 500KVA SR DYN11 3MM THICK AV SF6 FREE RMU DRY TYPE TRFR
(SAP 4379)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
6	4.2.8	LV Compartment		
6.1		Bus-bar-rating (see Table 2)	A	1,2 times the kVA capacity
6.2		Bus-bar-insulation		Air insulated
6.3		Bus-bars	Ø	3 + one identical neutral-earth bus-bar (insulated from frame)
6.4		Current density of bus-bars	A/mm ²	1,8 maximum
6.5		Rated withstand current – 1 s (25 kA for up to 630 kVA & 45 kA for 1000 kVA)	kA _{rms}	As per rating.
6.6		Min clearance to earth and between phases	mm	20
6.7		Provision of a LV neutral surge armineral fitted between mini-sub earth bar and LV neutral-earth bus-bar		Required
6.8		LV neutral-earth bus-bar to be earthed (via an electrical bridge to the mini-sub earth bar)		Required
6.9		Neutral isolating links		Not Required
6.10		Provision of LV main isolating switch		Not Required
6.11		Number of outgoing LV feeders to be provided for (drill bus-bar Ø14mm holes)		6
6.12		Spacing between holes (see Figure 1)	mm	110
6.13		LV panel designed for large frame MCCBs		Required
		Spacing (vertical): Between phase bus-bars	mm	185
		Between lowest LV bus-bar and LV neutral	mm	300
		Minimum distance between LV neutral and uni-strut	mm	200

**Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be
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Annex C - Technical schedules A and B for

**MSS TB 500KVA SR DYN11 3MM THICK AV SF6 FREE RMU DRY TYPE TRFR
(SAP 4379)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
6.14		LV maximum demand ammeters	On all three phases	
6.15		Ammeter type	Thermal integrating over 15 min period	
6.16		LV indicating voltmeter with a selector switch	Required	
6.17		Ammeter and voltmeter size and display mm	96 × 96, 90°	
6.18		Ammeter and voltmeter position	Top right hand side in LV compartment	
6.19		Electronic meter capable of reading current and voltage	Required	
6.20		Provision of removable non flammable barrier to separate LV end compartment and front LV compartment	Required	
6.21		Main MCCB manufacturer	Required	
6.22		Catalogue/model code of main MCCB	Required	
6.23		Size of main MCCB A	As per table 2	

Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Annex C - Technical schedules A and B for

**MSS TB 500KVA SR DYN11 3MM THICK AV SF6 FREE RMU DRY TYPE TRFR
(SAP 4379)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
7	4.2.6	LV auxiliaries		
7.1		Provision of three point socket outlet and 60W bulkhead fitting in LV compartment (with instantaneous-trip earth leakage unit [20 A; 5 kA rupturing capacity; 30 mA sensitivity] and 20 A HRC fuse with neutral fuse link)	Required	
7.2		Numbering ferrules for auxiliary wiring	Required	
7.3		Push-button fitted to shunt trip RMU tee-off	Required	
8	4.3.2	Materials and corrosion protection		
8.1		Mini-sub enclosure and transformer tank thickness 6(mm) or 3 mm	Mild steel	
8.2		Radiator	Mild steel	
8.3		Tinned copper bus-bars	Required	
8.4		Mini-sub base:Material	Steel	
8.5		Uni-strut clamping bar:Material	Required	
8.6		5mm cork packing (between ends and tank, base and ends, base and tank, and base and plinth)	Required	
8.7		Final colour	Avocado Green (12)	

Note: Ticks, Cross [√, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Annex C - Technical schedules A and B for

**MSS TB 500KVA SR DYN11 3MM THICK AV SF6 FREE RMU DRY TYPE TRFR
(SAP 4379)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
9	4.6.2	Notices, signs and labels		
9.1		Transformer rating plate	Required	
9.2		Treatment and Full First Aid Instructions on inside of MV and LV compartment doors	Required	
9.3		Elec. warning signs on all doors and barriers	Required	
9.4		Transformer phase labels below bushings	Required	
9.5		Colour-coded LV bus-bars	Required	
9.6		Stenciled labeling of MV and LV compartment doors (both inside and outside)	Required	
9.7		kVA, Prim V, Sec V & Corrosion Class	Required	
9.8		ID markings linking roof to body per batch	Required	
9.9		Provision for the safe-keeping of documents	Required	
10	4.7	Documentation		
10.1		Type test reportss (provide ref. numbers of reports)	Sets 1	
10.2		Routine test reportss	Sets 1	
10.3		Drawings	Sets 2	
10.4		Circuit diagrams (LV auxiliary wiring and equipment)	Sets 2	

Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Technical schedules A and B Deviation schedule for

**MSS TB 500KVA SR DYN11 3MM THICK AV SF6 FREE RMU DRY TYPE TRFR
(SAP 4379)**

Any deviations offered to this specification shall be listed below with reasons for deviation. In addition, evidence shall be provided that the proposed deviation will at least be more cost-effective than that specified by City Power.

Item	Sub clause of CP_TSSPEC_005	Proposed deviation

Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Annex C - Technical schedules A and B for

**MSS TB 500KVA DR DYN11 3MM THICK AV SF6 FREE RMU DRY TYPE TRFR
(SAP 4380)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
1		Standard operating conditions		
1.1		dd) Altitude m	1800	
1.2		b) Ambient air temperature °C	-5 to +40	
1.3		c) Lightning ground flash density Flashes/ km ² /year	> 10	
1.4		d) Maximum solar radiation W/m ²	1000	
1.5		e) Ultraviolet radiation	High	
1.6		f) Relative humidity %	10 to 95	
1.7		g) Corrosive conditions (inland therefore non-corrosive)	Non- corrosive	
1.8		h) wind pressure Pa	700	
2	4.2.1	Ratings		
2.1		Transformer power rating kVA	500	
2.2		Nominal voltage of system (Dual ratio) kV _{rms}	6,6 & 11	
2.3		System frequency Hz	50	
2.4		Number of phases	3	
2.5		Rated no-load secondary voltage V _{rms}	415	
2.6		Rated power-frequency voltage kV _{rms}	12	
2.7		Rated lightning impulse withstand voltage kV _{peak}	95	
2.8		Rated short-duration power frequency withstand voltage [50Hz: 1 min] kV _{rms}	28	
2.9		Induced voltage withstand level kV _{rms}	22	
2.10		Internal arc classification	AB-FLR	
2.11		Internal arc current and duration	20KA/500 ms	

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Annex C - Technical schedules A and B for

**MSS TB 500KVA DR DYN11 3MM THICK AV SF6 FREE RMU DRY TYPE TRFR
(SAP 4380)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
3	4.3.1	Construction design		
3.1		Layout	Type B	
3.2		Construction	Modular	
3.3		Removable base sections adjacent to MV compartment (sections to lap bolted with nuts on the inside of the channel and housing)	Required	
3.4		All doors shall be a manual three point locking mechanism, capable of being secured by a padlock, having a shackle diameter of 8mm.	Required	
3.5		Compartment lock protection facility (with welded mesh top with inside visibility)	Required	
3.6		Total mass of miniature substation Kg	Required	
3.7		Overall maximum dimensions	Required	
3.8		a) MV compartment length mm	Required	
		b) LV compartment length mm	Required	
		c) LV metering compartment mm	400 x 400	
		d) Overall length mm	3000	
		e) Overall width mm	1650	
		f) Overall height mm	2000	
		g)Base width mm	1200	
		h)Thickness mm	3	
		Provision for lifting of complete mini-sub onto a concrete plinth without need for dismantling	Required	
3.9		Provision of lifting lugs on roof for ease of removal	Required	
3.10		MV switchgear, LV panel, LV metering and transformer confined to separate compartments	Required	
3.11		Mini-sub housing sections and doors bonded	Required	

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Annex C - Technical schedules A and B for

**MSS TB 500KVA DR DYN11 3MM THICK AV SF6 FREE RMU DRY TYPE TRFR
(SAP 4380)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
4	4.2.1	Transformer unit (Dry-Type)		
4.1		Electrical requirements	As per SANS 60076	
4.2		Vector group	Dyn 11	
4.3		MV system earthing	Effective	
4.4		LV transformer neutral earthing	Solid – connection to insulated LV neutral/earth bar	
4.5		MV system fault level	kA 25	
4.6		Temperature rise limits	As per SANS 60076	
4.7		Secondary voltage regulation (Off-load on the 11 kV supply voltage windings)	% +6.0, + 3.0, 0, –3.0, –6.0	
4.8		No-load losses	W Required	
4.9		Load losses	W Required	
4.10		Impedance	% SANS 60076	
4.11		Cost /kW of no-load losses (Jul 2002)	R/kW 13 669	
4.12		Cost /kW of load losses (Jul 2002)	R/kW 1 623	
4.13		X/R	SANS 60076	
4.14		Audio-sound level – maximum	dB(A) Required	
4.15		Sealed transformer unit	Required	

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**MSS TB 500KVA DR DYN11 3MM THICK AV SF6 FREE RMU DRY TYPE TRFR
(SAP 4380)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
4.16	4.4.2	Transformer MV bushings (NB internal screen to be earthed)	BS 7215 –Type C with M16x2 thread	
4.17		MV bushing-centre clearances (minimum) mm	135	
4.18		Clearances between outer bushing-centres and mini-sub metal enclosure (minimum) mm	90	
4.19		Transformer overload protection facility	Required	
4.20		Winding material	MV Copper LV Copper	
4.21		Manufacturer of the distribution transformer	Required	
5		MV compartment		
5.1		Equipment in MV compartment	SF6 FREE Ring Main Unit (CP_TSSPEC_006)	
5.2		Ring Main Unit manufacturer	Required	
5.3		Incoming MV cable requirements		
		a) 185 mm ² 3 core Cu or 300 mm ² 3C Al XLPE	Required	
		b) Cable support (clamping) required	Required	
		c) Minimum distance from cable clamp to centre-line of RMU bushings mm	800	
		d) Type of connection	Screened	
5.4		Mini-sub earth bar (accessible in front of RMU)	Required	
5.5		Interconnection arrangement between RMU and transformer MV bushings	Required	
5.6		Unscreened interconnecting equipment and connections between ring main unit and transformer to be barricaded	Required	
5.7		Type of earth fault indicator	Required	
5.8		Voltage detecting system (VDS)	Required	

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Annex C - Technical schedules A and B for

**MSS TB 500KVA DR DYN11 3MM THICK AV SF6 FREE RMU DRY TYPE TRFR
(SAP 4380)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
6	4.2.8	LV Compartment		
6.1		Bus-bar-rating (see Table 2)	A	1,2 times the kVA capacity
6.2		Bus-bar-insulation		Air insulated
6.3		Bus-bars	Ø	3 + one identical neutral-earth bus-bar (insulated from frame)
6.4		Current density of bus-bars	A/mm ²	1,8 maximum
6.5		Rated withstand current – 1 s (25 kA for up to 630 kVA & 45 kA for 1000 kVA)	kA _{rms}	As per rating.
6.6		Min clearance to earth and between phases	mm	20
6.7		Provision of a LV neutral surge armineral fitted between mini-sub earth bar and LV neutral-earth bus-bar		Required
6.8		LV neutral-earth bus-bar to be earthed (via an electrical bridge to the mini-sub earth bar)		Required
6.9		Neutral isolating links		Not Required
6.10		Provision of LV main isolating switch		Not Required
6.11		Number of outgoing LV feeders to be provided for (drill bus-bar Ø14mm holes)		6
6.12		Spacing between holes (see Figure 1)	mm	110
6.13		LV panel designed for large frame MCCBs		Required
		Spacing (vertical): Between phase bus-bars	mm	185
		Between lowest LV bus-bar and LV neutral	mm	300
		Minimum distance between LV neutral and uni-strut	mm	200

**Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be
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Annex C - Technical schedules A and B for

**MSS TB 500KVA DR DYN11 3MM THICK AV SF6 FREE RMU DRY TYPE TRFR
(SAP 4380)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
6.14		LV maximum demand ammeters	On all three phases	
6.15		Ammeter type	Thermal integrating over 15 min period	
6.16		LV indicating voltmeter with a selector switch	Required	
6.17		Ammeter and voltmeter size and display mm	96 × 96, 90°	
6.18		Ammeter and voltmeter position	Top right hand side in LV compartment	
6.19		Electronic meter capable of reading current and voltage	Required	
6.20		Provision of removable non flammable barrier to separate LV end compartment and front LV compartment	Required	
6.21		Main MCCB manufacturer	Required	
6.22		Catalogue/model code of main MCCB	Required	
6.23		Size of main MCCB A	As per table 2	

Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Annex C - Technical schedules A and B for

**MSS TB 500KVA DR DYN11 3MM THICK AV SF6 FREE RMU DRY TYPE TRFR
(SAP 4380)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
7	4.2.6	LV auxiliaries		
7.1		Provision of three point socket outlet and 60W bulkhead fitting in LV compartment (with instantaneous-trip earth leakage unit [20 A; 5 kA rupturing capacity; 30 mA sensitivity] and 20 A HRC fuse with neutral fuse link)	Required	
7.2		Numbering ferrules for auxiliary wiring	Required	
7.3		Push-button fitted to shunt trip RMU tee-off	Required	
8	4.3.2	Materials and corrosion protection		
8.1		Mini-sub enclosure and transformer tank thickness 6(mm) or 3 mm	Mild steel	
8.2		Radiator	Mild steel	
8.3		Tinned copper bus-bars	Required	
8.4		Mini-sub base:Material	Steel	
8.5		Uni-strut clamping bar:Material	Required	
8.6		5mm cork packing (between ends and tank, base and ends, base and tank, and base and plinth)	Required	
8.7		Final colour	Avocado Green (12)	

Note: Ticks, Cross [√, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Annex C - Technical schedules A and B for

**MSS TB 500KVA DR DYN11 3MM THICK AV SF6 FREE RMU DRY TYPE TRFR
(SAP 4380)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
9	4.6.2	Notices, signs and labels		
9.1		Transformer rating plate	Required	
9.2		Treatment and Full First Aid Instructions on inside of MV and LV compartment doors	Required	
9.3		Elec. warning signs on all doors and barriers	Required	
9.4		Transformer phase labels below bushings	Required	
9.5		Colour-coded LV bus-bars	Required	
9.6		Stenciled labeling of MV and LV compartment doors (both inside and outside)	Required	
9.7		kVA, Prim V, Sec V & Corrosion Class	Required	
9.8		ID markings linking roof to body per batch	Required	
9.9		Provision for the safe-keeping of documents	Required	
10	4.7	Documentation		
10.1		Type test reportss (provide ref. numbers of reports)	Sets 1	
10.2		Routine test reportss	Sets 1	
10.3		Drawings	Sets 2	
10.4		Circuit diagrams (LV auxiliary wiring and equipment)	Sets 2	

Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Technical schedules A and B Deviation schedule for

**MSS TB 500KVA DR DYN11 3MM THICK AV SF6 FREE RMU DRY TYPE TRFR
(SAP 4380)**

Any deviations offered to this specification shall be listed below with reasons for deviation. In addition, evidence shall be provided that the proposed deviation will at least be more cost-effective than that specified by City Power.

Item	Sub clause of CP_TSSPEC_005	Proposed deviation

Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Annex C - Technical schedules A and B for

**MSS TB 500KVA SR DYN11 6MM THICK AV SF6 FREE RMU DRY TYPE TRFR
(SAP 4383)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
1		Standard operating conditions		
1.1		ee) Altitude m	1800	
1.2		b) Ambient air temperature °C	-5 to +40	
1.3		c) Lightning ground flash density Flashes/ km ² /year	> 10	
1.4		d) Maximum solar radiation W/m ²	1000	
1.5		e) Ultraviolet radiation	High	
1.6		f) Relative humidity %	10 to 95	
1.7		g) Corrosive conditions (inland therefore non-corrosive)	Non- corrosive	
1.8		h) wind pressure Pa	700	
2	4.2.1	Ratings		
2.1		Transformer power rating kVA	500	
2.2		Nominal voltage of system (Single ratio) kV _{rms}	11	
2.3		System frequency Hz	50	
2.4		Number of phases	3	
2.5		Rated no-load secondary voltage V _{rms}	415	
2.6		Rated power-frequency voltage kV _{rms}	12	
2.7		Rated lightning impulse withstand voltage kV _{peak}	95	
2.8		Rated short-duration power frequency withstand voltage [50Hz: 1 min] kV _{rms}	28	
2.9		Induced voltage withstand level kV _{rms}	22	
2.10		Internal arc classification	AB-FLR	
2.11		Internal arc current and duration	20KA/500 ms	

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Annex C - Technical schedules A and B for

**MSS TB 500KVA SR DYN11 6MM THICK AV SF6 FREE RMU DRY TYPE TRFR
(SAP 4383)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
3	4.3.1	Construction design		
3.1		Layout	Type B	
3.2		Construction	Modular	
3.3		Removable base sections adjacent to MV compartment (sections to lap bolted with nuts on the inside of the channel and housing)	Required	
3.4		All doors shall be a manual three point locking mechanism, capable of being secured by a padlock, having a shackle diameter of 8mm.	Required	
3.5		Compartment lock protection facility (with welded mesh top with inside visibility)	Required	
3.6		Total mass of miniature substation Kg	Required	
3.7		Overall maximum dimensions	Required	
3.8		a) MV compartment length mm	Required	
		b) LV compartment length mm	Required	
		c) LV metering compartment mm	400 x 400	
		d) Overall length mm	3000	
		e) Overall width mm	1650	
		f) Overall height mm	2000	
		g)Base width mm	1200	
		h)Thickness mm	6	
		Provision for lifting of complete mini-sub onto a concrete plinth without need for dismantling	Required	
3.9		Provision of lifting lugs on roof for ease of removal	Required	
3.10		MV switchgear, LV panel, LV metering and transformer confined to separate compartments	Required	
3.11		Mini-sub housing sections and doors bonded	Required	

Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Annex C - Technical schedules A and B for

**MSS TB 500KVA SR DYN11 6MM THICK AV SF6 FREE RMU DRY TYPE TRFR
(SAP 4383)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
4	4.2.1	Transformer unit (Dry-Type)		
4.1		Electrical requirements	As per SANS 60076	
4.2		Vector group	Dyn 11	
4.3		MV system earthing	Effective	
4.4		LV transformer neutral earthing	Solid – connection to insulated LV neutral/earth bar	
4.5		MV system fault level	kA 25	
4.6		Temperature rise limits	As per SANS /60076	
4.7		Secondary voltage regulation (Off-load on the 11 kV supply voltage windings)	% +6.0, + 3.0, 0, –3.0, –6.0	
4.8		No-load losses	W Required	
4.9		Load losses	W Required	
4.10		Impedance	% SANS 60076	
4.11		Cost /kW of no-load losses (Jul 2002)	R/kW 13 669	
4.12		Cost /kW of load losses (Jul 2002)	R/kW 1 623	
4.13		X/R	SANS 60076	
4.14		Audio-sound level – maximum	dB(A) Required	
4.15		Sealed transformer unit	Required	

Note: Ticks, Cross [√, X], Asterick [*], Word [Noted] or TBA [“To Be Advice”] will not be accepted.

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Full name of company: _____

Annex C - Technical schedules A and B for

**MSS TB 500KVA SR DYN11 6MM THICK AV SF6 FREE RMU DRY TYPE TRFR
(SAP 4383)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
4.16	4.4.2	Transformer MV bushings (NB internal screen to be earthed)	BS 7215 –Type C with M16x2 thread	
4.17		MV bushing-centre clearances (minimum) mm	135	
4.18		Clearances between outer bushing-centres and mini-sub metal enclosure (minimum) mm	90	
4.19		Transformer overload protection facility	Required	
4.20		Winding material MV	Copper	
		LV	Copper	
4.21		Manufacturer of the distribution transformer	Required	
5		MV compartment		
5.1		Equipment in MV compartment	SF6 FREE Ring Main Unit (CP_TSSPEC_006)	
5.2		Ring Main Unit manufacturer	Required	
5.3		Incoming MV cable requirements		
		a) 185 mm ² 3 core Cu or 300 mm ² 3C Al XLPE	Required	
		b) Cable support (clamping) required	Required	
		c) Minimum distance from cable clamp to centre-line of RMU bushings mm	800	
		d) Type of connection	Screened	
5.4		Mini-sub earth bar (accessible in front of RMU)	Required	
5.5		Interconnection arrangement between RMU and transformer MV bushings	Required	
5.6		Unscreened interconnecting equipment and connections between ring main unit and transformer to be barricaded	Required	
5.7		Type of earth fault indicator	Required	
5.8		Voltage detecting system (VDS)	Required	

Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA [“To Be Advice”] will not be accepted.

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Annex C - Technical schedules A and B for

**MSS TB 500KVA SR DYN11 6MM THICK AV SF6 FREE RMU DRY TYPE TRFR
(SAP 4383)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
6	4.2.8	LV Compartment		
6.1		Bus-bar-rating (see Table 2)	A	1,2 times the kVA capacity
6.2		Bus-bar-insulation		Air insulated
6.3		Bus-bars	Ø	3 + one identical neutral-earth bus-bar (insulated from frame)
6.4		Current density of bus-bars	A/mm ²	1,8 maximum
6.5		Rated withstand current – 1 s (25 kA for up to 630 kVA & 45 kA for 1000 kVA)	kA _{rms}	As per rating.
6.6		Min clearance to earth and between phases	mm	20
6.7		Provision of a LV neutral surge arrester fitted between mini-sub earth bar and LV neutral-earth bus-bar		Required
6.8		LV neutral-earth bus-bar to be earthed (via an electrical bridge to the mini-sub earth bar)		Required
6.9		Neutral isolating links		Not Required
6.10		Provision of LV main isolating switch		Not Required
6.11		Number of outgoing LV feeders to be provided for (drill bus-bar Ø14mm holes)		6
6.12		Spacing between holes (see Figure 1)	mm	110
6.13		LV panel designed for large frame MCCBs		Required
		Spacing (vertical): Between phase bus-bars	mm	185
		Between lowest LV bus-bar and LV neutral	mm	300
		Minimum distance between LV neutral and uni-strut	mm	200

Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Annex C - Technical schedules A and B for

**MSS TB 500KVA SR DYN11 6MM THICK AV SF6 FREE RMU DRY TYPE TRFR
(SAP 4383)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
6.14		LV maximum demand ammeters	On all three phases	
6.15		Ammeter type	Thermal integrating over 15 min period	
6.16		LV indicating voltmeter with a selector switch	Required	
6.17		Ammeter and voltmeter size and display mm	96 × 96, 90°	
6.18		Ammeter and voltmeter position	Top right hand side in LV compartment	
6.19		Electronic meter capable of reading current and voltage	Required	
6.20		Provision of removable non flammable barrier to separate LV end compartment and front LV compartment	Required	
6.21		Main MCCB manufacturer	Required	
6.22		Catalogue/model code of main MCCB	Required	
6.23		Size of main MCCB A	As per table 2	

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Annex C - Technical schedules A and B for

**MSS TB 500KVA SR DYN11 6MM THICK AV SF6 FREE RMU DRY TYPE TRFR
(SAP 4383)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
7	4.2.6	LV auxiliaries		
7.1		Provision of three point socket outlet and 60W bulkhead fitting in LV compartment (with instantaneous-trip earth leakage unit [20 A; 5 kA rupturing capacity; 30 mA sensitivity] and 20 A HRC fuse with neutral fuse link)	Required	
7.2		Numbering ferrules for auxiliary wiring	Required	
7.3		Push-button fitted to shunt trip RMU tee-off	Required	
8	4.3.2	Materials and corrosion protection		
8.1		Mini-sub enclosure and transformer tank thickness 6(mm) or 3 mm	Mild steel	
8.2		Radiator	Mild steel	
8.3		Tinned copper bus-bars	Required	
8.4		Mini-sub base:Material	Steel	
8.5		Uni-strut clamping bar:Material	Required	
8.6		5mm cork packing (between ends and tank, base and ends, base and tank, and base and plinth)	Required	
8.7		Final colour	Avocado Green (12)	

Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Annex C - Technical schedules A and B for

**MSS TB 500KVA SR DYN11 6MM THICK AV SF6 FREE RMU DRY TYPE TRFR
(SAP 4383)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
9	4.6.2	Notices, signs and labels		
9.1		Transformer rating plate	Required	
9.2		Treatment and Full First Aid Instructions on inside of MV and LV compartment doors	Required	
9.3		Elec. warning signs on all doors and barriers	Required	
9.4		Transformer phase labels below bushings	Required	
9.5		Colour-coded LV bus-bars	Required	
9.6		Stenciled labeling of MV and LV compartment doors (both inside and outside)	Required	
9.7		kVA, Prim V, Sec V & Corrosion Class	Required	
9.8		ID markings linking roof to body per batch	Required	
9.9		Provision for the safe-keeping of documents	Required	
10	4.7	Documentation		
10.1		Type test reportss (provide ref. numbers of reports)	Sets 1	
10.2		Routine test reportss	Sets 1	
10.3		Drawings	Sets 2	
10.4		Circuit diagrams (LV auxiliary wiring and equipment)	Sets 2	

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Technical schedules A and B Deviation schedule for

**MSS TB 500KVA SR DYN11 6MM THICK AV SF6 FREE RMU DRY TYPE TRFR
(SAP 4383)**

Any deviations offered to this specification shall be listed below with reasons for deviation. In addition, evidence shall be provided that the proposed deviation will at least be more cost-effective than that specified by City Power.

Item	Sub clause of CP_TSSPEC_005	Proposed deviation

Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Annex C - Technical schedules A and B for

**MSS TB 500KVA DR DYN11 6MM THICK AV SF6 FREE RMU DRY TYPE TRFR
(SAP 4384)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
1		Standard operating conditions		
1.1		ff) Altitude m	1800	
1.2		b) Ambient air temperature °C	-5 to +40	
1.3		c) Lightning ground flash density Flashes/ km ² /year	> 10	
1.4		d) Maximum solar radiation W/m ²	1000	
1.5		e) Ultraviolet radiation	High	
1.6		f) Relative humidity %	10 to 95	
1.7		g) Corrosive conditions (inland therefore non-corrosive)	Non- corrosive	
1.8		h) wind pressure Pa	700	
2	4.2.1	Ratings		
2.1		Transformer power rating kVA	500	
2.2		Nominal voltage of system (Dual ratio) kV _{rms}	6,6 & 11	
2.3		System frequency Hz	50	
2.4		Number of phases	3	
2.5		Rated no-load secondary voltage V _{rms}	415	
2.6		Rated power-frequency voltage kV _{rms}	12	
2.7		Rated lightning impulse withstand voltage kV _{peak}	95	
2.8		Rated short-duration power frequency withstand voltage [50Hz: 1 min] kV _{rms}	28	
2.9		Induced voltage withstand level kV _{rms}	22	
2.10		Internal arc classification	AB-FLR	
2.11		Internal arc current and duration	20KA/500 ms	

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Annex C - Technical schedules A and B for

**MSS TB 500KVA DR DYN11 6MM THICK AV SF6 FREE RMU DRY TYPE TRFR
(SAP 4384)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
3	4.3.1	Construction design		
3.1		Layout	Type B	
3.2		Construction	Modular	
3.3		Removable base sections adjacent to MV compartment (sections to lap bolted with nuts on the inside of the channel and housing)	Required	
3.4		All doors shall be a manual three point locking mechanism, capable of being secured by a padlock, having a shackle diameter of 8mm.	Required	
3.5		Compartment lock protection facility (with welded mesh top with inside visibility)	Required	
3.6		Total mass of miniature substation Kg	Required	
3.7		Overall maximum dimensions	Required	
3.8		a) MV compartment length mm	Required	
		b) LV compartment length mm	Required	
		c) LV metering compartment mm	400 x 400	
		d) Overall length mm	3000	
		e) Overall width mm	1650	
		f) Overall height mm	2000	
		g)Base width mm	1200	
		h)Thickness mm	6	
		Provision for lifting of complete mini-sub onto a concrete plinth without need for dismantling	Required	
3.9		Provision of lifting lugs on roof for ease of removal	Required	
3.10		MV switchgear, LV panel, LV metering and transformer confined to separate compartments	Required	
3.11		Mini-sub housing sections and doors bonded	Required	

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Annex C - Technical schedules A and B for

**MSS TB 500KVA DR DYN11 6MM THICK AV SF6 FREE RMU DRY TYPE TRFR
(SAP 4384)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
4	4.2.1	Transformer unit (Dry-Type)		
4.1		Electrical requirements	As per SANS 60076	
4.2		Vector group	Dyn 11	
4.3		MV system earthing	Effective	
4.4		LV transformer neutral earthing	Solid – connection to insulated LV neutral/earth bar	
4.5		MV system fault level	kA 25	
4.6		Temperature rise limits	As per SANS 60076	
4.7		Secondary voltage regulation (Off-load on the 11 kV supply voltage windings)	% +6.0, + 3.0, 0, –3.0, –6.0	
4.8		No-load losses	W Required	
4.9		Load losses	W Required	
4.10		Impedance	% SANS 780	
4.11		Cost /kW of no-load losses (Jul 2002)	R/kW 13 669	
4.12		Cost /kW of load losses (Jul 2002)	R/kW 1 623	
4.13		X/R	SANS 60076	
4.14		Audio-sound level – maximum	dB(A) Required	
4.15		Sealed transformer unit	Required	

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Annex C - Technical schedules A and B for

**MSS TB 500KVA DR DYN11 6MM THICK AV SF6 FREE RMU DRY TYPE TRFR
(SAP 4384)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
4.16	4.4.2	Transformer MV bushings (NB internal screen to be earthed)	BS 7215 –Type C with M16x2 thread	
4.17		MV bushing-centre clearances (minimum) mm	135	
4.18		Clearances between outer bushing-centres and mini-sub metal enclosure (minimum) mm	90	
4.19		Transformer overload protection facility	Required	
4.20		Winding material	MV Copper LV Copper	
4.21		Manufacturer of the distribution transformer	Required	
5		MV compartment		
5.1		Equipment in MV compartment	SF6 FREE Ring Main Unit (CP_TSSPEC_006)	
5.2		Ring Main Unit manufacturer	Required	
5.3		Incoming MV cable requirements		
		a) 185 mm ² 3 core Cu or 300 mm ² 3C Al XLPE	Required	
		b) Cable support (clamping) required	Required	
		c) Minimum distance from cable clamp to centre-line of RMU bushings mm	800	
		d) Type of connection	Screened	
5.4		Mini-sub earth bar (accessible in front of RMU)	Required	
5.5		Interconnection arrangement between RMU and transformer MV bushings	Required	
5.6		Unscreened interconnecting equipment and connections between ring main unit and transformer to be barricaded	Required	
5.7		Type of earth fault indicator	Required	
5.8		Voltage detecting system (VDS)	Required	

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Annex C - Technical schedules A and B for

**MSS TB 500KVA DR DYN11 6MM THICK AV SF6 FREE RMU DRY TYPE TRFR
(SAP 4384)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
6	4.2.8	LV Compartment		
6.1		Bus-bar-rating (see Table 2)	A	1,2 times the kVA capacity
6.2		Bus-bar-insulation		Air insulated
6.3		Bus-bars	Ø	3 + one identical neutral-earth bus-bar (insulated from frame)
6.4		Current density of bus-bars	A/mm ²	1,8 maximum
6.5		Rated withstand current – 1 s (25 kA for up to 630 kVA & 45 kA for 1000 kVA)	kA _{rms}	As per rating.
6.6		Min clearance to earth and between phases	mm	20
6.7		Provision of a LV neutral surge arrester fitted between mini-sub earth bar and LV neutral-earth bus-bar		Required
6.8		LV neutral-earth bus-bar to be earthed (via an electrical bridge to the mini-sub earth bar)		Required
6.9		Neutral isolating links		Not Required
6.10		Provision of LV main isolating switch		Not Required
6.11		Number of outgoing LV feeders to be provided for (drill bus-bar Ø14mm holes)		6
6.12		Spacing between holes (see Figure 1)	mm	110
6.13		LV panel designed for large frame MCCBs		Required
		Spacing (vertical): Between phase bus-bars	mm	185
		Between lowest LV bus-bar and LV neutral	mm	300
		Minimum distance between LV neutral and uni-strut	mm	200

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Annex C - Technical schedules A and B for

**MSS TB 500KVA DR DYN11 6MM THICK AV SF6 FREE RMU DRY TYPE TRFR
(SAP 4384)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
6.14		LV maximum demand ammeters	On all three phases	
6.15		Ammeter type	Thermal integrating over 15 min period	
6.16		LV indicating voltmeter with a selector switch	Required	
6.17		Ammeter and voltmeter size and display mm	96 × 96, 90°	
6.18		Ammeter and voltmeter position	Top right hand side in LV compartment	
6.19		Electronic meter capable of reading current and voltage	Required	
6.20		Provision of removable non flammable barrier to separate LV end compartment and front LV compartment	Required	
6.21		Main MCCB manufacturer	Required	
6.22		Catalogue/model code of main MCCB	Required	
6.23		Size of main MCCB A	As per table 2	

Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Annex C - Technical schedules A and B for

**MSS TB 500KVA DR DYN11 6MM THICK AV SF6 FREE RMU DRY TYPE TRFR
(SAP 4384)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
7	4.2.6	LV auxiliaries		
7.1		Provision of three point socket outlet and 60W bulkhead fitting in LV compartment (with instantaneous-trip earth leakage unit [20 A; 5 kA rupturing capacity; 30 mA sensitivity] and 20 A HRC fuse with neutral fuse link)	Required	
7.2		Numbering ferrules for auxiliary wiring	Required	
7.3		Push-button fitted to shunt trip RMU tee-off	Required	
8	4.3.2	Materials and corrosion protection		
8.1		Mini-sub enclosure and transformer tank thickness 6(mm) or 3 mm	Mild steel	
8.2		Radiator	Mild steel	
8.3		Tinned copper bus-bars	Required	
8.4		Mini-sub base:Material	Steel	
8.5		Uni-strut clamping bar:Material	Required	
8.6		5mm cork packing (between ends and tank, base and ends, base and tank, and base and plinth)	Required	
8.7		Final colour	Avocado Green (12)	

Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Annex C - Technical schedules A and B for

**MSS TB 500KVA DR DYN11 6MM THICK AV SF6 FREE RMU DRY TYPE TRFR
(SAP 4384)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
9	4.6.2	Notices, signs and labels		
9.1		Transformer rating plate	Required	
9.2		Treatment and Full First Aid Instructions on inside of MV and LV compartment doors	Required	
9.3		Elec. warning signs on all doors and barriers	Required	
9.4		Transformer phase labels below bushings	Required	
9.5		Colour-coded LV bus-bars	Required	
9.6		Stenciled labeling of MV and LV compartment doors (both inside and outside)	Required	
9.7		kVA, Prim V, Sec V & Corrosion Class	Required	
9.8		ID markings linking roof to body per batch	Required	
9.9		Provision for the safe-keeping of documents	Required	
10	4.7	Documentation		
10.1		Type test reportss (provide ref. numbers of reports)	Sets 1	
10.2		Routine test reportss	Sets 1	
10.3		Drawings	Sets 2	
10.4		Circuit diagrams (LV auxiliary wiring and equipment)	Sets 2	

Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Technical schedules A and B Deviation schedule for

**MSS TB 500KVA DR DYN11 6MM THICK AV SF6 FREE RMU DRY TYPE TRFR
(SAP 4384)**

Any deviations offered to this specification shall be listed below with reasons for deviation. In addition, evidence shall be provided that the proposed deviation will at least be more cost-effective than that specified by City Power.

Item	Sub clause of CP_TSSPEC_005	Proposed deviation

Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Annex C - Technical schedules A and B for

**MSS TB 630KVA DR DYN11 3MM THICK AV SF6 RMU OIL TYPE TRFR
(SAP 426)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
1		Standard operating conditions		
1.1		gg) Altitude m	1800	
1.2		b) Ambient air temperature °C	-5 to +40	
1.3		c) Lightning ground flash density Flashes/ km ² /year	> 10	
1.4		d) Maximum solar radiation W/m ²	1000	
1.5		e) Ultraviolet radiation	High	
1.6		f) Relative humidity %	10 to 95	
1.7		g) Corrosive conditions (inland therefore non-corrosive)	Non- corrosive	
1.8		h) wind pressure Pa	700	
2	4.2.1	Ratings		
2.1		Transformer power rating kVA	630	
2.2		Nominal voltage of system (Dual ratio) kV _{rms}	6,6 & 11	
2.3		System frequency Hz	50	
2.4		Number of phases	3	
2.5		Rated no-load secondary voltage V _{rms}	415	
2.6		Rated power-frequency voltage kV _{rms}	12	
2.7		Rated lightning impulse withstand voltage kV _{peak}	95	
2.8		Rated short-duration power frequency withstand voltage [50Hz: 1 min] kV _{rms}	28	
2.9		Induced voltage withstand level kV _{rms}	22	
3.0		Internal arc classification	AB-FLR	
3.1		Internal arc current and duration	20KA/500 ms	

Note: Ticks, Cross [√, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Signature

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Annex C - Technical schedules A and B for

**MSS TB 630KVA DR DYN11 3MM THICK AV SF6 RMU OIL TYPE TRFR (SAP
426)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
3	4.3.1	Construction design		
3.1		Layout	Type B	
3.2		Construction	Modular	
3.3		Removable base sections adjacent to MV compartment (sections to lap bolted with nuts on the inside of the channel and housing)	Required	
3.4		All doors shall be a manual three point locking mechanism, capable of being secured by a padlock, having a shackle diameter of 8mm.	Required	
3.5		Compartment lock protection facility (with welded mesh top with inside visibility)	Required	
3.6		Total mass of miniature substation Kg	Required	
3.7		Overall maximum dimensions		
3.8		a) MV compartment length mm	Required	
		b) LV compartment length mm	Required	
		c) LV metering compartment mm	400 x 400	
		d) Overall length mm	3000	
		e) Overall width mm	1650	
		f) Overall height mm	2000	
		g) Base width mm	1200	
		h) Thickness mm	3	
		Provision for lifting of complete mini-sub onto a concrete plinth without need for dismantling	Required	
3.9		Provision of lifting lugs on roof for ease of removal	Required	
3.10		MV switchgear, LV panel, LV metering and transformer confined to separate compartments	Required	
3.11		Mini-sub housing sections and doors bonded	Required	

Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Tenderer's Authorised Signatory: _____

Name in block letters

Signature

Full name of company: _____

Annex C - Technical schedules A and B for

**MSS TB 630KVA DR DYN11 3MM THICK AV SF6 RMU OIL TYPE TRFR (SAP
426)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
4	4.2.1	Transformer unit (Oil immersed)		
4.1		Electrical requirements	As per SANS 780	
4.2		Vector group	Dyn 11	
4.3		MV system earthing	Effective	
4.4		LV transformer neutral earthing	Solid – connection to insulated LV neutral/earth bar	
4.5		MV system fault level	kA 25	
4.6		Temperature rise limits	As per SANS 780 Table 6	
4.7		Secondary voltage regulation (Off-load on the 11 kV supply voltage windings)	% +6.0, + 3.0, 0, –3.0, –6.0	
4.8		No-load losses	W Required	
4.9		Load losses	W Required	
4.10		Impedance	% SANS 780	
4.11		Cost /kW of no-load losses (Jul 2002)	R/kW 13 669	
4.12		Cost /kW of load losses (Jul 2002)	R/kW 1 623	
4.13		X/R	SANS780	
4.14		Audio-sound level – maximum (see table 6)	dB(A) Table 6	
4.15		Sealed transformer unit	Required	

Note: Ticks, Cross [√, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Full name of company: _____

Annex C - Technical schedule A and B for

MSS TB 630KVA DR DYN11 3MM THICK AV SF6 RMU OIL TYPE TRFR (SAP 426)

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
4.16	4.4.2	Transformer MV bushings (NB internal screen to be earthed)	BS 7215 –Type C with M16x2 thread	
4.17		MV bushing-centre clearances (minimum) mm	135	
4.18		Clearances between outer bushing-centres and mini-sub metal enclosure (minimum) mm	90	
4.19		Transformer overload protection facility	Required	
4.20		Winding material MV	Required	
		LV	Required	
4.21		Manufacturer of the distribution transformer	Required	
5		MV compartment		
5.1		Equipment in MV compartment	Ring Main Unit (CP_TSSPEC_006)	
5.2		Ring Main Unit manufacturer	Required	
5.5		Incoming MV cable requirements		
		a) 185 mm ² 3 core Cu or 300 mm ² 3C Al XLPE	Required	
		b) Cable support (clamping) required	Required	
		c) Minimum distance from cable clamp to centre-line of RMU bushings mm	800	
		d) Type of connection	Sreened	
5.6		Mini-sub earth bar (accessible in front of RMU)	Required	
5.7		Interconnection arrangement between RMU and transformer MV bushings	Required	
5.8		Unscreened interconnecting equipment and connections between ring main unit and transformer to be barricaded	Required	
5.9		Type of earth fault indicator	Required	
5.10		Voltage detecting system (VDS)	Required	

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Full name of company: _____

Annex C - Technical schedules A and B for

**MSS TB 630KVA DR DYN11 3MM THICK AV SF6 RMU OIL TYPE TRFR (SAP
426)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
6	4.2.8	LV Compartment		
6.1		Bus-bar-rating (see Table 2)	A	1,2 times the kVA capacity
6.2		Bus-bar-insulation		Air insulated
6.3		Bus-bars	Ø	3 + one identical neutral-earth busbar (insulated from frame)
6.4		Current density of bus-bars	A/mm ²	1,8 maximum
6.5		Rated withstand current – 1 s (25 kA for up to 630 kVA & 45 kA for 1000 kVA)	kA _{rms}	As per rating.
6.6		Min clearance to earth and between phases	mm	20
6.7		Provision of a LV neutral surge armineral fitted between mini-sub earth bar and LV neutral-earth bus-bar		Required
6.8		LV neutral-earth bus-bar to be earthed (via an electrical bridge to the mini-sub earth bar)		Required
6.9		Neutral isolating links		Not Required
6.10		Provision of LV main isolating switch		Not Required
6.11		Number of outgoing LV feeders to be provided for (drill bus-bar Ø14mm holes)		6
6.12		Spacing between holes (see Figure 1)	mm	110
6.13		LV panel designed for large frame MCCBs		Required
		Spacing (vertical): Between phase bus-bars	mm	185
		Between lowest LV bus-bar and LV neutral	mm	300
		Minimum distance between LV neutral and uni-strut	mm	200

**Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be
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Name in block letters

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Annex C - Technical schedules A and B for

MSS TB 630KVA DR DYN11 3MM THICK AV SF6 RMU OIL TYPE TRFR (SAP 426)

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
6.14		LV maximum demand ammeters	On all three phases	
6.15		Ammeter type	Thermal integrating over 15 min period	
6.16		LV indicating voltmeter with a selector switch	Required	
6.17		Ammeter and voltmeter size and display mm	96 × 96, 90°	
6.18		Ammeter and voltmeter position	Top right hand side in LV compartment	
6.19		Analogue meter capable of reading current and voltage	Required	
6.20		Provision of removable non flammable barrier to separate LV end compartment and front LV compartment	Required	
6.21		Main MCCB manufacturer	Required	
6.22		Catalogue/model code of main MCCB	Required	
6.23		Size of main MCCB A	As per table 2	

Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Full name of company: _____

Annex C - Technical schedules A and B for

**MSS TB 630KVA DR DYN11 3MM THICK AV SF6 RMU OIL TYPE TRFR (SAP
426)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
7	4.2.6	LV auxiliaries		
7.1		Provision of three point socket outlet and 60W bulkhead fitting in LV compartment (with instantaneous-trip earth leakage unit [20 A; 5 kA rupturing capacity; 30 mA sensitivity] and 20 A HRC fuse with neutral fuse link)	Required	
7.2		Numbering ferrules for auxiliary wiring	Required	
7.3		Push-button fitted to shunt trip RMU tee-off	Required	
8	4.3.2	Materials and corrosion protection		
8.1		Mini-sub enclosure and transformer tank	Mild steel	
8.2		Radiator 3 or 6mm thickness	Mild steel	
8.3		Tinned copper bus-bars	Required	
8.4		Mini-sub base:Material	Steel	
8.5		5mm cork packing (between ends and tank, base and ends, base and tank, and base and plinth)	Required	
8.6		Final colour	Avocado Green (12)	

Note: Ticks, Cross [√, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Full name of company: _____

Annex C - Technical schedules A and B for

**MSS TB 630KVA DR DYN11 3MM THICK AV SF6 RMU OIL TYPE TRFR (SAP
426)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
9	4.6.2	Notices, signs and labels		
9.1		Transformer rating plate	Required	
9.2		Treatment and Full First Aid Instructions on inside of MV and LV compartment doors	Required	
9.3		Elec. warning signs on all doors and barriers	Required	
9.4		Transformer phase labels below bushings	Required	
9.5		Colour-coded LV bus-bars	Required	
9.6		Stenciled labeling of MV and LV compartment doors (both inside and outside)	Required	
9.7		kVA, Prim V, Sec V & Corrosion Class	Required	
9.8		ID markings linking roof to body per batch	Required	
9.9		Provision for the safe-keeping of documents	Required	
10	4.7	Documentation		
10.1		Type test reportss (provide ref. numbers of reports)	Sets 1	
10.2		Routine test reportss	Sets 1	
10.3		Drawings	Sets 2	
10.4		Circuit diagrams (LV auxiliary wiring and equipment)	Sets 2	

Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

Tender Number: _____

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Technical schedules A and B Deviation schedule for

**MSS TB 630KVA DR DYN11 3MM THICK AV SF6 RMU OIL TYPE TRFR (SAP
426)**

Any deviations offered to this specification shall be listed below with reasons for deviation. In addition, evidence shall be provided that the proposed deviation will at least be more cost-effective than that specified by City Power.

Item	Sub clause of CP_TSSPEC_005	Proposed deviation

Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

Tender Number: _____

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Full name of company: _____

Annex C - Technical schedules A and B for

**MSS TB 630KVA DR DYN11 6MM THICK AV SF6 RMU OIL TYPE TRFR
(SAP 3586)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
1		Standard operating conditions		
1.1		hh) Altitude m	1800	
1.2		b) Ambient air temperature °C	-5 to +40	
1.3		c) Lightning ground flash density Flashes/ km ² /year	> 10	
1.4		d) Maximum solar radiation W/m ²	1000	
1.5		e) Ultraviolet radiation	High	
1.6		f) Relative humidity %	10 to 95	
1.7		g) Corrosive conditions (inland therefore non-corrosive)	Non- corrosive	
1.8		h) wind pressure Pa	700	
2	4.2.1	Ratings		
2.1		Transformer power rating kVA	630	
2.2		Nominal voltage of system (Dual ratio) kV _{rms}	6,6 & 11	
2.3		System frequency Hz	50	
2.4		Number of phases	3	
2.5		Rated no-load secondary voltage V _{rms}	415	
2.6		Rated power-frequency voltage kV _{rms}	12	
2.7		Rated lightning impulse withstand voltage kV _{peak}	95	
2.8		Rated short-duration power frequency withstand voltage [50Hz: 1 min] kV _{rms}	28	
2.9		Induced voltage withstand level kV _{rms}	22	
3.0		Internal arc classification	AB-FLR	
3.1		Internal arc current and duration	20KA/500 ms	

Note: Ticks, Cross [√, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Annex C - Technical schedules A and B for

**MSS TB 630KVA DR DYN11 6MM THICK AV SF6 RMU OIL TYPE TRFR (SAP
3586)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
3	4.3.1	Construction design		
3.1		Layout	Type B	
3.2		Construction	Modular	
3.3		Removable base sections adjacent to MV compartment (sections to lap bolted with nuts on the inside of the channel and housing)	Required	
3.4		All doors shall be a manual three point locking mechanism, capable of being secured by a padlock, having a shackle diameter of 8mm.	Required	
3.5		Compartment lock protection facility (with welded mesh top with inside visibility)	Required	
3.6		Total mass of miniature substation Kg	Required	
3.7		Overall maximum dimensions	Required	
3.8		a) MV compartment length mm	Required	
		b) LV compartment length mm	Required	
		c) LV metering compartment mm	400 x 400	
		d) Overall length mm	3000	
		e) Overall width mm	1650	
		f) Overall height mm	2000	
		g) Base width mm	1200	
		h) Thickness mm	6	
		Provision for lifting of complete mini-sub onto a concrete plinth without need for dismantling	Required	
3.9		Provision of lifting lugs on roof for ease of removal	Required	
3.10		MV switchgear, LV panel, LV metering and transformer confined to separate compartments	Required	
3.11		Mini-sub housing sections and doors bonded	Required	

Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Annex C - Technical schedules A and B for

**MSS TB 630KVA DR DYN11 6MM THICK AV SF6 RMU OIL TYPE TRFR (SAP
3586)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
4	4.2.1	Transformer unit (Oil immersed)		
4.1		Electrical requirements	As per SANS 780	
4.2		Vector group	Dyn 11	
4.3		MV system earthing	Effective	
4.4		LV transformer neutral earthing	Solid – connection to insulated LV neutral/earth bar	
4.5		MV system fault level	kA 25	
4.6		Temperature rise limits	As per SANS 780 Table 6	
4.7		Secondary voltage regulation (Off-load on the 11 kV supply voltage windings)	% +6.0, + 3.0, 0, –3.0, –6.0	
4.8		No-load losses	W Required	
4.9		Load losses	W Required	
4.10		Impedance	% SANS780	
4.11		Cost /kW of no-load losses (Jul 2002)	R/kW 13 669	
4.12		Cost /kW of load losses (Jul 2002)	R/kW 1 623	
4.13		X/R	SANS780	
4.14		Audio-sound level – maximum (see table 6)	dB(A) Table 6	
4.15		Sealed transformer unit	Required	

**Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA [“To Be Advice”] will not be
accepted.**

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Annex C - Technical schedules A and B for

**MSS TB 630KVA DR DYN11 6MM THICK AV SF6 RMU OIL TYPE TRFR (SAP
3586)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
4.16	4.4.2	Transformer MV bushings (NB internal screen to be earthed)	BS 7215 –Type C with M16x2 thread	
4.17		MV bushing-centre clearances (minimum) mm	135	
4.18		Clearances between outer bushing-centres and mini-sub metal enclosure (minimum) mm	90	
4.19		Transformer overload protection facility	Required	
4.20		Winding material MV	Copper	
		LV	Copper	
4.21		Manufacturer of the distribution transformer	Required	
5		MV compartment		
5.1		Equipment in MV compartment	Ring Main Unit (CP_TSSPEC_006)	
5.2		Ring Main Unit manufacturer	Required	
5.5		Incoming MV cable requirements		
		a) 185 mm ² 3 core Cu or 300 mm ² 3C Al XLPE	Required	
		b) Cable support (clamping) required	Required	
		c) Minimum distance from cable clamp to centre-line of RMU bushings mm	800	
		d) Type of connection	Screened	
5.6		Mini-sub earth bar (accessible in front of RMU)	Required	
5.7		Interconnection arrangement between RMU and transformer MV bushings	Required	
5.8		Unscreened interconnecting equipment and connections between ring main unit and transformer to be barricaded	Required	
5.9		Type of earth fault indicator	Required	
5.10		Voltage detecting system (VDS)	Required	

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Annex C - Technical schedules A and B for

MSS TB 630KVA DR DYN11 6MM THICK AV SF6 RMU OIL TYPE TRFR (SAP 3586)

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
6	4.2.8	LV Compartment		
6.1		Bus-bar-rating (see Table 2)	A	1,2 times the kVA capacity
6.2		Bus-bar-insulation		Air insulated
6.3		Bus-bars	Ø	3 + one identical neutral-earth busbar (insulated from frame)
6.4		Current density of bus-bars	A/mm ²	1,8 maximum
6.5		Rated withstand current – 1 s (25 kA for up to 630 kVA & 45 kA for 1000 kVA)	kA _{rms}	As per rating.
6.6		Min clearance to earth and between phases	mm	20
6.7		Provision of a LV neutral surge arrester fitted between mini-sub earth bar and LV neutral-earth bus-bar		Required
6.8		LV neutral-earth bus-bar to be earthed (via an electrical bridge to the mini-sub earth bar)		Required
6.9		Neutral isolating links		Not Required
6.10		Provision of LV main isolating switch		Not Required
6.11		Number of outgoing LV feeders to be provided for (drill bus-bar Ø14mm holes)		6
6.12		Spacing between holes (see Figure 1)	mm	110
6.13		LV panel designed for large frame MCCBs		Required
		Spacing (vertical): Between phase bus-bars	mm	185
		Between lowest LV bus-bar and LV neutral	mm	300
		Minimum distance between LV neutral and uni-strut	mm	200

Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Annex C - Technical schedules A and B for

**MSS TB 630KVA DR DYN11 6MM THICK AV SF6 RMU OIL TYPE TRFR (SAP
3586)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
6.14		LV maximum demand ammeters	On all three phases	
6.15		Ammeter type	Thermal integrating over 15 min period	
6.16		LV indicating voltmeter with a selector switch	Required	
6.17		Ammeter and voltmeter size and display mm	96 × 96, 90°	
6.18		Ammeter and voltmeter position	Top right hand side in LV compartment	
6.19		Analogue meter capable of reading current and voltage	Required	
6.20		Provision of removable non flammable barrier to separate LV end compartment and front LV compartment	Required	
6.21		Main MCCB manufacturer	Required	
6.22		Catalogue/model code of main MCCB	Required	
6.23		Size of main MCCB A	As per table 2	

**Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be
accepted.**

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Annex C - Technical schedules A and B for

Miniature Substation Type B 630 kVA High risk (SAP 3586)

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
7	4.2.6	LV auxiliaries		
7.1		Provision of three point socket outlet and 60W bulkhead fitting in LV compartment (with instantaneous-trip earth leakage unit [20 A; 5 kA rupturing capacity; 30 mA sensitivity] and 20 A HRC fuse with neutral fuse link)	Required	
7.2		Numbering ferrules for auxiliary wiring	Required	
7.3		Push-button fitted to shunt trip RMU tee-off	Required	
8	4.3.2	Materials and corrosion protection		
8.1		Mini-sub enclosure and transformer tank 6 mm or 3 mm	Mild steel	
8.2		Radiator 6 mm thickness	Mild steel	
8.3		Tinned copper bus-bars	Required	
8.4		Mini-sub base:Material	Steel	
8.5		5mm cork packing (between ends and tank, base and ends, base and tank, and base and plinth)	Required	
8.6		Final colour	Avocado Green (12)	

Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Annex C - Technical schedules A and B for

**MSS TB 630KVA DR DYN11 6MM THICK AV SF6 RMU OIL TYPE TRFR (SAP
3586)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
9	4.6.2	Notices, signs and labels		
9.1		Transformer rating plate	Required	
9.2		Treatment and Full First Aid Instructions on inside of MV and LV compartment doors	Required	
9.3		Elec. warning signs on all doors and barriers	Required	
9.4		Transformer phase labels below bushings	Required	
9.5		Colour-coded LV bus-bars	Required	
9.6		Stenciled labeling of MV and LV compartment doors (both inside and outside)	Required	
9.7		kVA, Prim V, Sec V & Corrosion Class	Required	
9.8		ID markings linking roof to body per batch	Required	
9.9		Provision for the safe-keeping of documents	Required	
10	4.7	Documentation		
10.1		Type test reportss (provide ref. numbers of reports)	Sets 1	
10.2		Routine test reportss	Sets 1	
10.3		Drawings	Sets 2	
10.4		Circuit diagrams (LV auxiliary wiring and equipment)	Sets 2	

Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Technical schedules A and B Deviation schedule for

**MSS TB 630KVA DR DYN11 6MM THICK AV SF6 RMU OIL TYPE TRFR (SAP
3586)**

Any deviations offered to this specification shall be listed below with reasons for deviation. In addition, evidence shall be provided that the proposed deviation will at least be more cost-effective than that specified by City Power.

Item	Sub clause of CP_TSSPEC_005	Proposed deviation

Note: Ticks, Cross [√, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Name in block lettersSignature

Full name of company: _____

Annex C - Technical schedules A and B for

MSS TB 630KVA DR DYN11 3MM THICK AV SF6 RMU DRY TYPE TRFR (SAP 3709)

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
1		Standard operating conditions		
1.1		ii) Altitude m	1800	
1.2		b) Ambient air temperature °C	-5 to +40	
1.3		c) Lightning ground flash density Flashes/km ² /year	> 10	
1.4		d) Maximum solar radiation W/m ²	1000	
1.5		e) Ultraviolet radiation	High	
1.6		f) Relative humidity %	10 to 95	
1.7		g) Corrosive conditions (inland therefore non-corrosive)	Non-corrosive	
1.8		h) wind pressure Pa	700	
2	4.2.1	Ratings		
2.1		Transformer power rating kVA	630	
2.2		Nominal voltage of system (Dual ratio) kV _{rms}	6,6 & 11	
2.3		System frequency Hz	50	
2.4		Number of phases	3	
2.5		Rated no-load secondary voltage V _{rms}	415	
2.6		Rated power-frequency voltage kV _{rms}	12	
2.7		Rated lightning impulse withstand voltage kV _{peak}	95	
2.8		Rated short-duration power frequency withstand voltage [50Hz: 1 min] kV _{rms}	28	
2.9		Induced voltage withstand level kV _{rms}	22	
2.10		Internal arc classification	AB-FLR	
2.11		Internal arc current and duration	20KA/500 ms	

Note: Ticks, Cross [√, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

Tender Number: _____

Tenderer's Authorised Signatory: _____
Name in block letters Signature

Full name of company: _____

Annex C - Technical schedules A and B for

MSS TB 630KVA DR DYN11 3MM THICK AV SF6 RMU DRY TYPE TRFR (SAP 3709)

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
3	4.3.1	Construction design		
3.1		Layout	Type B	
3.2		Construction	Modular	
3.3		Removable base sections adjacent to MV compartment (sections to lap bolted with nuts on the inside of the channel and housing)	Required	
3.4		All doors shall be a manual three point locking mechanism, capable of being secured by a padlock, having a shackle diameter of 8mm.	Required	
3.5		Compartment lock protection facility (with welded mesh top with inside visibility)	Required	
3.6		Total mass of miniature substation Kg	Required	
3.7		Overall maximum dimensions	Required	
3.8		a) MV compartment length mm	Required	
		b) LV compartment length mm	Required	
		c) LV metering compartment mm	400 x 400	
		d) Overall length mm	3000	
		e) Overall width mm	1650	
		f) Overall height mm	2000	
		g)Base width mm	1200	
		h)Thickness mm	3	
		Provision for lifting of complete mini-sub onto a concrete plinth without need for dismantling	Required	
3.9		Provision of lifting lugs on roof for ease of removal	Required	
3.10		MV switchgear, LV panel, LV metering and transformer confined to separate compartments	Required	
3.11		Mini-sub housing sections and doors bonded	Required	

Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Tenderer's Authorised Signatory: _____

Name in block letters

Signature

Full name of company: _____

Annex C - Technical schedules A and B for

MSS TB 630KVA DR DYN11 3MM THICK AV SF6 RMU DRY TYPE TRFR (SAP 3709)

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
4	4.2.1	Transformer unit (/Dry-Type)		
4.1		Electrical requirements	As per SANS 60076	
4.2		Vector group	Dyn 11	
4.3		MV system earthing	Effective	
4.4		LV transformer neutral earthing	Solid – connection to insulated LV neutral/earth bar	
4.5		MV system fault level	kA 25	
4.6		Temperature rise limits	As per SANS 60076	
4.7		Secondary voltage regulation (Off-load on the 11 kV supply voltage windings)	% +6.0, + 3.0, 0, –3.0, –6.0	
4.8		No-load losses	W Required	
4.9		Load losses	W Required	
4.10		Impedance	% SANS 60076	
4.11		Cost /kW of no-load losses (Jul 2002)	R/kW 13 669	
4.12		Cost /kW of load losses (Jul 2002)	R/kW 1 623	
4.13		X/R	SANS 60076	
4.14		Audio-sound level – maximum (see table 6)	dB(A) Table 6	
4.15		Sealed transformer unit	Required	

Note: Ticks, Cross [√, X], Asterick [*], Word [Noted] or TBA [“To Be Advice”] will not be accepted.

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Annex C - Technical schedules A and B for

MSS TB 630KVA DR DYN11 3MM THICK AV SF6 RMU DRY TYPE TRFR (SAP 3709)

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
4.16	4.4.2	Transformer MV bushings (NB internal screen to be earthed)	BS 7215 –Type C with M16x2 thread	
4.17		MV bushing-centre clearances (minimum) mm	135	
4.18		Clearances between outer bushing-centres and mini-sub metal enclosure (minimum) mm	90	
4.19		Transformer overload protection facility	Required	
4.20		Winding material	MV Copper LV Copper	
4.21		Manufacturer of the distribution transformer	Required	
5		MV compartment		
5.1		Equipment in MV compartment	Ring Main Unit (CP_TSSPEC_006)	
5.2		Ring Main Unit manufacturer	Required	
5.3		Incoming MV cable requirements	Required	
		a) 185 mm ² 3 core Cu or 300 mm ² 3C Al XLPE	Required	
		b) Cable support (clamping) required	Required	
		c) Minimum distance from cable clamp to centre-line of RMU bushings mm	800	
		d) Type of connection	Screened	
5.4		Mini-sub earth bar (accessible in front of RMU)	Required	
5.5		Interconnection arrangement between RMU and transformer MV bushings	Required	
5.6		Unscreened interconnecting equipment and connections between ring main unit and transformer to be barricaded	Required	
5.7		Type of earth fault indicator	Required	
5.8		Voltage detecting system (VDS)	Required	

Note: Ticks, Cross [√, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Annex C - Technical schedules A and B for

MSS TB 630KVA DR DYN11 3MM THICK AV SF6 RMU DRY TYPE TRFR (SAP 3709)

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
6	4.2.8	LV Compartment		
6.1		Bus-bar-rating (see Table 2)	A	1,2 times the kVA capacity
6.2		Bus-bar-insulation		Air insulated
6.3		Bus-bars	Ø	3 + one identical neutral-earth bus-bar (insulated from frame)
6.4		Current density of bus-bars	A/mm ²	1,8 maximum
6.5		Rated withstand current – 1 s (25 kA for up to 630 kVA & 45 kA for 1000 kVA)	kA _{rms}	As per rating.
6.6		Min clearance to earth and between phases	mm	20
6.7		Provision of a LV neutral surge arrester fitted between mini-sub earth bar and LV neutral-earth bus-bar		Required
6.8		LV neutral-earth bus-bar to be earthed (via an electrical bridge to the mini-sub earth bar)		Required
6.9		Neutral isolating links		Not Required
6.10		Provision of LV main isolating switch		Not Required
6.11		Number of outgoing LV feeders to be provided for (drill bus-bar Ø14mm holes)		6
6.12		Spacing between holes (see Figure 1)	mm	110
6.13		LV panel designed for large frame MCCBs		Required
		Spacing (vertical): Between phase bus-bars	mm	185
		Between lowest LV bus-bar and LV neutral	mm	300
		Minimum distance between LV neutral and uni-strut	mm	200

Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Annex C - Technical schedules A and B for

MSS TB 630KVA DR DYN11 3MM THICK AV SF6 RMU DRY TYPE TRFR (SAP 3709)

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
6.14		LV maximum demand ammeters	On all three phases	
6.15		Ammeter type	Thermal integrating over 15 min period	
6.16		LV indicating voltmeter with a selector switch	Required	
6.17		Ammeter and voltmeter size and display mm	96 × 96, 90°	
6.18		Ammeter and voltmeter position	Top right hand side in LV compartment	
6.19		Electronic meter capable of reading current and voltage	Required	
6.20		Provision of removable non flammable barrier to separate LV end compartment and front LV compartment	Required	
6.21		Main MCCB manufacturer	Required	
6.22		Catalogue/model code of main MCCB	Required	
6.23		Size of main MCCB A	As per table 2	

Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Annex C - Technical schedules A and B for

MSS TB 630KVA DR DYN11 3MM THICK AV SF6 RMU DRY TYPE TRFR (SAP 3709)

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
7	4.2.6	LV auxiliaries		
7.1		Provision of three point socket outlet and 60W bulkhead fitting in LV compartment (with instantaneous-trip earth leakage unit [20 A; 5 kA rupturing capacity; 30 mA sensitivity] and 20 A HRC fuse with neutral fuse link)	Required	
7.2		Numbering ferrules for auxiliary wiring	Required	
7.3		Push-button fitted to shunt trip RMU tee-off	Required	
8	4.3.2	Materials and corrosion protection		
8.1		Mini-sub enclosure and transformer tank thickness 6(mm) or 3 mm	Mild steel	
8.2		Radiator	Mild steel	
8.3		Tinned copper bus-bars	Required	
8.4		Mini-sub base:Material	Steel	
8.5		Uni-strut clamping bar:Material	Required	
8.6		5mm cork packing (between ends and tank, base and ends, base and tank, and base and plinth)	Required	
8.7		Final colour	Avocado Green (12)	

Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Name in block letters

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Full name of company: _____

Annex C - Technical schedules A and B for

MSS TB 630KVA DR DYN11 3MM THICK AV SF6 RMU DRY TYPE TRFR (SAP 3709)

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
9	4.6.2	Notices, signs and labels		
9.1		Transformer rating plate	Required	
9.2		Treatment and Full First Aid Instructions on inside of MV and LV compartment doors	Required	
9.3		Elec. warning signs on all doors and barriers	Required	
9.4		Transformer phase labels below bushings	Required	
9.5		Colour-coded LV bus-bars	Required	
9.6		Stenciled labeling of MV and LV compartment doors (both inside and outside)	Required	
9.7		kVA, Prim V, Sec V & Corrosion Class	Required	
9.8		ID markings linking roof to body per batch	Required	
9.9		Provision for the safe-keeping of documents	Required	
10	4.7	Documentation		
10.1		Type test reportss (provide ref. numbers of reports) Sets	1	
10.2		Routine test reportss Sets	1	
10.3		Drawings Sets	2	
10.4		Circuit diagrams (LV auxiliary wiring and equipment) Sets	2	

Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

Tender Number: _____

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Technical schedules A and B Deviation schedule for

**MSS TB 630KVA DR DYN11 3MM THICK AV SF6 RMU DRY TYPE TRFR (SAP
3709)**

Any deviations offered to this specification shall be listed below with reasons for deviation. In addition, evidence shall be provided that the proposed deviation will at least be more cost-effective than that specified by City Power.

Item	Sub clause of CP_TSSPEC_005	Proposed deviation

Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA [“To Be Advice”] will not be accepted.

Tender Number: _____

Tenderer's Authorised Signatory: _____
Name in block lettersSignature

Full name of company: _____

Annex C - Technical schedules A and B for

**MSS TB 630KVA DR DYN11 6MM THICK AV SF6 RMU DRY TYPE TRFR (SAP
3713)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
1		Standard operating conditions		
1.1		j) Altitude m	1800	
1.2		b) Ambient air temperature °C	-5 to +40	
1.3		c) Lightning ground flash density Flashes/ km ² /year	> 10	
1.4		d) Maximum solar radiation W/m ²	1000	
1.5		e) Ultraviolet radiation	High	
1.6		f) Relative humidity %	10 to 95	
1.7		g) Corrosive conditions (inland therefore non-corrosive)	Non- corrosive	
1.8		h) wind pressure Pa	700	
2	4.2.1	Ratings		
2.1		Transformer power rating kVA	630	
2.2		Nominal voltage of system (Dual ratio) kV _{rms}	6,6 & 11	
2.3		System frequency Hz	50	
2.4		Number of phases	3	
2.5		Rated no-load secondary voltage V _{rms}	415	
2.6		Rated power-frequency voltage kV _{rms}	12	
2.7		Rated lightning impulse withstand voltage kV _{peak}	95	
2.8		Rated short-duration power frequency withstand voltage [50Hz: 1 min] kV _{rms}	28	
2.9		Induced voltage withstand level kV _{rms}	22	
2.10		Internal arc classification	AB-FLR	
2.11		Internal arc current and duration	20KA/500 ms	

**Note: Ticks, Cross [√, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be
accepted.**

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Name in block letters

Signature

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Annex C - Technical schedules A and B for

MSS TB 630KVA DR DYN11 6MM THICK AV SF6 RMU DRY TYPE TRFR (SAP 3713)

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
3	4.3.1	Construction design		
3.1		Layout	Type B	
3.2		Construction	Modular	
3.3		Removable base sections adjacent to MV compartment (sections to lap bolted with nuts on the inside of the channel and housing)	Required	
3.4		All doors shall be a manual three point locking mechanism, capable of being secured by a padlock, having a shackle diameter of 8mm.	Required	
3.5		Compartment lock protection facility (with welded mesh top with inside visibility)	Required	
3.6		Total mass of miniature substation Kg	Required	
3.7		Overall maximum dimensions	Required	
3.8		a) MV compartment length mm	Required	
		b) LV compartment length mm	Required	
		c) LV metering compartment mm	400 x 400	
		d) Overall length mm	3000	
		e) Overall width mm	1650	
		f) Overall height mm	2000	
		g)Base width mm	1200	
		h)Thickness mm	6	
		Provision for lifting of complete mini-sub onto a concrete plinth without need for dismantling	Required	
3.9		Provision of lifting lugs on roof for ease of removal	Required	
3.10		MV switchgear, LV panel, LV metering and transformer confined to separate compartments	Required	
3.11		Mini-sub housing sections and doors bonded	Required	

Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Annex C - Technical schedules A and B for

MSS TB 630KVA DR DYN11 6MM THICK AV SF6 RMU DRY TYPE TRFR (SAP 3713)

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
4	4.2.1	Transformer unit (Dry-Type)		
4.1		Electrical requirements	As per SANS 60076	
4.2		Vector group	Dyn 11	
4.3		MV system earthing	Effective	
4.4		LV transformer neutral earthing	Solid – connection to insulated LV neutral/earth bar	
4.5		MV system fault level	kA 25	
4.6		Temperature rise limits	As per SANS 60076	
4.7		Secondary voltage regulation (Off-load on the 11 kV supply voltage windings)	% +6.0, + 3.0, 0, –3.0, –6.0	
4.8		No-load losses	W Required	
4.9		Load losses	W Required	
4.10		Impedance	% SANS 630	
4.11		Cost /kW of no-load losses (Jul 2002)	R/kW 13 669	
4.12		Cost /kW of load losses (Jul 2002)	R/kW 1 623	
4.13		X/R	SANS 60076	
4.14		Audio-sound level – maximum	dB(A)	
4.15		Sealed transformer unit	Required	

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Annex C - Technical schedules A and B for

MSS TB 630KVA DR DYN11 6MM THICK AV SF6 RMU DRY TYPE TRFR (SAP 3713)

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
4.16	4.4.2	Transformer MV bushings (NB internal screen to be earthed)	BS 7215 –Type C with M16x2 thread	
4.17		MV bushing-centre clearances (minimum) mm	135	
4.18		Clearances between outer bushing-centres and mini-sub metal enclosure (minimum) mm	90	
4.19		Transformer overload protection facility	Required	
4.20		Winding material	MV Copper LV Copper	
4.21		Manufacturer of the distribution transformer	Required	
5		MV compartment		
5.1		Equipment in MV compartment	Ring Main Unit (CP_TSSPEC_006)	
5.2		Ring Main Unit manufacturer	Required	
5.3		Incoming MV cable requirements		
		a) 185 mm ² 3 core Cu or 300 mm ² 3C Al XLPE	Required	
		b) Cable support (clamping) required	Required	
		c) Minimum distance from cable clamp to centre-line of RMU bushings mm	800	
		d) Type of connection	Screened	
5.4		Mini-sub earth bar (accessible in front of RMU)	Required	
5.5		Interconnection arrangement between RMU and transformer MV bushings	Required	
5.6		Unscreened interconnecting equipment and connections between ring main unit and transformer to be barricaded	Required	
5.7		Type of earth fault indicator	Required	
5.8		Voltage detecting system (VDS)	Required	

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Annex C - Technical schedules A and B for

MSS TB 630KVA DR DYN11 6MM THICK AV SF6 RMU DRY TYPE TRFR (SAP 3713)

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
6	4.2.8	LV Compartment		
6.1		Bus-bar-rating (see Table 2)	A	1,2 times the kVA capacity
6.2		Bus-bar-insulation		Air insulated
6.3		Bus-bars	Ø	3 + one identical neutral-earth bus-bar (insulated from frame)
6.4		Current density of bus-bars	A/mm ²	1,8 maximum
6.5		Rated withstand current – 1 s (25 kA for up to 630 kVA & 45 kA for 1000 kVA)	kA _{rms}	As per rating.
6.6		Min clearance to earth and between phases	mm	20
6.7		Provision of a LV neutral surge arrester fitted between mini-sub earth bar and LV neutral-earth bus-bar		Required
6.8		LV neutral-earth bus-bar to be earthed (via an electrical bridge to the mini-sub earth bar)		Required
6.9		Neutral isolating links		Not Required
6.10		Provision of LV main isolating switch		Not Required
6.11		Number of outgoing LV feeders to be provided for (drill bus-bar Ø14mm holes)		6
6.12		Spacing between holes (see Figure 1)	mm	110
6.13		LV panel designed for large frame MCCBs		Required
		Spacing (vertical): Between phase bus-bars	mm	185
		Between lowest LV bus-bar and LV neutral	mm	300
		Minimum distance between LV neutral and uni-strut	mm	200

Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Annex C - Technical schedules A and B for

MSS TB 630KVA DR DYN11 6MM THICK AV SF6 RMU DRY TYPE TRFR (SAP 3713)

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
6.14		LV maximum demand ammeters	On all three phases	
6.15		Ammeter type	Thermal integrating over 15 min period	
6.16		LV indicating voltmeter with a selector switch	Required	
6.17		Ammeter and voltmeter size and display mm	96 × 96, 90°	
6.18		Ammeter and voltmeter position	Top right hand side in LV compartment	
6.19		Electronic meter capable of reading current and voltage	Required	
6.20		Provision of removable non flammable barrier to separate LV end compartment and front LV compartment	Required	
6.21		Main MCCB manufacturer	Required	
6.22		Catalogue/model code of main MCCB	Required	
6.23		Size of main MCCB A	As per table 2	

Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Annex C - Technical schedules A and B for

MSS TB 630KVA DR DYN11 6MM THICK AV SF6 RMU DRY TYPE TRFR (SAP 3713)

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
7	4.2.6	LV auxiliaries		
7.1		Provision of three point socket outlet and 60W bulkhead fitting in LV compartment (with instantaneous-trip earth leakage unit [20 A; 5 kA rupturing capacity; 30 mA sensitivity] and 20 A HRC fuse with neutral fuse link)	Required	
7.2		Numbering ferrules for auxiliary wiring	Required	
7.3		Push-button fitted to shunt trip RMU tee-off	Required	
8	4.3.2	Materials and corrosion protection		
8.1		Mini-sub enclosure and transformer tank thickness 6(mm) or 3 mm	Mild steel	
8.2		Radiator	Mild steel	
8.3		Tinned copper bus-bars	Required	
8.4		Mini-sub base:Material	Steel	
8.5		Uni-strut clamping bar:Material	Required	
8.6		5mm cork packing (between ends and tank, base and ends, base and tank, and base and plinth)	Required	
8.7		Final colour	Avocado Green (12)	

Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Annex C - Technical schedules A and B for

**MSS TB 630KVA DR DYN11 6MM THICK AV SF6 RMU DRY TYPE TRFR (SAP
3713)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
9	4.6.2	Notices, signs and labels		
9.1		Transformer rating plate	Required	
9.2		Treatment and Full First Aid Instructions on inside of MV and LV compartment doors	Required	
9.3		Elec. warning signs on all doors and barriers	Required	
9.4		Transformer phase labels below bushings	Required	
9.5		Colour-coded LV bus-bars	Required	
9.6		Stenciled labeling of MV and LV compartment doors (both inside and outside)	Required	
9.7		kVA, Prim V, Sec V & Corrosion Class	Required	
9.8		ID markings linking roof to body per batch	Required	
9.9		Provision for the safe-keeping of documents	Required	
10	4.7	Documentation		
10.1		Type test reportss (provide ref. numbers of reports)	Sets 1	
10.2		Routine test reportss	Sets 1	
10.3		Drawings	Sets 2	
10.4		Circuit diagrams (LV auxiliary wiring and equipment)	Sets 2	

**Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be
accepted.**

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Name in block lettersSignature

Full name of company: _____

Technical schedules A and B Deviation schedule for

**MSS TB 630KVA DR DYN11 6MM THICK AV SF6 RMU DRY TYPE TRFR (SAP
3713)**

Any deviations offered to this specification shall be listed below with reasons for deviation. In addition, evidence shall be provided that the proposed deviation will at least be more cost-effective than that specified by City Power.

Item	Sub clause of CP_TSSPEC_005	Proposed deviation

Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

Tender Number: _____

Tenderer's Authorised Signatory: _____
Name in block lettersSignature

Full name of company: _____

Annex C - Technical schedules A and B for

**MSS TB 630KVA DR DYN11 3MM THICK AV SF6 FREE RMU OIL TYPE
TRFR (SAP 4366)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
1		Standard operating conditions		
1.1		kk) Altitude m	1800	
1.2		b) Ambient air temperature °C	-5 to +40	
1.3		c) Lightning ground flash density Flashes/ km ² /year	> 10	
1.4		d) Maximum solar radiation W/m ²	1000	
1.5		e) Ultraviolet radiation	High	
1.6		f) Relative humidity %	10 to 95	
1.7		g) Corrosive conditions (inland therefore non-corrosive)	Non- corrosive	
1.8		h) wind pressure Pa	700	
2	4.2.1	Ratings		
2.1		Transformer power rating kVA	630	
2.2		Nominal voltage of system (Dual ratio) kV _{rms}	6,6 & 11	
2.3		System frequency Hz	50	
2.4		Number of phases	3	
2.5		Rated no-load secondary voltage V _{rms}	415	
2.6		Rated power-frequency voltage kV _{rms}	12	
2.7		Rated lightning impulse withstand voltage kV _{peak}	95	
2.8		Rated short-duration power frequency withstand voltage [50Hz: 1 min] kV _{rms}	28	
2.9		Induced voltage withstand level kV _{rms}	22	
3.0		Internal arc classification	AB-FLR	
3.1		Internal arc current and duration	20KA/500 ms	

Note: Ticks, Cross [√, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

Tender Number: _____

Tenderer's Authorised Signatory: _____
Name in block letters Signature

Full name of company: _____

Annex C - Technical schedules A and B for

**MSS TB 630KVA DR DYN11 3MM THICK AV SF6 FREE RMU OIL TYPE TRFR
(SAP 4366)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
3	4.3.1	Construction design		
3.1		Layout	Type B	
3.2		Construction	Modular	
3.3		Removable base sections adjacent to MV compartment (sections to lap bolted with nuts on the inside of the channel and housing)	Required	
3.4		All doors shall be a manual three point locking mechanism, capable of being secured by a padlock, having a shackle diameter of 8mm.	Required	
3.5		Compartment lock protection facility (with welded mesh top with inside visibility)	Required	
3.6		Total mass of miniature substation Kg	Required	
3.7		Overall maximum dimensions	Required	
3.8		a) MV compartment length mm	Required	
		b) LV compartment length mm	Required	
		c) LV metering compartment mm	400 x 400	
		d) Overall length mm	3000	
		e) Overall width mm	1650	
		f) Overall height mm	2000	
		g) Base width mm	1200	
		h) Thickness mm	3	
		Provision for lifting of complete mini-sub onto a concrete plinth without need for dismantling	Required	
3.9		Provision of lifting lugs on roof for ease of removal	Required	
3.10		MV switchgear, LV panel, LV metering and transformer confined to separate compartments	Required	
3.11		Mini-sub housing sections and doors bonded	Required	

Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Name in block letters

Signature

Full name of company: _____

Annex C - Technical schedules A and B for

**MSS TB 630KVA DR DYN11 3MM THICK AV SF6 FREE RMU OIL TYPE TRFR
(SAP 4366)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
4	4.2.1	Transformer unit (Oil immersed/Dry-Type)		
4.1		Electrical requirements	As per SANS 780	
4.2		Vector group	Dyn 11	
4.3		MV system earthing	Effective	
4.4		LV transformer neutral earthing	Solid – connection to insulated LV neutral/earth bar	
4.5		MV system fault level	kA 25	
4.6		Temperature rise limits	As per SANS 780 Table 6	
4.7		Secondary voltage regulation (Off-load on the 11 kV supply voltage windings)	% +6.0, + 3.0, 0, –3.0, –6.0	
4.8		No-load losses	W Required	
4.9		Load losses	W Required	
4.10		Impedance	% SANS780	
4.11		Cost /kW of no-load losses (Jul 2002)	R/k 13 669	
4.12		Cost /kW of load losses (Jul 2002)	R/k 1 623	
4.13		X/R	SANS780	
4.14		Audio-sound level – maximum (see table 6)	dB Table 6	
4.15		Sealed transformer unit	Required	

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Annex C - Technical schedules A and B for

**MSS TB 630KVA DR DYN11 3MM THICK AV SF6 FREE RMU OIL TYPE TRFR
(SAP 4366)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
4.16	4.4.2	Transformer MV bushings (NB internal screen to be earthed)	BS 7215 –Type C with M16x2 thread	
4.17		MV bushing-centre clearances (minimum) mm	135	
4.18		Clearances between outer bushing-centres and mini-sub metal enclosure (minimum) mm	90	
4.19		Transformer overload protection facility	Required	
4.20		Winding material	MV Copper LV Copper	
4.21		Manufacturer of the distribution transformer	Required	
5		MV compartment		
5.1		Equipment in MV compartment	SF6 FREE Ring Main Unit (CP_TSSPEC_006)	
5.2		Ring Main Unit manufacturer	Required	
5.5		Incoming MV cable requirements		
		a) 185 mm ² 3 core Cu or 300 mm ² 3C Al XLPE	Required	
		b) Cable support (clamping) required	Required	
		c) Minimum distance from cable clamp to centre-line of RMU bushings mm	800	
		d) Type of connection	Sreened	
5.6		Mini-sub earth bar (accessible in front of RMU)	Required	
5.7		Interconnection arrangement between RMU and transformer MV bushings	Required	
5.8		Unscreened interconnecting equipment and connections between ring main unit and transformer to be barricaded	Required	
5.9		Type of earth fault indicator	Required	
5.10		Voltage detecting system (VDS)	Required	

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Annex C - Technical schedules A and B for

**MSS TB 630KVA DR DYN11 3MM THICK AV SF6 FREE RMU OIL TYPE TRFR
(SAP 4366)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
6	4.2.8	LV Compartment		
6.1		Bus-bar-rating (see Table 2)	A	1,2 times the kVA capacity
6.2		Bus-bar-insulation		Air insulated
6.3		Bus-bars	Ø	3 + one identical neutral-earth busbar (insulated from frame)
6.4		Current density of bus-bars	A/mm ²	1,8 maximum
6.5		Rated withstand current – 1 s (25 kA for up to 630 kVA & 45 kA for 1000 kVA)	kA _{rms}	As per rating.
6.6		Min clearance to earth and between phases	mm	20
6.7		Provision of a LV neutral surge armineral fitted between mini-sub earth bar and LV neutral-earth bus-bar		Required
6.8		LV neutral-earth bus-bar to be earthed (via an electrical bridge to the mini-sub earth bar)		Required
6.9		Neutral isolating links		Not Required
6.10		Provision of LV main isolating switch		Not Required
6.11		Number of outgoing LV feeders to be provided for (drill bus-bar Ø14mm holes)		6
6.12		Spacing between holes (see Figure 1)	mm	110
6.13		LV panel designed for large frame MCCBs		Required
		Spacing (vertical): Between phase bus-bars	mm	185
		Between lowest LV bus-bar and LV neutral	mm	300
		Minimum distance between LV neutral and uni-strut	mm	200

**Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be
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Annex C - Technical schedules A and B for

**MSS TB 630KVA DR DYN11 3MM THICK AV SF6 FREE RMU OIL TYPE TRFR
(SAP 4366)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
6.14		LV maximum demand ammeters	On all three phases	
6.15		Ammeter type	Thermal integrating over 15 min period	
6.16		LV indicating voltmeter with a selector switch	Required	
6.17		Ammeter and voltmeter size and display mm	96 × 96, 90°	
6.18		Ammeter and voltmeter position	Top right hand side in LV compartment	
6.19		Analogue meter capable of reading current and voltage	Required	
6.20		Provision of removable non flammable barrier to separate LV end compartment and front LV compartment	Required	
6.21		Main MCCB manufacturer	Required	
6.22		Catalogue/model code of main MCCB	Required	
6.23		Size of main MCCB A	As per table 2	

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Annex C - Technical schedules A and B for

**MSS TB 630KVA DR DYN11 3MM THICK AV SF6 FREE RMU OIL TYPE TRFR
(SAP 4366)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
7	4.2.6	LV auxiliaries		
7.1		Provision of three point socket outlet and 60W bulkhead fitting in LV compartment (with instantaneous-trip earth leakage unit [20 A; 5 kA rupturing capacity; 30 mA sensitivity] and 20 A HRC fuse with neutral fuse link)	Required	
7.2		Numbering ferrules for auxiliary wiring	Required	
7.3		Push-button fitted to shunt trip RMU tee-off	Required	
8	4.3.2	Materials and corrosion protection		
8.1		Mini-sub enclosure and transformer tank	Mild steel	
8.2		Radiator 3 or 6mm thickness	Mild steel	
8.3		Tinned copper bus-bars	Required	
8.4		Mini-sub base:Material	Steel	
8.5		5mm cork packing (between ends and tank, base and ends, base and tank, and base and plinth)	Required	
8.6		Final colour	Avocado Green (12)	

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Annex C - Technical schedules A and B for

**MSS TB 630KVA DR DYN11 3MM THICK AV SF6 FREE RMU OIL TYPE TRFR
(SAP 4366)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
9	4.6.2	Notices, signs and labels		
9.1		Transformer rating plate	Required	
9.2		Treatment and Full First Aid Instructions on inside of MV and LV compartment doors	Required	
9.3		Elec. warning signs on all doors and barriers	Required	
9.4		Transformer phase labels below bushings	Required	
9.5		Colour-coded LV bus-bars	Required	
9.6		Stenciled labeling of MV and LV compartment doors (both inside and outside)	Required	
9.7		kVA, Prim V, Sec V & Corrosion Class	Required	
9.8		ID markings linking roof to body per batch	Required	
9.9		Provision for the safe-keeping of documents	Required	
10	4.7	Documentation		
10.1		Type test reportss (provide ref. numbers of reports)	Sets 1	
10.2		Routine test reportss	Sets 1	
10.3		Drawings	Sets 2	
10.4		Circuit diagrams (LV auxiliary wiring and equipment)	Sets 2	

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Technical schedules A and B Deviation schedule for

**MSS TB 630KVA DR DYN11 3MM THICK AV SF6 FREE RMU OIL TYPE TRFR
(SAP 4366)**

Any deviations offered to this specification shall be listed below with reasons for deviation. In addition, evidence shall be provided that the proposed deviation will at least be more cost-effective than that specified by City Power.

Item	Sub clause of CP_TSSPEC_005	Proposed deviation

Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Annex C - Technical Schedules A and B for

**MSS TB 630KVA DR DYN11 6MM THICK AV SF6 FREE RMU OIL TYPE
TRFR (SAP 4371)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
1		Standard operating conditions		
1.1		l) Altitude m	1800	
1.2		b) Ambient air temperature °C	-5 to +40	
1.3		c) Lightning ground flash density Flashes/ km ² /year	> 10	
1.4		d) Maximum solar radiation W/m ²	1000	
1.5		e) Ultraviolet radiation	High	
1.6		f) Relative humidity %	10 to 95	
1.7		g) Corrosive conditions (inland therefore non-corrosive)	Non- corrosive	
1.8		h) wind pressure Pa	700	
2	4.2.1	Ratings		
2.1		Transformer power rating kVA	630	
2.2		Nominal voltage of system (Dual ratio) kV _{rms}	6,6 & 11	
2.3		System frequency Hz	50	
2.4		Number of phases	3	
2.5		Rated no-load secondary voltage V _{rms}	415	
2.6		Rated power-frequency voltage kV _{rms}	12	
2.7		Rated lightning impulse withstand voltage kV _{peak}	95	
2.8		Rated short-duration power frequency withstand voltage [50Hz: 1 min] kV _{rms}	28	
2.9		Induced voltage withstand level kV _{rms}	22	
3.0		Internal arc classification	AB-FLR	
3.1		Internal arc current and duration	20KA/500 ms	

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Annex C - Technical schedules A and B for

**MSS TB 630KVA DR DYN11 6MM THICK AV SF6 FREE RMU OIL TYPE TRFR
(SAP 4371)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
3	4.3.1	Construction design		
3.1		Layout	Type B	
3.2		Construction	Modular	
3.3		Removable base sections adjacent to MV compartment (sections to lap bolted with nuts on the inside of the channel and housing)	Required	
3.4		All doors shall be a manual three point locking mechanism, capable of being secured by a padlock, having a shackle diameter of 8mm.	Required	
3.5		Compartment lock protection facility (with welded mesh top with inside visibility)	Required	
3.6		Total mass of miniature substation Kg	Required	
3.7		Overall maximum dimensions	Required	
3.8		a) MV compartment length mm	Required	
		b) LV compartment length mm	Required	
		c) LV metering compartment mm	400 x 400	
		d) Overall length mm	3000	
		e) Overall width mm	1650	
		f) Overall height mm	2000	
		g) Base width mm	1200	
		h) Thickness mm	6	
		Provision for lifting of complete mini-sub onto a concrete plinth without need for dismantling	Required	
3.9		Provision of lifting lugs on roof for ease of removal	Required	
3.10		MV switchgear, LV panel, LV metering and transformer confined to separate compartments	Required	
3.11		Mini-sub housing sections and doors bonded	Required	

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**MSS TB 630KVA DR DYN11 6MM THICK AV SF6 FREE RMU OIL TYPE TRFR
(SAP 4371)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
4	4.2.1	Transformer unit (Oil immersed)		
4.1		Electrical requirements	As per SANS 780	
4.2		Vector group	Dyn 11	
4.3		MV system earthing	Effective	
4.4		LV transformer neutral earthing	Solid – connection to insulated LV neutral/earth bar	
4.5		MV system fault level	kA 25	
4.6		Temperature rise limits	As per SANS 780 Table 6	
4.7		Secondary voltage regulation (Off-load on the 11 kV supply voltage windings)	% +6.0, + 3.0, 0, –3.0, –6.0	
4.8		No-load losses	W Required	
4.9		Load losses	W Required	
4.10		Impedance	% SANS780	
4.11		Cost /kW of no-load losses (Jul 2002)	R/kW 13 669	
4.12		Cost /kW of load losses (Jul 2002)	R/kW 1 623	
4.13		X/R	SANS780	
4.14		Audio-sound level – maximum (see table 6)	dB(A) Table 6	
4.15		Sealed transformer unit	Required	

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(SAP 4371)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
4.16	4.4.2	Transformer MV bushings (NB internal screen to be earthed)	BS 7215 –Type C with M16x2 thread	
4.17		MV bushing-centre clearances (minimum) mm	135	
4.18		Clearances between outer bushing-centres and mini-sub metal enclosure (minimum) mm	90	
4.19		Transformer overload protection facility	Required	
4.20		Winding material	MV Copper LV Copper	
4.21		Manufacturer of the distribution transformer	Required	
5		MV compartment		
5.1		Equipment in MV compartment	SF6 FREE Ring Main Unit (CP_TSSPEC_006)	
5.2		Ring Main Unit manufacturer	Required	
5.5		Incoming MV cable requirements		
		a) 185 mm ² 3 core Cu or 300 mm ² 3C Al XLPE	Required	
		b) Cable support (clamping) required	Required	
		c) Minimum distance from cable clamp to centre-line of RMU bushings mm	800	
		d) Type of connection	Screened	
5.6		Mini-sub earth bar (accessible in front of RMU)	Required	
5.7		Interconnection arrangement between RMU and transformer MV bushings	Required	
5.8		Unscreened interconnecting equipment and connections between ring main unit and transformer to be barricaded	Required	
5.9		Type of earth fault indicator	Required	
5.10		Voltage detecting system (VDS)	Required	

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(SAP 4371)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
6	4.2.8	LV Compartment		
6.1		Bus-bar-rating (see Table 2)	A	1,2 times the kVA capacity
6.2		Bus-bar-insulation		Air insulated
6.3		Bus-bars	Ø	3 + one identical neutral-earth busbar (insulated from frame)
6.4		Current density of bus-bars	A/mm ²	1,8 maximum
6.5		Rated withstand current – 1 s (25 kA for up to 630 kVA & 45 kA for 1000 kVA)	kA _{rms}	As per rating.
6.6		Min clearance to earth and between phases	mm	20
6.7		Provision of a LV neutral surge armineral fitted between mini-sub earth bar and LV neutral-earth bus-bar		Required
6.8		LV neutral-earth bus-bar to be earthed (via an electrical bridge to the mini-sub earth bar)		Required
6.9		Neutral isolating links		Not Required
6.10		Provision of LV main isolating switch		Not Required
6.11		Number of outgoing LV feeders to be provided for (drill bus-bar Ø14mm holes)		6
6.12		Spacing between holes (see Figure 1)	mm	110
6.13		LV panel designed for large frame MCCBs		Required
		Spacing (vertical): Between phase bus-bars	mm	185
		Between lowest LV bus-bar and LV neutral	mm	300
		Minimum distance between LV neutral and uni-strut	mm	200

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Annex C - Technical schedules A and B for

**MSS TB 630KVA DR DYN11 6MM THICK AV SF6 FREE RMU OIL TYPE TRFR
(SAP 4371)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
6.14		LV maximum demand ammeters	On all three phases	
6.15		Ammeter type	Thermal integrating over 15 min period	
6.16		LV indicating voltmeter with a selector switch	Required	
6.17		Ammeter and voltmeter size and display mm	96 × 96, 90°	
6.18		Ammeter and voltmeter position	Top right hand side in LV compartment	
6.19		Analogue meter capable of reading current and voltage	Required	
6.20		Provision of removable non flammable barrier to separate LV end compartment and front LV compartment	Required	
6.21		Main MCCB manufacturer	Required	
6.22		Catalogue/model code of main MCCB	Required	
6.23		Size of main MCCB A	As per table 2	

Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Annex C - Technical schedules A and B for

**MSS TB 630KVA DR DYN11 6MM THICK AV SF6 FREE RMU OIL TYPE TRFR
(SAP 4371)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
7	4.2.6	LV auxiliaries		
7.1		Provision of three point socket outlet and 60W bulkhead fitting in LV compartment (with instantaneous-trip earth leakage unit [20 A; 5 kA rupturing capacity; 30 mA sensitivity] and 20 A HRC fuse with neutral fuse link)	Required	
7.2		Numbering ferrules for auxiliary wiring	Required	
7.3		Push-button fitted to shunt trip RMU tee-off	Required	
8	4.3.2	Materials and corrosion protection		
8.1		Mini-sub enclosure and transformer tank 6 mm or 3 mm	Mild steel	
8.2		Radiator 6 mm thickness	Mild steel	
8.3		Tinned copper bus-bars	Required	
8.4		Mini-sub base:Material	Steel	
8.5		5mm cork packing (between ends and tank, base and ends, base and tank, and base and plinth)	Required	
8.6		Final colour	Avocado Green (12)	

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Annex C - Technical schedules A and B for

**MSS TB 630KVA DR DYN11 6MM THICK AV SF6 FREE RMU OIL TYPE TRFR
(SAP 4371)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
9	4.6.2	Notices, signs and labels		
9.1		Transformer rating plate	Required	
9.2		Treatment and Full First Aid Instructions on inside of MV and LV compartment doors	Required	
9.3		Elec. warning signs on all doors and barriers	Required	
9.4		Transformer phase labels below bushings	Required	
9.5		Colour-coded LV bus-bars	Required	
9.6		Stenciled labeling of MV and LV compartment doors (both inside and outside)	Required	
9.7		kVA, Prim V, Sec V & Corrosion Class	Required	
9.8		ID markings linking roof to body per batch	Required	
9.9		Provision for the safe-keeping of documents	Required	
10	4.7	Documentation		
10.1		Type test reportss (provide ref. numbers of reports)	Sets 1	
10.2		Routine test reportss	Sets 1	
10.3		Drawings	Sets 2	
10.4		Circuit diagrams (LV auxiliary wiring and equipment)	Sets 2	

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Technical schedules A and B Deviation schedule for

**MSS TB 630KVA DR DYN11 6MM THICK AV SF6 FREE RMU OIL TYPE TRFR
(SAP 4371)**

Any deviations offered to this specification shall be listed below with reasons for deviation. In addition, evidence shall be provided that the proposed deviation will at least be more cost-effective than that specified by City Power.

Item	Sub clause of CP_TSSPEC_005	Proposed deviation

Note: Ticks, Cross [√, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Full name of company: _____

Annex C - Technical schedules A and B for

**MSS TB 630KVA DR DYN11 3MM THICK AV SF6 FREE RMU DRY TYPE TRFR
(SAP 4381)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
1		Standard operating conditions		
1.1		a) Altitude m	1800	
1.2		b) Ambient air temperature °C	-5 to +40	
1.3		c) Lightning ground flash density Flashes/ km ² /year	> 10	
1.4		d) Maximum solar radiation W/m ²	1000	
1.5		e) Ultraviolet radiation	High	
1.6		f) Relative humidity %	10 to 95	
1.7		g) Corrosive conditions (inland therefore non-corrosive)	Non- corrosive	
1.8		h) wind pressure Pa	700	
2	4.2.1	Ratings		
2.1		Transformer power rating kVA	630	
2.2		Nominal voltage of system (Dual ratio) kV _{rms}	6,6 & 11	
2.3		System frequency Hz	50	
2.4		Number of phases	3	
2.5		Rated no-load secondary voltage V _{rms}	415	
2.6		Rated power-frequency voltage kV _{rms}	12	
2.7		Rated lightning impulse withstand voltage kV _{peak}	95	
2.8		Rated short-duration power frequency withstand voltage [50Hz: 1 min] kV _{rms}	28	
2.9		Induced voltage withstand level kV _{rms}	22	
2.10		Internal arc classification	AB-FLR	
2.11		Internal arc current and duration	20KA/500 ms	

Note: Ticks, Cross [√, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Annex C - Technical schedules A and B for

**MSS TB 630KVA DR DYN11 3MM THICK AV SF6 FREE RMU DRY TYPE TRFR
(SAP 4381)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
3	4.3.1	Construction design		
3.1		Layout	Type B	
3.2		Construction	Modular	
3.3		Removable base sections adjacent to MV compartment (sections to lap bolted with nuts on the inside of the channel and housing)	Required	
3.4		All doors shall be a manual three point locking mechanism, capable of being secured by a padlock, having a shackle diameter of 8mm.	Required	
3.5		Compartment lock protection facility (with welded mesh top with inside visibility)	Required	
3.6		Total mass of miniature substation Kg	Required	
3.7		Overall maximum dimensions	Required	
3.8		a) MV compartment length mm	Required	
		b) LV compartment length mm	Required	
		c) LV metering compartment mm	400 x 400	
		d) Overall length mm	3000	
		e) Overall width mm	1650	
		f) Overall height mm	2000	
		g)Base width mm	1200	
		h)Thickness mm	3	
		Provision for lifting of complete mini-sub onto a concrete plinth without need for dismantling	Required	
3.9		Provision of lifting lugs on roof for ease of removal	Required	
3.10		MV switchgear, LV panel, LV metering and transformer confined to separate compartments	Required	
3.11		Mini-sub housing sections and doors bonded	Required	

Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

Tender Number: _____

Tenderer's Authorised Signatory: _____

Name in block letters

Signature

Full name of company: _____

Annex C - Technical schedules A and B for

**MSS TB 630KVA DR DYN11 3MM THICK AV SF6 FREE RMU DRY TYPE TRFR
(SAP 4381)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
4	4.2.1	Transformer unit (/Dry-Type)		
4.1		Electrical requirements	As per SANS 60076	
4.2		Vector group	Dyn 11	
4.3		MV system earthing	Effective	
4.4		LV transformer neutral earthing	Solid – connection to insulated LV neutral/earth bar	
4.5		MV system fault level	kA 25	
4.6		Temperature rise limits	As per SANS 60076	
4.7		Secondary voltage regulation (Off-load on the 11 kV supply voltage windings)	% +6.0, + 3.0, 0, –3.0, –6.0	
4.8		No-load losses	W Required	
4.9		Load losses	W Required	
4.10		Impedance	% SANS 60076	
4.11		Cost /kW of no-load losses (Jul 2002)	R/kW 13 669	
4.12		Cost /kW of load losses (Jul 2002)	R/kW 1 623	
4.13		X/R	SANS 60076	
4.14		Audio-sound level – maximum	dB(A) Required	
4.15		Sealed transformer unit	Required	

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Annex C - Technical schedules A and B for

**MSS TB 630KVA DR DYN11 3MM THICK AV SF6 FREE RMU DRY TYPE TRFR
(SAP 4381)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
4.16	4.4.2	Transformer MV bushings (NB internal screen to be earthed)	BS 7215 –Type C with M16x2 thread	
4.17		MV bushing-centre clearances (minimum) mm	135	
4.18		Clearances between outer bushing-centres and mini-sub metal enclosure (minimum) mm	90	
4.19		Transformer overload protection facility	Required	
4.20		Winding material	MV Copper LV Copper	
4.21		Manufacturer of the distribution transformer	Required	
5		MV compartment		
5.1		Equipment in MV compartment	SF6 FREE Ring Main Unit (CP_TSSPEC_006)	
5.2		Ring Main Unit manufacturer	Required	
5.3		Incoming MV cable requirements		
		a) 185 mm ² 3 core Cu or 300 mm ² 3C Al XLPE	Required	
		b) Cable support (clamping) required	Required	
		c) Minimum distance from cable clamp to centre-line of RMU bushings mm	800	
		d) Type of connection	Screened	
5.4		Mini-sub earth bar (accessible in front of RMU)	Required	
5.5		Interconnection arrangement between RMU and transformer MV bushings	Required	
5.6		Unscreened interconnecting equipment and connections between ring main unit and transformer to be barricaded	Required	
5.7		Type of earth fault indicator	Required	
5.8		Voltage detecting system (VDS)	Required	

Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA [“To Be Advice”] will not be accepted.

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Annex C - Technical schedules A and B for

**MSS TB 630KVA DR DYN11 3MM THICK AV SF6 FREE RMU DRY TYPE TRFR
(SAP 4381)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
6	4.2.8	LV Compartment		
6.1		Bus-bar-rating (see Table 2)	A	1,2 times the kVA capacity
6.2		Bus-bar-insulation		Air insulated
6.3		Bus-bars	Ø	3 + one identical neutral-earth bus-bar (insulated from frame)
6.4		Current density of bus-bars	A/mm ²	1,8 maximum
6.5		Rated withstand current – 1 s (25 kA for up to 630 kVA & 45 kA for 1000 kVA)	kA _{rms}	As per rating.
6.6		Min clearance to earth and between phases	mm	20
6.7		Provision of a LV neutral surge armineral fitted between mini-sub earth bar and LV neutral-earth bus-bar		Required
6.8		LV neutral-earth bus-bar to be earthed (via an electrical bridge to the mini-sub earth bar)		Required
6.9		Neutral isolating links		Not Required
6.10		Provision of LV main isolating switch		Not Required
6.11		Number of outgoing LV feeders to be provided for (drill bus-bar Ø14mm holes)		6
6.12		Spacing between holes (see Figure 1)	mm	110
6.13		LV panel designed for large frame MCCBs		Required
		Spacing (vertical): Between phase bus-bars	mm	185
		Between lowest LV bus-bar and LV neutral	mm	300
		Minimum distance between LV neutral and uni-strut	mm	200

**Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be
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Annex C - Technical schedules A and B for

**MSS TB 630KVA DR DYN11 3MM THICK AV SF6 FREE RMU DRY TYPE TRFR
(SAP 4381)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
6.14		LV maximum demand ammeters	On all three phases	
6.15		Ammeter type	Thermal integrating over 15 min period	
6.16		LV indicating voltmeter with a selector switch	Required	
6.17		Ammeter and voltmeter size and display mm	96 × 96, 90°	
6.18		Ammeter and voltmeter position	Top right hand side in LV compartment	
6.19		Electronic meter capable of reading current and voltage	Required	
6.20		Provision of removable non flammable barrier to separate LV end compartment and front LV compartment	Required	
6.21		Main MCCB manufacturer	Required	
6.22		Catalogue/model code of main MCCB	Required	
6.23		Size of main MCCB A	As per table 2	

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Annex C - Technical schedules A and B for

**MSS TB 630KVA DR DYN11 3MM THICK AV SF6 FREE RMU DRY TYPE TRFR
(SAP 4381)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
7	4.2.6	LV auxiliaries		
7.1		Provision of three point socket outlet and 60W bulkhead fitting in LV compartment (with instantaneous-trip earth leakage unit [20 A; 5 kA rupturing capacity; 30 mA sensitivity] and 20 A HRC fuse with neutral fuse link)	Required	
7.2		Numbering ferrules for auxiliary wiring	Required	
7.3		Push-button fitted to shunt trip RMU tee-off	Required	
8	4.3.2	Materials and corrosion protection		
8.1		Mini-sub enclosure and transformer tank thickness 6(mm) or 3 mm	Mild steel	
8.2		Radiator	Mild steel	
8.3		Tinned copper bus-bars	Required	
8.4		Mini-sub base:Material	Steel	
8.5		Uni-strut clamping bar:Material	Required	
8.6		5mm cork packing (between ends and tank, base and ends, base and tank, and base and plinth)	Required	
8.7		Final colour	Avocado Green (12)	

Note: Ticks, Cross [√, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Annex C - Technical schedules A and B for

**MSS TB 630KVA DR DYN11 3MM THICK AV SF6 FREE RMU DRY TYPE TRFR
(SAP 4381)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
9	4.6.2	Notices, signs and labels		
9.1		Transformer rating plate	Required	
9.2		Treatment and Full First Aid Instructions on inside of MV and LV compartment doors	Required	
9.3		Elec. warning signs on all doors and barriers	Required	
9.4		Transformer phase labels below bushings	Required	
9.5		Colour-coded LV bus-bars	Required	
9.6		Stenciled labeling of MV and LV compartment doors (both inside and outside)	Required	
9.7		kVA, Prim V, Sec V & Corrosion Class	Required	
9.8		ID markings linking roof to body per batch	Required	
9.9		Provision for the safe-keeping of documents	Required	
10	4.7	Documentation		
10.1		Type test reportss (provide ref. numbers of reports)	Sets 1	
10.2		Routine test reportss	Sets 1	
10.3		Drawings	Sets 2	
10.4		Circuit diagrams (LV auxiliary wiring and equipment)	Sets 2	

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Technical schedules A and B Deviation schedule for

**MSS TB 630KVA DR DYN11 3MM THICK AV SF6 FREE RMU DRY TYPE TRFR
(SAP 4381)**

Any deviations offered to this specification shall be listed below with reasons for deviation. In addition, evidence shall be provided that the proposed deviation will at least be more cost-effective than that specified by City Power.

Item	Sub clause of CP_TSSPEC_005	Proposed deviation

Note: Ticks, Cross [√, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Annex C - Technical schedules A and B for

**MSS TB 630KVA DR DYN11 6MM THICK AV SF6 FREE RMU DRY TYPE TRFR
(SAP 4385)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
1		Standard operating conditions		
1.1		nn) Altitude m	1800	
1.2		b) Ambient air temperature °C	-5 to +40	
1.3		c) Lightning ground flash density Flashes/ km ² /year	> 10	
1.4		d) Maximum solar radiation W/m ²	1000	
1.5		e) Ultraviolet radiation	High	
1.6		f) Relative humidity %	10 to 95	
1.7		g) Corrosive conditions (inland therefore non-corrosive)	Non- corrosive	
1.8		h) wind pressure Pa	700	
2	4.2.1	Ratings		
2.1		Transformer power rating kVA	630	
2.2		Nominal voltage of system (Dual ratio) kV _{rms}	6,6 & 11	
2.3		System frequency Hz	50	
2.4		Number of phases	3	
2.5		Rated no-load secondary voltage V _{rms}	415	
2.6		Rated power-frequency voltage kV _{rms}	12	
2.7		Rated lightning impulse withstand voltage kV _{peak}	95	
2.8		Rated short-duration power frequency withstand voltage [50Hz: 1 min] kV _{rms}	28	
2.9		Induced voltage withstand level kV _{rms}	22	
2.10		Internal arc classification	AB-FLR	
2.11		Internal arc current and duration	20KA/500 ms	

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Annex C - Technical schedules A and B for

**MSS TB 630KVA DR DYN11 6MM THICK AV SF6 FREE RMU DRY TYPE TRFR
(SAP 4385)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
3	4.3.1	Construction design		
3.1		Layout	Type B	
3.2		Construction	Modular	
3.3		Removable base sections adjacent to MV compartment (sections to lap bolted with nuts on the inside of the channel and housing)	Required	
3.4		All doors shall be a manual three point locking mechanism, capable of being secured by a padlock, having a shackle diameter of 8mm.	Required	
3.5		Compartment lock protection facility (with welded mesh top with inside visibility)	Required	
3.6		Total mass of miniature substation Kg	Required	
3.7		Overall maximum dimensions	Required	
3.8		a) MV compartment length mm	Required	
		b) LV compartment length mm	Required	
		c) LV metering compartment mm	400 x 400	
		d) Overall length mm	3000	
		e) Overall width mm	1650	
		f) Overall height mm	2000	
		g)Base width mm	1200	
		h)Thickness mm	6	
		Provision for lifting of complete mini-sub onto a concrete plinth without need for dismantling	Required	
3.9		Provision of lifting lugs on roof for ease of removal	Required	
3.10		MV switchgear, LV panel, LV metering and transformer confined to separate compartments	Required	
3.11		Mini-sub housing sections and doors bonded	Required	

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Annex C - Technical schedules A and B for

**MSS TB 630KVA DR DYN11 6MM THICK AV SF6 FREE RMU DRY TYPE TRFR
(SAP 4385)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
4	4.2.1	Transformer unit (Dry-Type)		
4.1		Electrical requirements	As per SANS 60076	
4.2		Vector group	Dyn 11	
4.3		MV system earthing	Effective	
4.4		LV transformer neutral earthing	Solid – connection to insulated LV neutral/earth bar	
4.5		MV system fault level	kA 25	
4.6		Temperature rise limits	As per SANS 60076	
4.7		Secondary voltage regulation (Off-load on the 11 kV supply voltage windings)	% +6.0, + 3.0, 0, –3.0, –6.0	
4.8		No-load losses	W Required	
4.9		Load losses	W Required	
4.10		Impedance	% SANS 630	
4.11		Cost /kW of no-load losses (Jul 2002)	R/kW 13 669	
4.12		Cost /kW of load losses (Jul 2002)	R/kW 1 623	
4.13		X/R	SANS 60076	
4.14		Audio-sound level – maximum (see table 6)	dB(A) Required	
4.15		Sealed transformer unit	Required	

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Annex C - Technical schedules A and B for

**MSS TB 630KVA DR DYN11 6MM THICK AV SF6 FREE RMU DRY TYPE TRFR
(SAP 4385)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
4.16	4.4.2	Transformer MV bushings (NB internal screen to be earthed)	BS 7215 –Type C with M16x2 thread	
4.17		MV bushing-centre clearances (minimum) mm	135	
4.18		Clearances between outer bushing-centres and mini-sub metal enclosure (minimum) mm	90	
4.19		Transformer overload protection facility	Required	
4.20		Winding material	MV Copper LV Copper	
4.21		Manufacturer of the distribution transformer	Required	
5		MV compartment		
5.1		Equipment in MV compartment	SF6 FREE Ring Main Unit (CP_TSSPEC_006)	
5.2		Ring Main Unit manufacturer	Required	
5.3		Incoming MV cable requirements		
		a) 185 mm ² 3 core Cu or 300 mm ² 3C Al XLPE	Required	
		b) Cable support (clamping) required	Required	
		c) Minimum distance from cable clamp to centre-line of RMU bushings mm	800	
		d) Type of connection	Screened	
5.4		Mini-sub earth bar (accessible in front of RMU)	Required	
5.5		Interconnection arrangement between RMU and transformer MV bushings	Required	
5.6		Unscreened interconnecting equipment and connections between ring main unit and transformer to be barricaded	Required	
5.7		Type of earth fault indicator	Required	
5.8		Voltage detecting system (VDS)	Required	

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Annex C - Technical schedules A and B for

**MSS TB 630KVA DR DYN11 6MM THICK AV SF6 FREE RMU DRY TYPE TRFR
(SAP 4385)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
6	4.2.8	LV Compartment		
6.1		Bus-bar-rating (see Table 2)	A	1,2 times the kVA capacity
6.2		Bus-bar-insulation		Air insulated
6.3		Bus-bars	Ø	3 + one identical neutral-earth bus-bar (insulated from frame)
6.4		Current density of bus-bars	A/mm ²	1,8 maximum
6.5		Rated withstand current – 1 s (25 kA for up to 630 kVA & 45 kA for 1000 kVA)	kA _{rms}	As per rating.
6.6		Min clearance to earth and between phases	mm	20
6.7		Provision of a LV neutral surge armineral fitted between mini-sub earth bar and LV neutral-earth bus-bar		Required
6.8		LV neutral-earth bus-bar to be earthed (via an electrical bridge to the mini-sub earth bar)		Required
6.9		Neutral isolating links		Not Required
6.10		Provision of LV main isolating switch		Not Required
6.11		Number of outgoing LV feeders to be provided for (drill bus-bar Ø14mm holes)		6
		Spacing between holes (see Figure 1)	mm	110
6.12		LV panel designed for large frame MCCBs		Required
6.13		Spacing (vertical): Between phase bus-bars	mm	185
		Between lowest LV bus-bar and LV neutral	mm	300
		Minimum distance between LV neutral and uni-strut	mm	200

**Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be
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Annex C - Technical schedules A and B for

**MSS TB 630KVA DR DYN11 6MM THICK AV SF6 FREE RMU DRY TYPE TRFR
(SAP 4385)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
6.14		LV maximum demand ammeters	On all three phases	
6.15		Ammeter type	Thermal integrating over 15 min period	
6.16		LV indicating voltmeter with a selector switch	Required	
6.17		Ammeter and voltmeter size and display mm	96 × 96, 90°	
6.18		Ammeter and voltmeter position	Top right hand side in LV compartment	
6.19		Electronic meter capable of reading current and voltage	Required	
6.20		Provision of removable non flammable barrier to separate LV end compartment and front LV compartment	Required	
6.21		Main MCCB manufacturer	Required	
6.22		Catalogue/model code of main MCCB	Required	
6.23		Size of main MCCB A	As per table 2	

Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Annex C - Technical schedules A and B for

**MSS TB 630KVA DR DYN11 6MM THICK AV SF6 FREE RMU DRY TYPE TRFR
(SAP 4385)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
7	4.2.6	LV auxiliaries		
7.1		Provision of three point socket outlet and 60W bulkhead fitting in LV compartment (with instantaneous-trip earth leakage unit [20 A; 5 kA rupturing capacity; 30 mA sensitivity] and 20 A HRC fuse with neutral fuse link)	Required	
7.2		Numbering ferrules for auxiliary wiring	Required	
7.3		Push-button fitted to shunt trip RMU tee-off	Required	
8	4.3.2	Materials and corrosion protection		
8.1		Mini-sub enclosure and transformer tank thickness 6(mm) or 3 mm	Mild steel	
8.2		Radiator	Mild steel	
8.3		Tinned copper bus-bars	Required	
8.4		Mini-sub base:Material	Steel	
8.5		Uni-strut clamping bar:Material	Required	
8.6		5mm cork packing (between ends and tank, base and ends, base and tank, and base and plinth)	Required	
8.7		Final colour	Avocado Green (12)	

Note: Ticks, Cross [√, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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**Annex C - Technical schedules A and B for
MSS TB 630KVA DR DYN11 6MM THICK AV SF6 FREE RMU DRY TYPE TRFR
(SAP 4385)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
9	4.6.2	Notices, signs and labels		
9.1		Transformer rating plate	Required	
9.2		Treatment and Full First Aid Instructions on inside of MV and LV compartment doors	Required	
9.3		Elec. warning signs on all doors and barriers	Required	
9.4		Transformer phase labels below bushings	Required	
9.5		Colour-coded LV bus-bars	Required	
9.6		Stenciled labeling of MV and LV compartment doors (both inside and outside)	Required	
9.7		kVA, Prim V, Sec V & Corrosion Class	Required	
9.8		ID markings linking roof to body per batch	Required	
9.9		Provision for the safe-keeping of documents	Required	
10	4.7	Documentation		
10.1		Type test reportss (provide ref. numbers of reports)	Sets 1	
10.2		Routine test reportss	Sets 1	
10.3		Drawings	Sets 2	
10.4		Circuit diagrams (LV auxiliary wiring and equipment)	Sets 2	

Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Technical schedules A and B Deviation schedule for

**MSS TB 630KVA DR DYN11 6MM THICK AV SF6 FREE RMU DRY TYPE TRFR
(SAP 4385)**

Any deviations offered to this specification shall be listed below with reasons for deviation. In addition, evidence shall be provided that the proposed deviation will at least be more cost-effective than that specified by City Power.

Item	Sub clause of CP_TSSPEC_005	Proposed deviation

Note: Ticks, Cross [√, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Annex C - Technical schedules A and B for

**MSS TB 1000KVA DR DYN11 3MM THICK AV SF6 RMU OIL TYPE TRFR
(SAP 427)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
1		Standard operating conditions		
1.1		oo) Altitude m	1800	
1.2		b) Ambient air temperature °C	–5 to +40	
1.3		c) Lightning ground flash density Flashes/ km ² /year	> 10	
1.4		d) Maximum solar radiation W/m ²	1000	
1.5		e) Ultraviolet radiation	High	
1.6		f) Relative humidity %	10 to 95	
1.7		g) Corrosive conditions (inland therefore non-corrosive)	Non- corrosive	
1.8		h) wind pressure Pa	700	
2	4.2.1	Ratings		
2.1		Transformer power rating kVA	1000	
2.2		Nominal voltage of system (Dual ratio) kV _{rms}	6,6 & 11	
2.3		System frequency Hz	50	
2.4		Number of phases	3	
2.5		Rated no-load secondary voltage V _{rms}	415	
2.6		Rated power-frequency voltage kV _{rms}	12	
2.7		Rated lightning impulse withstand voltage kV _{peak}	95	
2.8		Rated short-duration power frequency withstand voltage [50Hz: 1 min] kV _{rms}	28	
2.9		Induced voltage withstand level kV _{rms}	22	
2.10		Internal arc classification	AB-FLR	
2.11		Internal arc current and duration	20KA/500m s	

Note: Ticks, Cross [√, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Full name of company: _____

Annex C - Technical schedules A and B for

MSS TB 1000KVA DR DYN11 3MM THICK AV SF6 RMU OIL TYPE TRFR (SAP 427)

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
3	4.3.1	Construction design		
3.1		Layout	Type B	
3.2		Construction	Modular	
3.3		Removable base sections adjacent to MV compartment (sections to lap bolted with nuts on the inside of the channel and housing)	Required	
3.4		All doors shall be a manual three point locking mechanism, capable of being secured by a padlock, having a shackle diameter of 8mm.	Required	
3.5		Compartment lock protection facility (with welded mesh top with inside visibility)	Required	
3.6		Total mass of miniature substation Kg	Required	
3.7		Overall maximum dimensions	Required	
3.8		a) MV compartment length mm	Required	
		b) LV compartment length mm	Required	
		c) LV metering compartment mm	400 x 400	
		d) Overall length mm	3000	
		e) Overall width mm	1650	
		f) Overall height mm	2000	
		g)Base width mm	1200	
		h)Thickness mm	3	
		Provision for lifting of complete mini-sub onto a concrete plinth without need for dismantling	Required	
3.9		Provision of lifting lugs on roof for ease of removal	Required	
3.10		MV switchgear, LV panel, LV metering and transformer confined to separate compartments	Required	
3.11		Mini-sub housing sections and doors bonded	Required	

Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Annex C - Technical schedules A and B for

MSS TB 1000KVA DR DYN11 3MM THICK AV SF6 RMU OIL TYPE TRFR (SAP 427)

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
4	4.2.1	Transformer unit (Oil immersed)		
4.1		Electrical requirements	As per SANS 780	
4.2		Vector group	Dyn 11	
4.3		MV system earthing	Effective	
4.4		LV transformer neutral earthing	Solid – connection to insulated LV neutral/earth bar	
4.5		MV system fault level	kA 25	
4.6		Temperature rise limits	As per SANS 780 Table 6	
4.7		Secondary voltage regulation (Off-load on the 11 kV supply voltage windings)	% +6.0, + 3.0, 0, –3.0, –6.0	
4.8		No-load losses	W Required	
4.9		Load losses	W Required	
4.10		Impedance	% SANS 780	
4.11		Cost /kW of no-load losses (Jul 2002)	R/kW 13 669	
4.12		Cost /kW of load losses (Jul 2002)	R/kW 1 623	
4.13		X/R	SANS 780	
4.14		Audio-sound level – maximum (see table 6)	dB(A) Table 6	
4.15		Sealed transformer unit	Required	

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Full name of company: _____

Annex C - Technical schedules A and B for

MSS TB 1000KVA DR DYN11 3MM THICK AV SF6 RMU OIL TYPE TRFR (SAP 427)

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
4.16	4.4.2	Transformer MV bushings (NB internal screen to be earthed)	BS 7215 –Type C with M16x2 thread	
4.17		MV bushing-centre clearances (minimum) mm	135	
4.18		Clearances between outer bushing-centres and mini-sub metal enclosure (minimum) mm	90	
4.19		Transformer overload protection facility	Required	
4.20		Winding material MV	Copper	
		LV	Copper	
4.21		Manufacturer of the distribution transformer	Required	
5		MV compartment		
5.1		Equipment in MV compartment	Ring Main Unit (CP_TSSPEC_006)	
5.2		Ring Main Unit manufacturer	Required	
5.3		Incoming MV cable requirements		
		a) 185 mm ² 3 core Cu or 300 mm ² 3C Al XLPE	Required	
		b) Cable support (clamping) required	Required	
		c) Minimum distance from cable clamp to centre-line of RMU bushings mm	800	
		d) Type of connection	Screened	
5.4		Mini-sub earth bar (accessible in front of RMU)	Required	
5.5		Interconnection arrangement between RMU and transformer MV bushings	Required	
5.6		Unscreened interconnecting equipment and connections between ring main unit and transformer to be barricaded	Required	
5.7		Type of earth fault indicator	Required	
5.8		Voltage detecting system (VDS)	Required	

Note: Ticks, Cross [√, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Signature

Full name of company: _____

Annex C - Technical schedules A and B for

MSS TB 1000KVA DR DYN11 3MM THICK AV SF6 RMU OIL TYPE TRFR (SAP 427)

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
6	4.2.8	LV Compartment		
6.1		Bus-bar-rating (see Table 2)	A	1,2 times the kVA capacity
6.2		Bus-bar-insulation		Air insulated
6.3		Bus-bars	Ø	3 + one identical neutral-earth bus-bar (insulated from frame)
6.4		Current density of bus-bars	A/mm ²	1,8 maximum
6.5		Rated withstand current – 1 s (25 kA for up to 630 kVA & 45 kA for 1000 kVA)	kA _{rms}	As per rating.
6.6		Min clearance to earth and between phases	mm	20
6.7		Provision of a LV neutral surge arrester fitted between mini-sub earth bar and LV neutral-earth bus-bar		Required
6.8		LV neutral-earth bus-bar to be earthed (via an electrical bridge to the mini-sub earth bar)		Required
6.9		Neutral isolating links		Not Required
6.10		Provision of LV main isolating switch		Not Required
6.11		Number of outgoing LV feeders to be provided for (drill bus-bar Ø14mm holes)		6
6.12		Spacing between holes (see Figure 1)	mm	110
6.13		LV panel designed for large frame MCCBs		Required
		Spacing (vertical): Between phase bus-bars	mm	185
		Between lowest LV bus-bar and LV neutral	mm	300
		Minimum distance between LV neutral and uni-strut	mm	200

Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Annex C - Technical schedules A and B for

MSS TB 1000KVA DR DYN11 3MM THICK AV SF6 RMU OIL TYPE TRFR (SAP 427)

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
6.14		LV maximum demand ammeters	On all three phases	
6.15		Ammeter type	Thermal integrating over 15 min period	
6.16		LV indicating voltmeter with a selector switch	Required	
6.17		Ammeter and voltmeter size and display mm	96 × 96, 90°	
6.18		Ammeter and voltmeter position	Top right hand side in LV compartment	
6.19		Electronic meter capable of reading current and voltage	Required	
6.20		Provision of removable non flammable barrier to separate LV end compartment and front LV compartment	Required	
6.21		Main MCCB manufacturer	Required	
6.22		Catalogue/model code of main MCCB	Required	
6.23		Size of main MCCB A	As per table 2	

Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Annex C - Technical schedules A and B for

MSS TB 1000KVA DR DYN11 3MM THICK AV SF6 RMU OIL TYPE TRFR (SAP 427)

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
7	4.2.6	LV auxiliaries		
7.1		Provision of three point socket outlet and 60W bulkhead fitting in LV compartment (with instantaneous-trip earth leakage unit [20 A; 5 kA rupturing capacity; 30 mA sensitivity] and 20 A HRC fuse with neutral fuse link)	Required	
7.2		Numbering ferrules for auxiliary wiring	Required	
7.3		Push-button fitted to shunt trip RMU tee-off	Required	
8	4.3.2	Materials and corrosion protection		
8.1		Mini-sub enclosure and transformer tank thickness 3 or 6(mm)	Mild steel	
8.2		Radiator	Mild steel	
8.3		Tinned copper bus-bars	Required	
8.4		Mini-sub base:Material	Steel	
8.5		Uni-strut clamping bar:Material	Required	
8.6		5mm cork packing (between ends and tank, base and ends, base and tank, and base and plinth)	Required	
8.7		Final colour	Avocado Green (12)	

Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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**Annex C - Technical schedules A and B for
MSS TB 1000KVA DR DYN11 3MM THICK AV SF6 RMU OIL TYPE TRFR (SAP
427)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
9	4.6.2	Notices, signs and labels		
9.1		Transformer rating plate	Required	
9.2		Treatment and Full First Aid Instructions on inside of MV and LV compartment doors	Required	
9.3		Elec. warning signs on all doors and barriers	Required	
9.4		Transformer phase labels below bushings	Required	
9.5		Colour-coded LV bus-bars	Required	
9.6		Stenciled labeling of MV and LV compartment doors (both inside and outside)	Required	
9.7		kVA, Prim V, Sec V & Corrosion Class	Required	
9.8		ID markings linking roof to body per batch	Required	
9.9		Provision for the safe-keeping of documents	Required	
10	4.7	Documentation		
10.1		Type test reportss (provide ref. numbers of reports) Sets	1	
10.2		Routine test reportss Sets	1	
10.3		Drawings Sets	2	
10.4		Circuit diagrams (LV auxiliary wiring and equipment) Sets	2	

Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Technical schedules A and B Deviation schedule for

**MSS TB 1000KVA DR DYN11 3MM THICK AV SF6 RMU OIL TYPE TRFR (SAP
427)**

Any deviations offered to this specification shall be listed below with reasons for deviation. In addition, evidence shall be provided that the proposed deviation will at least be more cost-effective than that specified by City Power.

Item	Sub clause of CP_TSSPEC_005	Proposed deviation

Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Annex C - Technical schedules A and B for

**MSS TB 1000KVA DR DYN11 6MM THICK AV SF6 RMU OIL TYPE TRFR
(SAP 3587)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
1		Standard operating conditions		
1.1		a) Altitude m	1800	
1.2		b) Ambient air temperature °C	-5 to +40	
1.3		c) Lightning ground flash density Flashes/ km ² /year	> 10	
1.4		d) Maximum solar radiation W/m ²	1000	
1.5		e) Ultraviolet radiation	High	
1.6		f) Relative humidity %	10 to 95	
1.7		g) Corrosive conditions (inland therefore non-corrosive)	Non- corrosive	
1.8		h) wind pressure Pa	700	
2	4.2.1	Ratings		
2.1		Transformer power rating kVA	1000	
2.2		Nominal voltage of system (Dual ratio) kV _{rms}	6,6 & 11	
2.3		System frequency Hz	50	
2.4		Number of phases	3	
2.5		Rated no-load secondary voltage V _{rms}	415	
2.6		Rated power-frequency voltage kV _{rms}	12	
2.7		Rated lightning impulse withstand voltage kV _{peak}	95	
2.8		Rated short-duration power frequency withstand voltage [50Hz: 1 min] kV _{rms}	28	
2.9		Induced voltage withstand level kV _{rms}	22	
2.10		Internal arc classification	AB-FLR	
2.11		Internal arc current and duration	20KA/500 ms	

Note: Ticks, Cross [√, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Annex C - Technical schedules A and B for

MSS TB 1000KVA DR DYN11 6MM THICK AV SF6 RMU OIL TYPE TRFR (SAP 3587)

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
3	4.3.1	Construction design		
3.1		Layout	Type B	
3.2		Construction	Modular	
3.3		Removable base sections adjacent to MV compartment (sections to lap bolted with nuts on the inside of the channel and housing)	Required	
3.4		All doors shall be a manual three point locking mechanism, capable of being secured by a padlock, having a shackle diameter of 8mm.	Required	
3.5		Compartment lock protection facility (with welded mesh top with inside visibility)	Required	
3.6		Total mass of miniature substation Kg	Required	
3.7		Overall maximum dimensions	Required	
3.8		a) MV compartment length mm	Required	
		b) LV compartment length mm	Required	
		c) LV metering compartment mm	400 x 400	
		d) Overall length mm	3000	
		e) Overall width mm	1650	
		f) Overall height mm	2000	
		g)Base width mm	1200	
		h)Thickness mm	6	
		Provision for lifting of complete mini-sub onto a concrete plinth without need for dismantling	Required	
3.9		Provision of lifting lugs on roof for ease of removal	Required	
3.10		MV switchgear, LV panel, LV metering and transformer confined to separate compartments	Required	
3.11		Mini-sub housing sections and doors bonded	Required	

Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Annex C - Technical schedules A and B for

MSS TB 1000KVA DR DYN11 6MM THICK AV SF6 RMU OIL TYPE TRFR (SAP 3587)

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
4	4.2.1	Transformer unit (Oil immersed)		
4.1		Electrical requirements	As per SANS 780	
4.2		Vector group	Dyn 11	
4.3		MV system earthing	Effective	
4.4		LV transformer neutral earthing	Solid – connection to insulated LV neutral/earth bar	
4.5		MV system fault level	kA 25	
4.6		Temperature rise limits	As per SANS 780	
4.7		Secondary voltage regulation (Off-load on the 11 kV supply voltage windings)	% +6.0, + 3.0, 0, –3.0, –6.0	
4.8		No-load losses	W Required	
4.9		Load losses	W Required	
4.10		Impedance	% SANS 780	
4.11		Cost /kW of no-load losses (Jul 2002)	R/kW 13 669	
4.12		Cost /kW of load losses (Jul 2002)	R/kW 1 623	
4.13		X/R	SANS 780	
4.14		Audio-sound level – maximum (see table 6)	dB(A) Table 6	
4.15		Sealed transformer unit	Required	

Note: Ticks, Cross [√, X], Asterick [∗], Word [Noted] or TBA [“To Be Advice”] will not be accepted.

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Annex C - Technical schedules A and B for

MSS TB 1000KVA DR DYN11 6MM THICK AV SF6 RMU OIL TYPE TRFR (SAP 3587)

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
4.16	4.4.2	Transformer MV bushings (NB internal screen to be earthed)	BS 7215 –Type C with M16x2 thread	
4.17		MV bushing-centre clearances (minimum) mm	135	
4.18		Clearances between outer bushing-centres and mini-sub metal enclosure (minimum) mm	90	
4.19		Transformer overload protection facility	Required	
4.20		Winding material MV	Copper	
		LV	Copppe	
4.21		Manufacturer of the distribution transformer	Required	
5		MV compartment		
5.1		Equipment in MV compartment	Ring Main Unit (CP_TSSPEC_006)	
5.2		Ring Main Unit manufacturer	Required	
5.3		Incoming MV cable requirements		
		a) 185 mm ² 3 core Cu or 300 mm ² 3C Al XLPE	Required	
		b) Cable support (clamping) required	Required	
		c) Minimum distance from cable clamp to centre-line of RMU bushings mm	800	
		d) Type of connection	Screened	
5.4		Mini-sub earth bar (accessible in front of RMU)	Required	
5.5		Interconnection arrangement between RMU and transformer MV bushings	Required	
5.6		Unscreened interconnecting equipment and connections between ring main unit and transformer to be barricaded	Required	
5.7		Type of earth fault indicator	Required	
5.8		Voltage detecting system (VDS)	Required	

Note: Ticks, Cross [√, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Annex C - Technical schedules A and B for

MSS TB 1000KVA DR DYN11 6MM THICK AV SF6 RMU OIL TYPE TRFR (SAP 3587)

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
6	4.2.8	LV Compartment		
6.1		Bus-bar-rating (see Table 2)	A	1,2 times the kVA capacity
6.2		Bus-bar-insulation		Air insulated
6.3		Bus-bars	Ø	3 + one identical neutral-earth bus-bar (insulated from frame)
6.4		Current density of bus-bars	A/mm ²	1,8 maximum
6.5		Rated withstand current – 1 s (25 kA for up to 630 kVA & 45 kA for 1000 kVA)	kA _{rms}	As per rating.
6.6		Min clearance to earth and between phases	mm	20
6.7		Provision of a LV neutral surge arrester fitted between mini-sub earth bar and LV neutral-earth bus-bar		Required
6.8		LV neutral-earth bus-bar to be earthed (via an electrical bridge to the mini-sub earth bar)		Required
6.9		Neutral isolating links		Not Required
6.10		Provision of LV main isolating switch		Not Required
6.11		Number of outgoing LV feeders to be provided for (drill bus-bar Ø14mm holes)		6
6.12		Spacing between holes (see Figure 1)	mm	110
6.13		LV panel designed for large frame MCCBs		Required
		Spacing (vertical): Between phase bus-bars	mm	185
		Between lowest LV bus-bar and LV neutral	mm	300
		Minimum distance between LV neutral and uni-strut	mm	200

Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Annex C - Technical schedules A and B for

MSS TB 1000KVA DR DYN11 6MM THICK AV SF6 RMU OIL TYPE TRFR (SAP 3587)

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
6.14		LV maximum demand ammeters	On all three phases	
6.15		Ammeter type	Thermal integrating over 15 min period	
6.16		LV indicating voltmeter with a selector switch	Required	
6.17		Ammeter and voltmeter size and display mm	96 × 96, 90°	
6.18		Ammeter and voltmeter position	Top right hand side in LV compartment	
6.19		Electronic meter capable of reading current and voltage	Required	
6.20		Provision of removable non flammable barrier to separate LV end compartment and front LV compartment	Required	
6.21		Main MCCB manufacturer	Required	
6.22		Catalogue/model code of main MCCB	Required	
6.23		Size of main MCCB A	As per table 2	

Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Full name of company: _____

Annex C - Technical schedules A and B for

MSS TB 1000KVA DR DYN11 6MM THICK AV SF6 RMU OIL TYPE TRFR (SAP 3587)

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
7	4.2.6	LV auxiliaries		
7.1		Provision of three point socket outlet and 60W bulkhead fitting in LV compartment (with instantaneous-trip earth leakage unit [20 A; 5 kA rupturing capacity; 30 mA sensitivity] and 20 A HRC fuse with neutral fuse link)	Required	
7.2		Numbering ferrules for auxiliary wiring	Required	
7.3		Push-button fitted to shunt trip RMU tee-off	Required	
8	4.3.2	Materials and corrosion protection		
8.1		Mini-sub enclosure and transformer tank thickness 6(mm) or 3 mm	Mild steel	
8.2		Radiator	Mild steel	
8.3		Tinned copper bus-bars	Required	
8.4		Mini-sub base:Material	Steel	
8.5		Uni-strut clamping bar:Material	Required	
8.6		5mm cork packing (between ends and tank, base and ends, base and tank, and base and plinth)	Required	
8.7		Final colour	Avocado Green (12)	

Note: Ticks, Cross [√, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Tenderer's Authorised Signatory: _____
Name in block letters Signature

Full name of company: _____

**Annex C - Technical schedules A and B for
MSS TB 1000KVA DR DYN11 6MM THICK AV SF6 RMU OIL TYPE TRFR (SAP
3587)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
9	4.6.2	Notices, signs and labels		
9.1		Transformer rating plate	Required	
9.2		Treatment and Full First Aid Instructions on inside of MV and LV compartment doors	Required	
9.3		Elec. warning signs on all doors and barriers	Required	
9.4		Transformer phase labels below bushings	Required	
9.5		Colour-coded LV bus-bars	Required	
9.6		Stenciled labeling of MV and LV compartment doors (both inside and outside)	Required	
9.7		kVA, Prim V, Sec V & Corrosion Class	Required	
9.8		ID markings linking roof to body per batch	Required	
9.9		Provision for the safe-keeping of documents	Required	
10	4.7	Documentation		
10.1		Type test reportss (provide ref. numbers of reports)	Sets 1	
10.2		Routine test reportss	Sets 1	
10.3		Drawings	Sets 2	
10.4		Circuit diagrams (LV auxiliary wiring and equipment)	Sets 2	

Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Tenderer's Authorised Signatory: _____

Name in block lettersSignature

Full name of company: _____

Technical schedules A and B Deviation schedule for

**MSS TB 1000KVA DR DYN11 6MM THICK AV SF6 RMU OIL TYPE TRFR (SAP
3587)**

Any deviations offered to this specification shall be listed below with reasons for deviation. In addition, evidence shall be provided that the proposed deviation will at least be more cost-effective than that specified by City Power.

Item	Sub clause of CP_TSSPEC_005	Proposed deviation

Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

Tender Number: _____

Tenderer's Authorised Signatory: _____
Name in block lettersSignature

Full name of company: _____

Annex C - Technical schedules A and B for

MSS TB 1000KVA DR DYN11 3MM THICK AV SF6 RMU DRY TYPE TRFR (SAP 3710)

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
1		Standard operating conditions		
1.1		qq) Altitude m	1800	
1.2		b) Ambient air temperature °C	-5 to +40	
1.3		c) Lightning ground flash density Flashes/km ² /year	> 10	
1.4		d) Maximum solar radiation W/m ²	1000	
1.5		e) Ultraviolet radiation	High	
1.6		f) Relative humidity %	10 to 95	
1.7		g) Corrosive conditions (inland therefore non-corrosive)	Non-corrosive	
1.8		h) wind pressure Pa	700	
2	4.2.1	Ratings		
2.1		Transformer power rating kVA	1000	
2.2		Nominal voltage of system (Dual ratio) kV _{rms}	6,6 & 11	
2.3		System frequency Hz	50	
2.4		Number of phases	3	
2.5		Rated no-load secondary voltage V _{rms}	415	
2.6		Rated power-frequency voltage kV _{rms}	12	
2.7		Rated lightning impulse withstand voltage kV _{peak}	95	
2.8		Rated short-duration power frequency withstand voltage [50Hz: 1 min] kV _{rms}	28	
2.9		Induced voltage withstand level kV _{rms}	22	
2.10		Internal arc classification	AB-FLR	
2.11		Internal arc current and duration	20KA/500 ms	

Note: Ticks, Cross [√, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Annex C - Technical schedules A and B for

MSS TB 1000KVA DR DYN11 3MM THICK AV SF6 RMU DRY TYPE TRFR (SAP 3710)

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
3	4.3.1	Construction design		
3.1		Layout	Type B	
3.2		Construction	Modular	
3.3		Removable base sections adjacent to MV compartment (sections to lap bolted with nuts on the inside of the channel and housing)	Required	
3.4		All doors shall be a manual three point locking mechanism, capable of being secured by a padlock, having a shackle diameter of 8mm.	Required	
3.5		Compartment lock protection facility (with welded mesh top with inside visibility)	Required	
3.6		Total mass of miniature substation Kg	Required	
3.7		Overall maximum dimensions	Required	
3.8		a) MV compartment length mm	Required	
		b) LV compartment length mm	Required	
		c) LV metering compartment mm	400 x 400	
		d) Overall length mm	3000	
		e) Overall width mm	1650	
		f) Overall height mm	2000	
		g)Base width mm	1200	
		h)Thickness mm	3	
		Provision for lifting of complete mini-sub onto a concrete plinth without need for dismantling	Required	
3.9		Provision of lifting lugs on roof for ease of removal	Required	
3.10		MV switchgear, LV panel, LV metering and transformer confined to separate compartments	Required	
3.11		Mini-sub housing sections and doors bonded	Required	

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Annex C - Technical schedules A and B for

MSS TB 1000KVA DR DYN11 3MM THICK AV SF6 RMU DRY TYPE TRFR (SAP 3710)

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
4	4.2.1	Transformer unit (Dry-Type)		
4.1		Electrical requirements	As per SANS 60076	
4.2		Vector group	Dyn 11	
4.3		MV system earthing	Effective	
4.4		LV transformer neutral earthing	Solid – connection to insulated LV neutral/earth bar	
4.5		MV system fault level	kA 25	
4.6		Temperature rise limits	As per SANS 60076	
4.7		Secondary voltage regulation (Off-load on the 11 kV supply voltage windings)	% +6.0, + 3.0, 0, –3.0, –6.0	
4.8		No-load losses	W Required	
4.9		Load losses	W Required	
4.10		Impedance	% SANS 60076	
4.11		Cost /kW of no-load losses (Jul 2002)	R/kW 13 669	
4.12		Cost /kW of load losses (Jul 2002)	R/kW 1 623	
4.13		X/R	SANS 60076	
4.14		Audio-sound level – maximum	dB(A) Required	
4.15		Sealed transformer unit	Required	

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Annex C - Technical schedules A and B for

MSS TB 1000KVA DR DYN11 3MM THICK AV SF6 RMU DRY TYPE TRFR (SAP 3710)

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
4.16	4.4.2	Transformer MV bushings (NB internal screen to be earthed)	BS 7215 –Type C with M16x2 thread	
4.17		MV bushing-centre clearances (minimum) mm	135	
4.18		Clearances between outer bushing-centres and mini-sub metal enclosure (minimum) mm	90	
4.19		Transformer overload protection facility	Required	
4.20		Winding material MV	Copper	
		LV	Copper	
4.21		Manufacturer of the distribution transformer	Required	
5		MV compartment		
5.1		Equipment in MV compartment	Ring Main Unit (CP_TSSPEC_006)	
5.2		Ring Main Unit manufacturer	Required	
5.3		Incoming MV cable requirements		
		a) 185 mm ² 3 core Cu or 300 mm ² 3C Al XLPE	Required	
		b) Cable support (clamping) required	Required	
		c) Minimum distance from cable clamp to centre-line of RMU bushings mm	800	
		d) Type of connection	Screened	
5.4		Mini-sub earth bar (accessible in front of RMU)	Required	
5.5		Interconnection arrangement between RMU and transformer MV bushings	Required	
5.6		Unscreened interconnecting equipment and connections between ring main unit and transformer to be barricaded	Required	
5.7		Type of earth fault indicator	Required	
5.8		Voltage detecting system (VDS)	Required	

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Annex C - Technical schedules A and B for

MSS TB 1000KVA DR DYN11 3MM THICK AV SF6 RMU DRY TYPE TRFR (SAP 3710)

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
6	4.2.8	LV Compartment		
6.1		Bus-bar-rating (see Table 2)	A	1,2 times the kVA capacity
6.2		Bus-bar-insulation		Air insulated
6.3		Bus-bars	Ø	3 + one identical neutral-earth bus-bar (insulated from frame)
6.4		Current density of bus-bars	A/mm ²	1,8 maximum
6.5		Rated withstand current – 1 s (25 kA for up to 630 kVA & 45 kA for 1000 kVA)	kA _{rms}	As per rating.
6.6		Min clearance to earth and between phases	mm	20
6.7		Provision of a LV neutral surge arrester fitted between mini-sub earth bar and LV neutral-earth bus-bar		Required
6.8		LV neutral-earth bus-bar to be earthed (via an electrical bridge to the mini-sub earth bar)		Required
6.9		Neutral isolating links		Not Required
6.10		Provision of LV main isolating switch		Not Required
6.11		Number of outgoing LV feeders to be provided for (drill bus-bar Ø14mm holes)		6
6.12		Spacing between holes (see Figure 1)	mm	110
6.13		LV panel designed for large frame MCCBs		Required
		Spacing (vertical): Between phase bus-bars	mm	185
		Between lowest LV bus-bar and LV neutral	mm	300
		Minimum distance between LV neutral and uni-strut	mm	200

Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Annex C - Technical schedules A and B for

MSS TB 1000KVA DR DYN11 3MM THICK AV SF6 RMU DRY TYPE TRFR (SAP 3710)

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
6.14		LV maximum demand ammeters	On all three phases	
6.15		Ammeter type	Thermal integrating over 15 min period	
6.16		LV indicating voltmeter with a selector switch	Required	
6.17		Ammeter and voltmeter size and display mm	96 × 96, 90°	
6.18		Ammeter and voltmeter position	Top right hand side in LV compartment	
6.19		Electronic meter capable of reading current and voltage	Required	
6.20		Provision of removable non flammable barrier to separate LV end compartment and front LV compartment	Required	
6.21		Main MCCB manufacturer	Required	
6.22		Catalogue/model code of main MCCB	Required	
6.23		Size of main MCCB A	As per table 2	

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Annex C - Technical schedules A and B for

MSS TB 1000KVA DR DYN11 3MM THICK AV SF6 RMU DRY TYPE TRFR (SAP 3710)

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
7	4.2.6	LV auxiliaries		
7.1		Provision of three point socket outlet and 60W bulkhead fitting in LV compartment (with instantaneous-trip earth leakage unit [20 A; 5 kA rupturing capacity; 30 mA sensitivity] and 20 A HRC fuse with neutral fuse link)	Required	
7.2		Numbering ferrules for auxiliary wiring	Required	
7.3		Push-button fitted to shunt trip RMU tee-off	Required	
8	4.3.2	Materials and corrosion protection		
8.1		Mini-sub enclosure and transformer tank thickness 6(mm) or 3 mm	Mild steel	
8.2		Radiator	Mild steel	
8.3		Tinned copper bus-bars	Required	
8.4		Mini-sub base:Material	Steel	
8.5		Uni-strut clamping bar:Material	Required	
8.6		5mm cork packing (between ends and tank, base and ends, base and tank, and base and plinth)	Required	
8.7		Final colour	Avocado Green (12)	

Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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**Annex C - Technical schedules A and B for
MSS TB 1000KVA DR DYN11 3MM THICK AV SF6 RMU DRY TYPE TRFR (SAP
3710)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
9	4.6.2	Notices, signs and labels		
9.1		Transformer rating plate	Required	
9.2		Treatment and Full First Aid Instructions on inside of MV and LV compartment doors	Required	
9.3		Elec. warning signs on all doors and barriers	Required	
9.4		Transformer phase labels below bushings	Required	
9.5		Colour-coded LV bus-bars	Required	
9.6		Stenciled labeling of MV and LV compartment doors (both inside and outside)	Required	
9.7		kVA, Prim V, Sec V & Corrosion Class	Required	
9.8		ID markings linking roof to body per batch	Required	
9.9		Provision for the safe-keeping of documents	Required	
10	4.7	Documentation		
10.1		Type test reportss (provide ref. numbers of reports)	Sets 1	
10.2		Routine test reportss	Sets 1	
10.3		Drawings	Sets 2	
10.4		Circuit diagrams (LV auxiliary wiring and equipment)	Sets 2	

Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Technical schedules A and B Deviation schedule for

**MSS TB 1000KVA DR DYN11 3MM THICK AV SF6 RMU DRY TYPE TRFR (SAP
3710)**

Any deviations offered to this specification shall be listed below with reasons for deviation. In addition, evidence shall be provided that the proposed deviation will at least be more cost-effective than that specified by City Power.

Item	Sub clause of CP_TSSPEC_005	Proposed deviation

Note: Ticks, Cross [√, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Annex C - Technical schedules A and B for

MSS TB 1000KVA DR DYN11 6MM THICK AV SF6 RMU DRY TYPE TRFR (SAP 3714)

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
1		Standard operating conditions		
1.1		rr) Altitude m	1800	
1.2		b) Ambient air temperature °C	-5 to +40	
1.3		c) Lightning ground flash density Flashes/km ² /year	> 10	
1.4		d) Maximum solar radiation W/m ²	1000	
1.5		e) Ultraviolet radiation	High	
1.6		f) Relative humidity %	10 to 95	
1.7		g) Corrosive conditions (inland therefore non-corrosive)	Non-corrosive	
1.8		h) wind pressure Pa	700	
2	4.2.1	Ratings		
2.1		Transformer power rating kVA	1000	
2.2		Nominal voltage of system (Dual ratio) kV _{rms}	6,6 & 11	
2.3		System frequency Hz	50	
2.4		Number of phases	3	
2.5		Rated no-load secondary voltage V _{rms}	415	
2.6		Rated power-frequency voltage kV _{rms}	12	
2.7		Rated lightning impulse withstand voltage kV _{peak}	95	
2.8		Rated short-duration power frequency withstand voltage [50Hz: 1 min] kV _{rms}	28	
2.9		Induced voltage withstand level kV _{rms}	22	
2.10		Internal arc classification	AB-FLR	
2.11		Internal arc current and duration	20KA/500 ms	

Note: Ticks, Cross [√, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Annex C - Technical schedules A and B for

MSS TB 1000KVA DR DYN11 6MM THICK AV SF6 RMU DRY TYPE TRFR (SAP 3714)

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
3	4.3.1	Construction design		
3.1		Layout	Type B	
3.2		Construction	Modular	
3.3		Removable base sections adjacent to MV compartment (sections to lap bolted with nuts on the inside of the channel and housing)	Required	
3.4		All doors shall be a manual three point locking mechanism, capable of being secured by a padlock, having a shackle diameter of 8mm.	Required	
3.5		Compartment lock protection facility (with welded mesh top with inside visibility)	Required	
3.6		Total mass of miniature substation Kg	Required	
3.7		Overall maximum dimensions	Required	
3.8		a) MV compartment length mm	Required	
		b) LV compartment length mm	Required	
		c) LV metering compartment mm	400 x 400	
		d) Overall length mm	3000	
		e) Overall width mm	1650	
		f) Overall height mm	2000	
		g)Base width mm	1200	
		h)Thickness mm	6	
		Provision for lifting of complete mini-sub onto a concrete plinth without need for dismantling	Required	
3.9		Provision of lifting lugs on roof for ease of removal	Required	
3.10		MV switchgear, LV panel, LV metering and transformer confined to separate compartments	Required	
3.11		Mini-sub housing sections and doors bonded	Required	

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Annex C - Technical schedules A and B for

MSS TB 1000KVA DR DYN11 6MM THICK AV SF6 RMU DRY TYPE TRFR (SAP 3714)

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
4	4.2.1	Transformer unit (Dry-Type)		
4.1		Electrical requirements	As per SANS 60076	
4.2		Vector group	Dyn 11	
4.3		MV system earthing	Effective	
4.4		LV transformer neutral earthing	Solid – connection to insulated LV neutral/earth bar	
4.5		MV system fault level	kA 25	
4.6		Temperature rise limits	As per SANS 60076	
4.7		Secondary voltage regulation (Off-load on the 11 kV supply voltage windings)	% +6.0, + 3.0, 0, –3.0, –6.0	
4.8		No-load losses	W Required	
4.9		Load losses	W Required	
4.10		Impedance	% SANS 60076	
4.11		Cost /kW of no-load losses (Jul 2002)	R/kW 13 669	
4.12		Cost /kW of load losses (Jul 2002)	R/kW 1 623	
4.13		X/R	SANS 60076	
4.14		Audio-sound level – maximum	dB(A) Required	
4.15		Sealed transformer unit	Required	

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Annex C - Technical schedules A and B for

MSS TB 1000KVA DR DYN11 6MM THICK AV SF6 RMU DRY TYPE TRFR (SAP 3714)

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
4.16	4.4.2	Transformer MV bushings (NB internal screen to be earthed)	BS 7215 –Type C with M16x2 thread	
4.17		MV bushing-centre clearances (minimum) mm	135	
4.18		Clearances between outer bushing-centres and mini-sub metal enclosure (minimum) mm	90	
4.19		Transformer overload protection facility	Required	
4.20		Winding material MV	Copper	
		LV	Copper	
4.21		Manufacturer of the distribution transformer	Required	
5		MV compartment		
5.1		Equipment in MV compartment	Ring Main Unit (CP_TSSPEC_006)	
5.2		Ring Main Unit manufacturer	Required	
5.3		Incoming MV cable requirements		
		a) 185 mm ² 3 core Cu or 300 mm ² 3C Al XLPE	Required	
		b) Cable support (clamping) required	Required	
		c) Minimum distance from cable clamp to centre-line of RMU bushings mm	800	
		d) Type of connection	Screened	
5.4		Mini-sub earth bar (accessible in front of RMU)	Required	
5.5		Interconnection arrangement between RMU and transformer MV bushings	Required	
5.6		Unscreened interconnecting equipment and connections between ring main unit and transformer to be barricaded	Required	
5.7		Type of earth fault indicator	Required	
5.8		Voltage detecting system (VDS)	Required	

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Annex C - Technical schedules A and B for

MSS TB 1000KVA DR DYN11 6MM THICK AV SF6 RMU DRY TYPE TRFR (SAP 3714)

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
6	4.2.8	LV Compartment		
6.1		Bus-bar-rating (see Table 2)	A	1,2 times the kVA capacity
6.2		Bus-bar-insulation		Air insulated
6.3		Bus-bars	Ø	3 + one identical neutral-earth bus-bar (insulated from frame)
6.4		Current density of bus-bars	A/mm ²	1,8 maximum
6.5		Rated withstand current – 1 s (25 kA for up to 630 kVA & 45 kA for 1000 kVA)	kA _{rms}	As per rating.
6.6		Min clearance to earth and between phases	mm	20
6.7		Provision of a LV neutral surge arrester fitted between mini-sub earth bar and LV neutral-earth bus-bar		Required
6.8		LV neutral-earth bus-bar to be earthed (via an electrical bridge to the mini-sub earth bar)		Required
6.9		Neutral isolating links		Not Required
6.10		Provision of LV main isolating switch		Not Required
6.11		Number of outgoing LV feeders to be provided for (drill bus-bar Ø14mm holes)		6
6.12		Spacing between holes (see Figure 1)	mm	110
6.13		LV panel designed for large frame MCCBs		Required
		Spacing (vertical): Between phase bus-bars	mm	185
		Between lowest LV bus-bar and LV neutral	mm	300
		Minimum distance between LV neutral and uni-strut	mm	200

Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Annex C - Technical schedules A and B for

MSS TB 1000KVA DR DYN11 6MM THICK AV SF6 RMU DRY TYPE TRFR (SAP 3714)

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
6.14		LV maximum demand ammeters	On all three phases	
6.15		Ammeter type	Thermal integrating over 15 min period	
6.16		LV indicating voltmeter with a selector switch	Required	
6.17		Ammeter and voltmeter size and display mm	96 × 96, 90°	
6.18		Ammeter and voltmeter position	Top right hand side in LV compartment	
6.19		Electronic meter capable of reading current and voltage	Required	
6.20		Provision of removable non flammable barrier to separate LV end compartment and front LV compartment	Required	
6.21		Main MCCB manufacturer	Required	
6.22		Catalogue/model code of main MCCB	Required	
6.23		Size of main MCCB A	As per table 2	

Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Annex C - Technical schedules A and B for

MSS TB 1000KVA DR DYN11 6MM THICK AV SF6 RMU DRY TYPE TRFR (SAP 3714)

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
7	4.2.6	LV auxiliaries		
7.1		Provision of three point socket outlet and 60W bulkhead fitting in LV compartment (with instantaneous-trip earth leakage unit [20 A; 5 kA rupturing capacity; 30 mA sensitivity] and 20 A HRC fuse with neutral fuse link)	Required	
7.2		Numbering ferrules for auxiliary wiring	Required	
7.3		Push-button fitted to shunt trip RMU tee-off	Required	
8	4.3.2	Materials and corrosion protection		
8.1		Mini-sub enclosure and transformer tank thickness 6(mm) or 3 mm	Mild steel	
8.2		Radiator	Mild steel	
8.3		Tinned copper bus-bars	Required	
8.4		Mini-sub base:Material	Steel	
8.5		Uni-strut clamping bar:Material	Required	
8.6		5mm cork packing (between ends and tank, base and ends, base and tank, and base and plinth)	Required	
8.7		Final colour	Avocado Green (12)	

Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Name in block letters

Signature

Full name of company: _____

**Annex C - Technical schedules A and B for
MSS TB 1000KVA DR DYN11 6MM THICK AV SF6 RMU DRY TYPE TRFR (SAP
3714)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
9	4.6.2	Notices, signs and labels		
9.1		Transformer rating plate	Required	
9.2		Treatment and Full First Aid Instructions on inside of MV and LV compartment doors	Required	
9.3		Elec. warning signs on all doors and barriers	Required	
9.4		Transformer phase labels below bushings	Required	
9.5		Colour-coded LV bus-bars	Required	
9.6		Stenciled labeling of MV and LV compartment doors (both inside and outside)	Required	
9.7		kVA, Prim V, Sec V & Corrosion Class	Required	
9.8		ID markings linking roof to body per batch	Required	
9.9		Provision for the safe-keeping of documents	Required	
10	4.7	Documentation		
10.1		Type test reportss (provide ref. numbers of reports)	Sets 1	
10.2		Routine test reportss	Sets 1	
10.3		Drawings	Sets 2	
10.4		Circuit diagrams (LV auxiliary wiring and equipment)	Sets 2	

Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

Tender Number: _____

Tenderer's Authorised Signatory: _____

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Full name of company: _____

Technical schedules A and B Deviation schedule for

**MSS TB 1000KVA DR DYN11 6MM THICK AV SF6 RMU DRY TYPE TRFR (SAP
3714)**

Any deviations offered to this specification shall be listed below with reasons for deviation. In addition, evidence shall be provided that the proposed deviation will at least be more cost-effective than that specified by City Power.

Item	Sub clause of CP_TSSPEC_005	Proposed deviation

Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

Tender Number: _____

Tenderer's Authorised Signatory: _____
Name in block lettersSignature

Full name of company: _____

Annex C - Technical schedules A and B for

**MSS TB 1000KVA DR DYN11 3MM THICK AV SF6 FREE RMU OIL TYPE
TRFR (SAP 4367)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
1		Standard operating conditions		
1.1		ss) Altitude m	1800	
1.2		b) Ambient air temperature °C	-5 to +40	
1.3		c) Lightning ground flash density Flashes/ km ² /year	> 10	
1.4		d) Maximum solar radiation W/m ²	1000	
1.5		e) Ultraviolet radiation	High	
1.6		f) Relative humidity %	10 to 95	
1.7		g) Corrosive conditions (inland therefore non-corrosive)	Non- corrosive	
1.8		h) wind pressure Pa	700	
2	4.2.1	Ratings		
2.1		Transformer power rating kVA	1000	
2.2		Nominal voltage of system (Dual ratio) kV _{rms}	6,6 & 11	
2.3		System frequency Hz	50	
2.4		Number of phases	3	
2.5		Rated no-load secondary voltage V _{rms}	415	
2.6		Rated power-frequency voltage kV _{rms}	12	
2.7		Rated lightning impulse withstand voltage kV _{peak}	95	
2.8		Rated short-duration power frequency withstand voltage [50Hz: 1 min] kV _{rms}	28	
2.9		Induced voltage withstand level kV _{rms}	22	
2.10		Internal arc classification	AB-FLR	
2.11		Internal arc current and duration	20KA/500ms	

Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

Tender Number: _____

Tenderer's Authorised Signatory: _____
Name in block letters Signature

Full name of company: _____

Annex C - Technical schedules A and B for

**MSS TB 1000KVA DR DYN11 3MM THICK AV SF6 FREE RMU OIL TYPE TRFR
(SAP 4367)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
3	4.3.1	Construction design		
3.1		Layout	Type B	
3.2		Construction	Modular	
3.3		Removable base sections adjacent to MV compartment (sections to lap bolted with nuts on the inside of the channel and housing)	Required	
3.4		All doors shall be a manual three point locking mechanism, capable of being secured by a padlock, having a shackle diameter of 8mm.	Required	
3.5		Compartment lock protection facility (with welded mesh top with inside visibility)	Required	
3.6		Total mass of miniature substation Kg	Required	
3.7		Overall maximum dimensions	Required	
3.8		a) MV compartment length mm	Required	
		b) LV compartment length mm	Required	
		c) LV metering compartment mm	400 x 400	
		d) Overall length mm	3000	
		e) Overall width mm	1650	
		f) Overall height mm	2000	
		g)Base width mm	1200	
		h)Thickness mm	3	
		Provision for lifting of complete mini-sub onto a concrete plinth without need for dismantling	Required	
3.9		Provision of lifting lugs on roof for ease of removal	Required	
3.10		MV switchgear, LV panel, LV metering and transformer confined to separate compartments	Required	
3.11		Mini-sub housing sections and doors bonded	Required	

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Annex C - Technical schedules A and B for

**MSS TB 1000KVA DR DYN11 3MM THICK AV SF6 FREE RMU OIL TYPE TRFR
(SAP 4367)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
4	4.2.1	Transformer unit (Oil immersed)		
4.1		Electrical requirements	As per SANS 780	
4.2		Vector group	Dyn 11	
4.3		MV system earthing	Effective	
4.4		LV transformer neutral earthing	Solid – connection to insulated LV neutral/earth bar	
4.5		MV system fault level	kA 25	
4.6		Temperature rise limits	As per SANS 780 Table 6	
4.7		Secondary voltage regulation (Off-load on the 11 kV supply voltage windings)	% +6.0, + 3.0, 0, –3.0, –6.0	
4.8		No-load losses	W Required	
4.9		Load losses	W Required	
4.10		Impedance	% SANS 780	
4.11		Cost /kW of no-load losses (Jul 2002)	R/kW 13 669	
4.12		Cost /kW of load losses (Jul 2002)	R/kW 1 623	
4.13		X/R	SANS 780	
4.14		Audio-sound level – maximum (see table 6)	dB(A) Table 6	
4.15		Sealed transformer unit	Required	

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Annex C - Technical schedules A and B for

**MSS TB 1000KVA DR DYN11 3MM THICK AV SF6 FREE RMU OIL TYPE TRFR
(SAP 4367)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
4.16	4.4.2	Transformer MV bushings (NB internal screen to be earthed)	BS 7215 –Type C with M16x2 thread	
4.17		MV bushing-centre clearances (minimum) mm	135	
4.18		Clearances between outer bushing-centres and mini-sub metal enclosure (minimum) mm	90	
4.19		Transformer overload protection facility	Required	
4.20		Winding material	MV Copper LV Copper	
4.21		Manufacturer of the distribution transformer	Required	
5		MV compartment		
5.1		Equipment in MV compartment	SF6 FREE Ring Main Unit (CP_TSSPEC_006)	
5.2		Ring Main Unit manufacturer	Required	
5.3		Incoming MV cable requirements		
		a) 185 mm ² 3 core Cu or 300 mm ² 3C Al XLPE	Required	
		b) Cable support (clamping) required	Required	
		c) Minimum distance from cable clamp to centre-line of RMU bushings mm	800	
		d) Type of connection	Screened	
5.4		Mini-sub earth bar (accessible in front of RMU)	Required	
5.5		Interconnection arrangement between RMU and transformer MV bushings	Required	
5.6		Unscreened interconnecting equipment and connections between ring main unit and transformer to be barricaded	Required	
5.7		Type of earth fault indicator	Required	
5.8		Voltage detecting system (VDS)	Required	

Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA [“To Be Advice”] will not be accepted.

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Annex C - Technical schedules A and B for

**MSS TB 1000KVA DR DYN11 3MM THICK AV SF6 FREE RMU OIL TYPE TRFR
(SAP 4367)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
6	4.2.8	LV Compartment		
6.1		Bus-bar-rating (see Table 2)	A	1,2 times the kVA capacity
6.2		Bus-bar-insulation		Air insulated
6.3		Bus-bars	Ø	3 + one identical neutral-earth bus-bar (insulated from frame)
6.4		Current density of bus-bars	A/mm ²	1,8 maximum
6.5		Rated withstand current – 1 s (25 kA for up to 630 kVA & 45 kA for 1000 kVA)	kA _{rms}	As per rating.
6.6		Min clearance to earth and between phases	mm	20
6.7		Provision of a LV neutral surge arrester fitted between mini-sub earth bar and LV neutral-earth bus-bar		Required
6.8		LV neutral-earth bus-bar to be earthed (via an electrical bridge to the mini-sub earth bar)		Required
6.9		Neutral isolating links		Not Required
6.10		Provision of LV main isolating switch		Not Required
6.11		Number of outgoing LV feeders to be provided for (drill bus-bar Ø14mm holes)		6
6.12		Spacing between holes (see Figure 1)	mm	110
6.13		LV panel designed for large frame MCCBs		Required
		Spacing (vertical): Between phase bus-bars	mm	185
		Between lowest LV bus-bar and LV neutral	mm	300
		Minimum distance between LV neutral and uni-strut	mm	200

Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Annex C - Technical schedules A and B for

**MSS TB 1000KVA DR DYN11 3MM THICK AV SF6 FREE RMU OIL TYPE TRFR
(SAP 4367)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
6.14		LV maximum demand ammeters	On all three phases	
6.15		Ammeter type	Thermal integrating over 15 min period	
6.16		LV indicating voltmeter with a selector switch	Required	
6.17		Ammeter and voltmeter size and display mm	96 × 96, 90°	
6.18		Ammeter and voltmeter position	Top right hand side in LV compartment	
6.19		Electronic meter capable of reading current and voltage	Required	
6.20		Provision of removable non flammable barrier to separate LV end compartment and front LV compartment	Required	
6.21		Main MCCB manufacturer	Required	
6.22		Catalogue/model code of main MCCB	Required	
6.23		Size of main MCCB A	As per table 2	

Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Annex C - Technical schedules A and B for

**MSS TB 1000KVA DR DYN11 3MM THICK AV SF6 FREE RMU OIL TYPE TRFR
(SAP 4367)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
7	4.2.6	LV auxiliaries		
7.1		Provision of three point socket outlet and 60W bulkhead fitting in LV compartment (with instantaneous-trip earth leakage unit [20 A; 5 kA rupturing capacity; 30 mA sensitivity] and 20 A HRC fuse with neutral fuse link)	Required	
7.2		Numbering ferrules for auxiliary wiring	Required	
7.3		Push-button fitted to shunt trip RMU tee-off	Required	
8	4.3.2	Materials and corrosion protection		
8.1		Mini-sub enclosure and transformer tank thickness 3 or 6(mm)	Mild steel	
8.2		Radiator	Mild steel	
8.3		Tinned copper bus-bars	Required	
8.4		Mini-sub base:Material	Steel	
8.5		Uni-strut clamping bar:Material	Required	
8.6		5mm cork packing (between ends and tank, base and ends, base and tank, and base and plinth)	Required	
8.7		Final colour	Avocado Green (12)	

Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Annex C - Technical schedules A and B for

**MSS TB 1000KVA DR DYN11 3MM THICK AV SF6 FREE RMU OIL TYPE TRFR
(SAP 4367)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
9	4.6.2	Notices, signs and labels		
9.1		Transformer rating plate	Required	
9.2		Treatment and Full First Aid Instructions on inside of MV and LV compartment doors	Required	
9.3		Elec. warning signs on all doors and barriers	Required	
9.4		Transformer phase labels below bushings	Required	
9.5		Colour-coded LV bus-bars	Required	
9.6		Stenciled labeling of MV and LV compartment doors (both inside and outside)	Required	
9.7		kVA, Prim V, Sec V & Corrosion Class	Required	
9.8		ID markings linking roof to body per batch	Required	
9.9		Provision for the safe-keeping of documents	Required	
10	4.7	Documentation		
10.1		Type test reportss (provide ref. numbers of reports)	Sets 1	
10.2		Routine test reportss	Sets 1	
10.3		Drawings	Sets 2	
10.4		Circuit diagrams (LV auxiliary wiring and equipment)	Sets 2	

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Technical schedules A and B Deviation schedule for

**MSS TB 1000KVA DR DYN11 3MM THICK AV SF6 FREE RMU OIL TYPE TRFR
(SAP 4367)**

Any deviations offered to this specification shall be listed below with reasons for deviation. In addition, evidence shall be provided that the proposed deviation will at least be more cost-effective than that specified by City Power.

Item	Sub clause of CP_TSSPEC_005	Proposed deviation

Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Annex C - Technical schedules A and B for

**MSS TB 1000KVA DR DYN11 6MM THICK AV SF6 FREE RMU OIL TYPE
TRFR (SAP 4372)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
1		Standard operating conditions		
1.1		tt) Altitude m	1800	
1.2		b) Ambient air temperature °C	-5 to +40	
1.3		c) Lightning ground flash density Flashes/ km ² /year	> 10	
1.4		d) Maximum solar radiation W/m ²	1000	
1.5		e) Ultraviolet radiation	High	
1.6		f) Relative humidity %	10 to 95	
1.7		g) Corrosive conditions (inland therefore non-corrosive)	Non- corrosive	
1.8		h) wind pressure Pa	700	
2	4.2.1	Ratings		
2.1		Transformer power rating kVA	1000	
2.2		Nominal voltage of system (Dual ratio) kV _{rms}	6,6 & 11	
2.3		System frequency Hz	50	
2.4		Number of phases	3	
2.5		Rated no-load secondary voltage V _{rms}	415	
2.6		Rated power-frequency voltage kV _{rms}	12	
2.7		Rated lightning impulse withstand voltage kV _{peak}	95	
2.8		Rated short-duration power frequency withstand voltage [50Hz: 1 min] kV _{rms}	28	
2.9		Induced voltage withstand level kV _{rms}	22	
2.10		Internal arc classification	AB-FLR	
2.11		Internal arc current and duration	20KA/500 ms	

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Annex C - Technical schedules A and B for

**MSS TB 1000KVA DR DYN11 6MM THICK AV SF6 FREE RMU OIL TYPE TRFR
(SAP 4372)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
3	4.3.1	Construction design		
3.1		Layout	Type B	
3.2		Construction	Modular	
3.3		Removable base sections adjacent to MV compartment (sections to lap bolted with nuts on the inside of the channel and housing)	Required	
3.4		All doors shall be a manual three point locking mechanism, capable of being secured by a padlock, having a shackle diameter of 8mm.	Required	
3.5		Compartment lock protection facility (with welded mesh top with inside visibility)	Required	
3.6		Total mass of miniature substation Kg	Required	
3.7		Overall maximum dimensions	Required	
3.8		a) MV compartment length mm	Required	
		b) LV compartment length mm	Required	
		c) LV metering compartment mm	400 x 400	
		d) Overall length mm	3000	
		e) Overall width mm	1650	
		f) Overall height mm	2000	
		g)Base width mm	1200	
		h)Thickness mm	6	
		Provision for lifting of complete mini-sub onto a concrete plinth without need for dismantling	Required	
3.9		Provision of lifting lugs on roof for ease of removal	Required	
3.10		MV switchgear, LV panel, LV metering and transformer confined to separate compartments	Required	
3.11		Mini-sub housing sections and doors bonded	Required	

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Annex C - Technical schedules A and B for

**MSS TB 1000KVA DR DYN11 6MM THICK AV SF6 FREE RMU OIL TYPE TRFR
(SAP 4372)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
4	4.2.1	Transformer unit (Oil immersed)		
4.1		Electrical requirements	As per SANS 780	
4.2		Vector group	Dyn 11	
4.3		MV system earthing	Effective	
4.4		LV transformer neutral earthing	Solid – connection to insulated LV neutral/earth bar	
4.5		MV system fault level	kA 25	
4.6		Temperature rise limits	As per SANS 780	
4.7		Secondary voltage regulation (Off-load on the 11 kV supply voltage windings)	% +6.0, + 3.0, 0, –3.0, –6.0	
4.8		No-load losses	W Required	
4.9		Load losses	W Required	
4.10		Impedance	% SANS 780	
4.11		Cost /kW of no-load losses (Jul 2002)	R/kW 13 669	
4.12		Cost /kW of load losses (Jul 2002)	R/kW 1 623	
4.13		X/R	SANS 780	
4.14		Audio-sound level – maximum (see table 6)	dB(A) Table 6	
4.15		Sealed transformer unit	Required	

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**MSS TB 1000KVA DR DYN11 6MM THICK AV SF6 FREE RMU OIL TYPE TRFR
(SAP 4372)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
4.16	4.4.2	Transformer MV bushings (NB internal screen to be earthed)	BS 7215 –Type C with M16x2 thread	
4.17		MV bushing-centre clearances (minimum) mm	135	
4.18		Clearances between outer bushing-centres and mini-sub metal enclosure (minimum) mm	90	
4.19		Transformer overload protection facility	Required	
4.20		Winding material	MV Copper LV Copper	
4.21		Manufacturer of the distribution transformer	Required	
5		MV compartment		
5.1		Equipment in MV compartment	SF6 FREE Ring Main Unit (CP_TSSPEC_006)	
5.2		Ring Main Unit manufacturer	Required	
5.3		Incoming MV cable requirements		
		a) 185 mm ² 3 core Cu or 300 mm ² 3C Al XLPE	Required	
		b) Cable support (clamping) required	Required	
		c) Minimum distance from cable clamp to centre-line of RMU bushings mm	800	
		d) Type of connection	Screened	
5.4		Mini-sub earth bar (accessible in front of RMU)	Required	
5.5		Interconnection arrangement between RMU and transformer MV bushings	Required	
5.6		Unscreened interconnecting equipment and connections between ring main unit and transformer to be barricaded	Required	
5.7		Type of earth fault indicator	Required	
5.8		Voltage detecting system (VDS)	Required	

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Annex C - Technical schedules A and B for

**MSS TB 1000KVA DR DYN11 6MM THICK AV SF6 FREE RMU OIL TYPE TRFR
(SAP 4372)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
6	4.2.8	LV Compartment		
6.1		Bus-bar-rating (see Table 2)	A	1,2 times the kVA capacity
6.2		Bus-bar-insulation		Air insulated
6.3		Bus-bars	Ø	3 + one identical neutral-earth bus-bar (insulated from frame)
6.4		Current density of bus-bars	A/mm ²	1,8 maximum
6.5		Rated withstand current – 1 s (25 kA for up to 630 kVA & 45 kA for 1000 kVA)	kA _{rms}	As per rating.
6.6		Min clearance to earth and between phases	mm	20
6.7		Provision of a LV neutral surge arrester fitted between mini-sub earth bar and LV neutral-earth bus-bar		Required
6.8		LV neutral-earth bus-bar to be earthed (via an electrical bridge to the mini-sub earth bar)		Required
6.9		Neutral isolating links		Not Required
6.10		Provision of LV main isolating switch		Not Required
6.11		Number of outgoing LV feeders to be provided for (drill bus-bar Ø14mm holes)		6
6.12		Spacing between holes (see Figure 1)	mm	110
6.13		LV panel designed for large frame MCCBs		Required
		Spacing (vertical): Between phase bus-bars	mm	185
		Between lowest LV bus-bar and LV neutral	mm	300
		Minimum distance between LV neutral and uni-strut	mm	200

**Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be
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Annex C - Technical schedules A and B for

**MSS TB 1000KVA DR DYN11 6MM THICK AV SF6 FREE RMU OIL TYPE TRFR
(SAP 4372)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
6.14		LV maximum demand ammeters	On all three phases	
6.15		Ammeter type	Thermal integrating over 15 min period	
6.16		LV indicating voltmeter with a selector switch	Required	
6.17		Ammeter and voltmeter size and display mm	96 × 96, 90°	
6.18		Ammeter and voltmeter position	Top right hand side in LV compartment	
6.19		Electronic meter capable of reading current and voltage	Required	
6.20		Provision of removable non flammable barrier to separate LV end compartment and front LV compartment	Required	
6.21		Main MCCB manufacturer	Required	
6.22		Catalogue/model code of main MCCB	Required	
6.23		Size of main MCCB A	As per table 2	

Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Annex C - Technical schedules A and B for

**MSS TB 1000KVA DR DYN11 6MM THICK AV SF6 FREE RMU OIL TYPE TRFR
(SAP 4372)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
7	4.2.6	LV auxiliaries		
7.1		Provision of three point socket outlet and 60W bulkhead fitting in LV compartment (with instantaneous-trip earth leakage unit [20 A; 5 kA rupturing capacity; 30 mA sensitivity] and 20 A HRC fuse with neutral fuse link)	Required	
7.2		Numbering ferrules for auxiliary wiring	Required	
7.3		Push-button fitted to shunt trip RMU tee-off	Required	
8	4.3.2	Materials and corrosion protection		
8.1		Mini-sub enclosure and transformer tank thickness 6(mm) or 3 mm	Mild steel	
8.2		Radiator	Mild steel	
8.3		Tinned copper bus-bars	Required	
8.4		Mini-sub base:Material	Steel	
8.5		Uni-strut clamping bar:Material	Required	
8.6		5mm cork packing (between ends and tank, base and ends, base and tank, and base and plinth)	Required	
8.7		Final colour	Avocado Green (12)	

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Annex C - Technical schedules A and B for

**MSS TB 1000KVA DR DYN11 6MM THICK AV SF6 FREE RMU OIL TYPE TRFR
(SAP 4372)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
9	4.6.2	Notices, signs and labels		
9.1		Transformer rating plate	Required	
9.2		Treatment and Full First Aid Instructions on inside of MV and LV compartment doors	Required	
9.3		Elec. warning signs on all doors and barriers	Required	
9.4		Transformer phase labels below bushings	Required	
9.5		Colour-coded LV bus-bars	Required	
9.6		Stenciled labeling of MV and LV compartment doors (both inside and outside)	Required	
9.7		kVA, Prim V, Sec V & Corrosion Class	Required	
9.8		ID markings linking roof to body per batch	Required	
9.9		Provision for the safe-keeping of documents	Required	
10	4.7	Documentation		
10.1		Type test reportss (provide ref. numbers of reports)	Sets 1	
10.2		Routine test reportss	Sets 1	
10.3		Drawings	Sets 2	
10.4		Circuit diagrams (LV auxiliary wiring and equipment)	Sets 2	

Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Technical schedules A and B Deviation schedule for

**MSS TB 1000KVA DR DYN11 6MM THICK AV SF6 FREE RMU OIL TYPE TRFR
(SAP 4372)**

Any deviations offered to this specification shall be listed below with reasons for deviation. In addition, evidence shall be provided that the proposed deviation will at least be more cost-effective than that specified by City Power.

Item	Sub clause of CP_TSSPEC_005	Proposed deviation

Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

Tender Number: _____

Tenderer's Authorised Signatory: _____

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Full name of company: _____

Annex C - Technical schedules A and B for

**MSS TB 1000KVA DR DYN11 3MM THICK AV SF6 FREE RMU DRY TYPE TRFR
(SAP 4382)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
1		Standard operating conditions		
1.1		uu) Altitude m	1800	
1.2		b) Ambient air temperature °C	-5 to +40	
1.3		c) Lightning ground flash density Flashes/ km ² /year	> 10	
1.4		d) Maximum solar radiation W/m ²	1000	
1.5		e) Ultraviolet radiation	High	
1.6		f) Relative humidity %	10 to 95	
1.7		g) Corrosive conditions (inland therefore non-corrosive)	Non- corrosive	
1.8		h) wind pressure Pa	700	
2	4.2.1	Ratings		
2.1		Transformer power rating kVA	1000	
2.2		Nominal voltage of system (Dual ratio) kV _{rms}	6,6 & 11	
2.3		System frequency Hz	50	
2.4		Number of phases	3	
2.5		Rated no-load secondary voltage V _{rms}	415	
2.6		Rated power-frequency voltage kV _{rms}	12	
2.7		Rated lightning impulse withstand voltage kV _{peak}	95	
2.8		Rated short-duration power frequency withstand voltage [50Hz: 1 min] kV _{rms}	28	
2.9		Induced voltage withstand level kV _{rms}	22	
2.10		Internal arc classification	AB-FLR	
2.11		Internal arc current and duration	20KA/500 ms	

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Annex C - Technical schedules A and B for

**MSS TB 1000KVA DR DYN11 3MM THICK AV SF6 FREE RMU DRY TYPE TRFR
(SAP 4382)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
3	4.3.1	Construction design		
3.1		Layout	Type B	
3.2		Construction	Modular	
3.3		Removable base sections adjacent to MV compartment (sections to lap bolted with nuts on the inside of the channel and housing)	Required	
3.4		All doors shall be a manual three point locking mechanism, capable of being secured by a padlock, having a shackle diameter of 8mm.	Required	
3.5		Compartment lock protection facility (with welded mesh top with inside visibility)	Required	
3.6		Total mass of miniature substation Kg	Required	
3.7		Overall maximum dimensions	Required	
3.8		a) MV compartment length mm	Required	
		b) LV compartment length mm	Required	
		c) LV metering compartment mm	400 x 400	
		d) Overall length mm	3000	
		e) Overall width mm	1650	
		f) Overall height mm	2000	
		g)Base width mm	1200	
		h)Thickness mm	3	
		Provision for lifting of complete mini-sub onto a concrete plinth without need for dismantling	Required	
3.9		Provision of lifting lugs on roof for ease of removal	Required	
3.10		MV switchgear, LV panel, LV metering and transformer confined to separate compartments	Required	
3.11		Mini-sub housing sections and doors bonded	Required	

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Annex C - Technical schedules A and B for

**MSS TB 1000KVA DR DYN11 3MM THICK AV SF6 FREE RMU DRY TYPE TRFR
(SAP 4382)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
4	4.2.1	Transformer unit (Dry-Type)		
4.1		Electrical requirements	As per SANS 60076	
4.2		Vector group	Dyn 11	
4.3		MV system earthing	Effective	
4.4		LV transformer neutral earthing	Solid – connection to insulated LV neutral/earth bar	
4.5		MV system fault level	kA 25	
4.6		Temperature rise limits	As per SANS 60076	
4.7		Secondary voltage regulation (Off-load on the 11 kV supply voltage windings)	% +6.0, + 3.0, 0, –3.0, –6.0	
4.8		No-load losses	W Required	
4.9		Load losses	W Required	
4.10		Impedance	% SANS 60076	
4.11		Cost /kW of no-load losses (Jul 2002)	R/kW 13 669	
4.12		Cost /kW of load losses (Jul 2002)	R/kW 1 623	
4.13		X/R	SANS 60076	
4.14		Audio-sound level – maximum	dB(A) Required	
4.15		Sealed transformer unit	Required	

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Annex C - Technical schedules A and B for

**MSS TB 1000KVA DR DYN11 3MM THICK AV SF6 FREE RMU DRY TYPE TRFR
(SAP 4382)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
4.16	4.4.2	Transformer MV bushings (NB internal screen to be earthed)	BS 7215 –Type C with M16x2 thread	
4.17		MV bushing-centre clearances (minimum) mm	135	
4.18		Clearances between outer bushing-centres and mini-sub metal enclosure (minimum) mm	90	
4.19		Transformer overload protection facility	Required	
4.20		Winding material MV	Copper	
		LV	Copper	
4.21		Manufacturer of the distribution transformer	Required	
5		MV compartment		
5.1		Equipment in MV compartment	SF6 FREE Ring Main Unit (CP_TSSPEC_006)	
5.2		Ring Main Unit manufacturer	Required	
5.3		Incoming MV cable requirements		
		a) 185 mm ² 3 core Cu or 300 mm ² 3C Al XLPE	Required	
		b) Cable support (clamping) required	Required	
		c) Minimum distance from cable clamp to centre-line of RMU bushings mm	800	
		d) Type of connection	Screened	
5.4		Mini-sub earth bar (accessible in front of RMU)	Required	
5.5		Interconnection arrangement between RMU and transformer MV bushings	Required	
5.6		Unscreened interconnecting equipment and connections between ring main unit and transformer to be barricaded	Required	
5.7		Type of earth fault indicator	Required	
5.8		Voltage detecting system (VDS)	Required	

Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA [“To Be Advice”] will not be accepted.

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Annex C - Technical schedules A and B for

**MSS TB 1000KVA DR DYN11 3MM THICK AV SF6 FREE RMU DRY TYPE TRFR
(SAP 4382)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
6	4.2.8	LV Compartment		
6.1		Bus-bar-rating (see Table 2)	A	1,2 times the kVA capacity
6.2		Bus-bar-insulation		Air insulated
6.3		Bus-bars	Ø	3 + one identical neutral-earth bus-bar (insulated from frame)
6.4		Current density of bus-bars	A/mm ²	1,8 maximum
6.5		Rated withstand current – 1 s (25 kA for up to 630 kVA & 45 kA for 1000 kVA)	kA _{rms}	As per rating.
6.6		Min clearance to earth and between phases	mm	20
6.7		Provision of a LV neutral surge armineral fitted between mini-sub earth bar and LV neutral-earth bus-bar		Required
6.8		LV neutral-earth bus-bar to be earthed (via an electrical bridge to the mini-sub earth bar)		Required
6.9		Neutral isolating links		Not Required
6.10		Provision of LV main isolating switch		Not Required
6.11		Number of outgoing LV feeders to be provided for (drill bus-bar Ø14mm holes)		6
6.12		Spacing between holes (see Figure 1)	mm	110
6.13		LV panel designed for large frame MCCBs		Required
		Spacing (vertical): Between phase bus-bars	mm	185
		Between lowest LV bus-bar and LV neutral	mm	300
		Minimum distance between LV neutral and uni-strut	mm	200

**Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be
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Annex C - Technical schedules A and B for

**MSS TB 1000KVA DR DYN11 3MM THICK AV SF6 FREE RMU DRY TYPE TRFR
(SAP 4382)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
6.14		LV maximum demand ammeters	On all three phases	
6.15		Ammeter type	Thermal integrating over 15 min period	
6.16		LV indicating voltmeter with a selector switch	Required	
6.17		Ammeter and voltmeter size and display mm	96 × 96, 90°	
6.18		Ammeter and voltmeter position	Top right hand side in LV compartment	
6.19		Electronic meter capable of reading current and voltage	Required	
6.20		Provision of removable non flammable barrier to separate LV end compartment and front LV compartment	Required	
6.21		Main MCCB manufacturer	Required	
6.22		Catalogue/model code of main MCCB	Required	
6.23		Size of main MCCB A	As per table 2	

Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Annex C - Technical schedules A and B for

**MSS TB 1000KVA DR DYN11 3MM THICK AV SF6 FREE RMU DRY TYPE TRFR
(SAP 4382)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
7	4.2.6	LV auxiliaries		
7.1		Provision of three point socket outlet and 60W bulkhead fitting in LV compartment (with instantaneous-trip earth leakage unit [20 A; 5 kA rupturing capacity; 30 mA sensitivity] and 20 A HRC fuse with neutral fuse link)	Required	
7.2		Numbering ferrules for auxiliary wiring	Required	
7.3		Push-button fitted to shunt trip RMU tee-off	Required	
8	4.3.2	Materials and corrosion protection		
8.1		Mini-sub enclosure and transformer tank thickness 6(mm) or 3 mm	Mild steel	
8.2		Radiator	Mild steel	
8.3		Tinned copper bus-bars	Required	
8.4		Mini-sub base:Material	Steel	
8.5		Uni-strut clamping bar:Material	Required	
8.6		5mm cork packing (between ends and tank, base and ends, base and tank, and base and plinth)	Required	
8.7		Final colour	Avocado Green (12)	

Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Annex C - Technical schedules A and B for

**MSS TB 1000KVA DR DYN11 3MM THICK AV SF6 FREE RMU DRY TYPE TRFR
(SAP 4382)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
9	4.6.2	Notices, signs and labels		
9.1		Transformer rating plate	Required	
9.2		Treatment and Full First Aid Instructions on inside of MV and LV compartment doors	Required	
9.3		Elec. warning signs on all doors and barriers	Required	
9.4		Transformer phase labels below bushings	Required	
9.5		Colour-coded LV bus-bars	Required	
9.6		Stenciled labeling of MV and LV compartment doors (both inside and outside)	Required	
9.7		kVA, Prim V, Sec V & Corrosion Class	Required	
9.8		ID markings linking roof to body per batch	Required	
9.9		Provision for the safe-keeping of documents	Required	
10	4.7	Documentation		
10.1		Type test reportss (provide ref. numbers of reports)	Sets 1	
10.2		Routine test reportss	Sets 1	
10.3		Drawings	Sets 2	
10.4		Circuit diagrams (LV auxiliary wiring and equipment)	Sets 2	

Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Technical schedules A and B Deviation schedule for

**MSS TB 1000KVA DR DYN11 3MM THICK AV SF6 FREE RMU DRY TYPE TRFR
(SAP 4382)**

Any deviations offered to this specification shall be listed below with reasons for deviation. In addition, evidence shall be provided that the proposed deviation will at least be more cost-effective than that specified by City Power.

Item	Sub clause of CP_TSSPEC_005	Proposed deviation

Note: Ticks, Cross [√, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

Tender Number: _____

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Annex C - Technical schedules A and B for

**MSS TB 1000KVA DR DYN11 6MM THICK AV SF6 FREE RMU DRY TYPE TRFR
(SAP 4386)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
1		Standard operating conditions		
1.1		vv) Altitude m	1800	
1.2		b) Ambient air temperature °C	-5 to +40	
1.3		c) Lightning ground flash density Flashes/ km ² /year	> 10	
1.4		d) Maximum solar radiation W/m ²	1000	
1.5		e) Ultraviolet radiation	High	
1.6		f) Relative humidity %	10 to 95	
1.7		g) Corrosive conditions (inland therefore non-corrosive)	Non- corrosive	
1.8		h) wind pressure Pa	700	
2	4.2.1	Ratings		
2.1		Transformer power rating kVA	1000	
2.2		Nominal voltage of system (Dual ratio) kV _{rms}	6,6 & 11	
2.3		System frequency Hz	50	
2.4		Number of phases	3	
2.5		Rated no-load secondary voltage V _{rms}	415	
2.6		Rated power-frequency voltage kV _{rms}	12	
2.7		Rated lightning impulse withstand voltage kV _{peak}	95	
2.8		Rated short-duration power frequency withstand voltage [50Hz: 1 min] kV _{rms}	28	
2.9		Induced voltage withstand level kV _{rms}	22	
2.10		Internal arc classification	AB-FLR	
2.11		Internal arc current and duration	20KA/500 ms	

Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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Full name of company: _____

Annex C - Technical schedules A and B for

**MSS TB 1000KVA DR DYN11 6MM THICK AV SF6 FREE RMU DRY TYPE TRFR
(SAP 4386)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
3	4.3.1	Construction design		
3.1		Layout	Type B	
3.2		Construction	Modular	
3.3		Removable base sections adjacent to MV compartment (sections to lap bolted with nuts on the inside of the channel and housing)	Required	
3.4		All doors shall be a manual three point locking mechanism, capable of being secured by a padlock, having a shackle diameter of 8mm.	Required	
3.5		Compartment lock protection facility (with welded mesh top with inside visibility)	Required	
3.6		Total mass of miniature substation Kg	Required	
3.7		Overall maximum dimensions	Required	
3.8		a) MV compartment length mm	Required	
		b) LV compartment length mm	Required	
		c) LV metering compartment mm	400 x 400	
		d) Overall length mm	3000	
		e) Overall width mm	1650	
		f) Overall height mm	2000	
		g)Base width mm	1200	
		h)Thickness mm	6	
		Provision for lifting of complete mini-sub onto a concrete plinth without need for dismantling	Required	
3.9		Provision of lifting lugs on roof for ease of removal	Required	
3.10		MV switchgear, LV panel, LV metering and transformer confined to separate compartments	Required	
3.11		Mini-sub housing sections and doors bonded	Required	

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Annex C - Technical schedules A and B for

**MSS TB 1000KVA DR DYN11 6MM THICK AV SF6 FREE RMU DRY TYPE TRFR
(SAP 4386)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
4	4.2.1	Transformer unit (Dry-Type)		
4.1		Electrical requirements	As per SANS 60076	
4.2		Vector group	Dyn 11	
4.3		MV system earthing	Effective	
4.4		LV transformer neutral earthing	Solid – connection to insulated LV neutral/earth bar	
4.5		MV system fault level	kA 25	
4.6		Temperature rise limits	As per SANS 60076	
4.7		Secondary voltage regulation (Off-load on the 11 kV supply voltage windings)	% +6.0, + 3.0, 0, –3.0, –6.0	
4.8		No-load losses	W Required	
4.9		Load losses	W Required	
4.10		Impedance	% SANS 60076	
4.11		Cost /kW of no-load losses (Jul 2002)	R/kW 13 669	
4.12		Cost /kW of load losses (Jul 2002)	R/kW 1 623	
4.13		X/R	SANS 60076	
4.14		Audio-sound level – maximum	dB(A) Required	
4.15		Sealed transformer unit	Required	

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Annex C - Technical schedules A and B for

**MSS TB 1000KVA DR DYN11 6MM THICK AV SF6 FREE RMU DRY TYPE TRFR
(SAP 4386)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
4.16	4.4.2	Transformer MV bushings (NB internal screen to be earthed)	BS 7215 –Type C with M16x2 thread	
4.17		MV bushing-centre clearances (minimum) mm	135	
4.18		Clearances between outer bushing-centres and mini-sub metal enclosure (minimum) mm	90	
4.19		Transformer overload protection facility	Required	
4.20		Winding material MV	Copper	
		LV	Copper	
4.21		Manufacturer of the distribution transformer	Required	
5		MV compartment		
5.1		Equipment in MV compartment	SF6 FREE Ring Main Unit (CP_TSSPEC_006)	
5.2		Ring Main Unit manufacturer	Required	
5.3		Incoming MV cable requirements		
		a) 185 mm ² 3 core Cu or 300 mm ² 3C Al XLPE	Required	
		b) Cable support (clamping) required	Required	
		c) Minimum distance from cable clamp to centre-line of RMU bushings mm	800	
		d) Type of connection	Screened	
5.4		Mini-sub earth bar (accessible in front of RMU)	Required	
5.5		Interconnection arrangement between RMU and transformer MV bushings	Required	
5.6		Unscreened interconnecting equipment and connections between ring main unit and transformer to be barricaded	Required	
5.7		Type of earth fault indicator	Required	
5.8		Voltage detecting system (VDS)	Required	

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Annex C - Technical schedules A and B for

**MSS TB 1000KVA DR DYN11 6MM THICK AV SF6 FREE RMU DRY TYPE TRFR
(SAP 4386)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
6	4.2.8	LV Compartment		
6.1		Bus-bar-rating (see Table 2)	A	1,2 times the kVA capacity
6.2		Bus-bar-insulation		Air insulated
6.3		Bus-bars	Ø	3 + one identical neutral-earth bus-bar (insulated from frame)
6.4		Current density of bus-bars	A/mm ²	1,8 maximum
6.5		Rated withstand current – 1 s (25 kA for up to 630 kVA & 45 kA for 1000 kVA)	kA _{rms}	As per rating.
6.6		Min clearance to earth and between phases	mm	20
6.7		Provision of a LV neutral surge armineral fitted between mini-sub earth bar and LV neutral-earth bus-bar		Required
6.8		LV neutral-earth bus-bar to be earthed (via an electrical bridge to the mini-sub earth bar)		Required
6.9		Neutral isolating links		Not Required
6.10		Provision of LV main isolating switch		Not Required
6.11		Number of outgoing LV feeders to be provided for (drill bus-bar Ø14mm holes)		6
6.12		Spacing between holes (see Figure 1)	mm	110
6.13		LV panel designed for large frame MCCBs		Required
		Spacing (vertical): Between phase bus-bars	mm	185
		Between lowest LV bus-bar and LV neutral	mm	300
		Minimum distance between LV neutral and uni-strut	mm	200

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Annex C - Technical schedules A and B for

**MSS TB 1000KVA DR DYN11 6MM THICK AV SF6 FREE RMU DRY TYPE TRFR
(SAP 4386)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
6.14		LV maximum demand ammeters	On all three phases	
6.15		Ammeter type	Thermal integrating over 15 min period	
6.16		LV indicating voltmeter with a selector switch	Required	
6.17		Ammeter and voltmeter size and display mm	96 × 96, 90°	
6.18		Ammeter and voltmeter position	Top right hand side in LV compartment	
6.19		Electronic meter capable of reading current and voltage	Required	
6.20		Provision of removable non flammable barrier to separate LV end compartment and front LV compartment	Required	
6.21		Main MCCB manufacturer	Required	
6.22		Catalogue/model code of main MCCB	Required	
6.23		Size of main MCCB A	As per table 2	

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Annex C - Technical schedules A and B for

**MSS TB 1000KVA DR DYN11 6MM THICK AV SF6 FREE RMU DRY TYPE TRFR
(SAP 4386)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
7	4.2.6	LV auxiliaries		
7.1		Provision of three point socket outlet and 60W bulkhead fitting in LV compartment (with instantaneous-trip earth leakage unit [20 A; 5 kA rupturing capacity; 30 mA sensitivity] and 20 A HRC fuse with neutral fuse link)	Required	
7.2		Numbering ferrules for auxiliary wiring	Required	
7.3		Push-button fitted to shunt trip RMU tee-off	Required	
8	4.3.2	Materials and corrosion protection		
8.1		Mini-sub enclosure and transformer tank thickness 6(mm) or 3 mm	Mild steel	
8.2		Radiator	Mild steel	
8.3		Tinned copper bus-bars	Required	
8.4		Mini-sub base:Material	Steel	
8.5		Uni-strut clamping bar:Material	Required	
8.6		5mm cork packing (between ends and tank, base and ends, base and tank, and base and plinth)	Required	
8.7		Final colour	Avocado Green (12)	

Note: Ticks, Cross [√, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

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**Annex C - Technical schedules A and B for
MSS TB 1000KVA DR DYN11 6MM THICK AV SF6 FREE RMU DRY TYPE TRFR
(SAP 4386)**

Schedule A: Purchaser's specific requirements

Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub clause of CP_TSSPEC_005	Description	Schedule A	Schedule B
9	4.6.2	Notices, signs and labels		
9.1		Transformer rating plate	Required	
9.2		Treatment and Full First Aid Instructions on inside of MV and LV compartment doors	Required	
9.3		Elec. warning signs on all doors and barriers	Required	
9.4		Transformer phase labels below bushings	Required	
9.5		Colour-coded LV bus-bars	Required	
9.6		Stenciled labeling of MV and LV compartment doors (both inside and outside)	Required	
9.7		kVA, Prim V, Sec V & Corrosion Class	Required	
9.8		ID markings linking roof to body per batch	Required	
9.9		Provision for the safe-keeping of documents	Required	
10	4.7	Documentation		
10.1		Type test reportss (provide ref. numbers of reports)	Sets 1	
10.2		Routine test reportss	Sets 1	
10.3		Drawings	Sets 2	
10.4		Circuit diagrams (LV auxiliary wiring and equipment)	Sets 2	

Note: Ticks, Cross [✓, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

Tender Number: _____

Tenderer's Authorised Signatory: _____

Name in block lettersSignature

Full name of company: _____

Technical schedules A and B Deviation schedule for

**MSS TB 1000KVA DR DYN11 6MM THICK AV SF6 FREE RMU DRY TYPE TRFR
(SAP 4386)**

Any deviations offered to this specification shall be listed below with reasons for deviation. In addition, evidence shall be provided that the proposed deviation will at least be more cost-effective than that specified by City Power.

Item	Sub clause of CP_TSSPEC_005	Proposed deviation

Note: Ticks, Cross [√, X], Asterick [*], Word [Noted] or TBA ["To Be Advice"] will not be accepted.

Tender Number: _____

Tenderer's Authorised Signatory: _____
Name in block lettersSignature

Full name of company: _____

ANNEXTURE D- Stock Items

Material Group: TRANS-MSS

Item	SAP No.	SAP Short Description	SAP Long Description
1	424	MSS TB 315KVA DR DYN11 3MM THICK AV SF6 OIL TYPE TRFR	MINIATURE SUBSTATION TYPE'B' 315 KVA 11 / 6,6 KV / 415V DUAL RATIO DYN11 3MM THICK PAINTED AVOCADO OIL TYPE TRFR ITEM SPECIFICATION NO. CP_TSSPEC_005
2	3583	MSS TB 315KVA DR DYN11 6MM THICK AV SF6 OIL TYPE TRFR	HIGH RISK AREAS MINIATURE SUBSTATION TYPE'B' 315 KVA 11 / 6,6 KV / 415V DUAL RATIO DYN11 6MM THICK PAINTED AVOCADO OIL TYPE TRFR ITEM SPECIFICATION NO. CP_TSSPEC_005
3	3701	MSS TB 315KVA DR DYN11 3MM THICK AV SF6 DRY TYPE TRFR	MINIATURE SUBSTATION TYPE'B' 315 KVA 11 / 6,6 KV / 415V DUAL RATIO DYN11 3MM THICK PAINTED AVOCADODRY TYPE TRFR ITEM SPECIFICATION NO. CP_TSSPEC_005
4	3706	MSS TB 315KVA DR DYN11 6MM THICK AV SF6 DRY TYPE TRFR	HIGH RISK AREAS MINIATURE SUBSTATION TYPE'B' 315 KVA 11 / 6,6 KV / 415V DUAL RATIO DYN11 6MM THICK PAINTED AVOCADO DRY TYPE TRFR ITEM SPECIFICATION NO. CP_TSSPEC_005
5	3705	MSS TB 315KVA SR DYN11 3MM THICK AV SF6 OIL TYPE TRFR	MINIATURE SUBSTATION TYPE'B' 315 KVA 11/415V SINGLE RATIO DYN11 3MM THICK PAINTED AVOCADO OIL TYPE TRFR ITEM SPECIFICATION NO. CP_TSSPEC_005
6	3704	MSS TB 315KVA SR DYN11 6MM THICK AV SF6 OIL TYPE TRFR	HIGH RISK AREAS MINIATURE SUBSTATION TYPE'B' 315 KVA 11/415V SINGLE RATIO DYN11 6MM THICK PAINTED AVOCADO OIL TYPE TRFR ITEM SPECIFICATION NO. CP_TSSPEC_005
7	3702	MSS TB 315KVA SR DYN11 3MM THICK AV SF6 DRY TYPE TRFR	HIGH RISK AREAS MINIATURE SUBSTATION TYPE'B' 315 KVA 11/415V SINGLE RATIO DYN11 3MM THICK PAINTED AVOCADO DRY TYPE TRFR ITEM SPECIFICATION NO. CP_TSSPEC_005
8	3707	MSS TB 315KVA SR DYN11 6MM THICK AV SF6 DRY TYPE TRFR	HIGH RISK AREAS MINIATURE SUBSTATION TYPE'B' 315 KVA 11/415V SINGLE RATIO DYN11 6MM THICK PAINTED AVOCADODRY TYPE TRFR ITEM SPECIFICATION NO. CP_TSSPEC_005
9	4363	MSS TB 315KVA DR DYN11 3MM THICK AV SF6 FREE OIL TYPE TRFR	MINIATURE SUBSTATION TYPE'B' 315 KVA 11 / 6,6 KV / 415V DUAL RATIO DYN11 3MM THICK PAINTED AVOCADO SF6 FREE RMU, OIL TYPE TRFR ITEM SPECIFICATION NO. CP_TSSPEC_005
10	4368	MSS TB 315KVA DR DYN11 6MM THICK AV SF6 FREE OIL TYPE TRFR	HIGH RISK AREAS MINIATURE SUBSTATION TYPE'B' 315 KVA 11 / 6,6 KV / 415V DUAL RATIO DYN11 6MM THICK PAINTED AVOCADO, SF6 FREE RMU, OIL TYPE TRFR ITEM SPECIFICATION NO. CP_TSSPEC_005
11	4373	MSS TB 315KVA DR DYN11 3MM THICK AV SF6 FREE DRY TYPE TRFR	MINIATURE SUBSTATION TYPE'B' 315 KVA 11 / 6,6 KV / 415V DUAL RATIO DYN11 3MM THICK PAINTED AVOCADO, SF6 FREE RMU, DRY TYPE TRFR ITEM SPECIFICATION NO. CP_TSSPEC_005

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12	4374	MSS TB 315KVA DR DYN11 6MM THICK AV SF6 FREE DRY TYPE TRFR	HIGH RISK AREAS MINIATURE SUBSTATION TYPE'B' 315 KVA 11 / 6,6 KV / 415V DUAL RATIO DYN11 6MM THICK PAINTED AVOCADO, SF6 FREE RMU, DRY TYPE TRFR ITEM SPECIFICATION NO. CP_TSSPEC_005
13	4375	MSS TB 315KVA SR DYN11 3MM THICK AV SF6 FREE OIL TYPE TRFR	MINIATURE SUBSTATION TYPE'B' 315 KVA 11/415V SINGLE RATIO DYN11 3MM THICK PAINTED AVOCADO, SF6 FREE RMU, OIL TYPE TRFR. ITEM SPECIFICATION NO. CP_TSSPEC_005
14	4376	MSS TB 315KVA SR DYN11 6MM THICK AV SF6 FREE OIL TYPE TRFR	HIGH RISK AREAS MINIATURE SUBSTATION TYPE'B' 315 KVA 11/415V SINGLE RATIO DYN11 6MM THICK PAINTED AVOCADO, SF6 FREE RMU, OIL TYPE TRFR ITEM SPECIFICATION NO. CP_TSSPEC_005
15	4377	MSS TB 315KVA SR DYN11 3MM THICK AV SF6 FREE DRY TYPE TRFR	HIGH RISK AREAS MINIATURE SUBSTATION TYPE'B' 315 KVA 11/415V SINGLE RATIO DYN11 3MM THICK PAINTED AVOCADO, SF6 FREE RMU, DRY TYPE TRFRITEM SPECIFICATION NO. CP_TSSPEC_005
16	4378	MSS TB 315KVA SR DYN11 6MM THICK AV SF6 DRY TYPE TRFR	HIGH RISK AREAS MINIATURE SUBSTATION TYPE'B' 315 KVA 11/415V SINGLE RATIO DYN11 6MM THICK PAINTED AVOCADO DRY TYPE TRFR ITEM SPECIFICATION NO. CP_TSSPEC_005
17	3582	MSS TB 500KVA SR DYN11 3MM THICK AV SF6 OIL TYPE TRFR	MINIATURE SUBSTATION TYPE'B' 500 KVA 11KV / 415V SINGLE RATIO DYN11 3MM THICK PAINTED AVOCADO OIL TYPE TRFR ITEM SPECIFICATION NO. CP_TSSPEC_005
18	425	MSS TB 500KVA DR DYN11 3MM THICK AV SF6 OIL TYPE TRFR	MINIATURE SUBSTATION TYPE'B' 500 KVA 11 / 6,6 KV / 415V DUAL RATIO DYN11 3MM THICK PAINTED AVOCADO OIL TYPE TRFR ITEM SPECIFICATION NO. CP_TSSPEC_005
19	3584	MSS TB 500KVA SR DYN11 6MM THICK AV SF6 OIL TYPE TRFR	HIGH RISK AREAS MINIATURE SUBSTATION TYPE'B' 500 KVA 11KV / 415V SINGLE RATIO DYN11 6MM THICK PAINTED AVOCADO OIL TYPE TRFR ITEM SPECIFICATION NO. CP_TSSPEC_005
20	3585	MSS TB 500KVA DR DYN11 6MM THICK AV SF6 OIL TYPE TRFR	HIGH RISK AREAS MINIATURE SUBSTATION TYPE'B' 500 KVA 11 / 6,6 KV / 415V DUAL RATIO DYN11 6MM THICK PAINTED AVOCADO OIL TYPE TRFR ITEM SPECIFICATION NO. CP_TSSPEC_005
21	3708	MSS TB 500KVA SR DYN11 3MM THICK AV SF6 DRY TYPE TRFR	MINIATURE SUBSTATION TYPE'B' 500 KVA 11KV / 415V SINGLE RATIO DYN11 3MM THICK PAINTED AVOCADO DRY TYPE TRFR ITEM SPECIFICATION NO. CP_TSSPEC_005
22	3703	MSS TB 500KVA DR DYN11 3MM THICK AV SF6 DRY TYPE TRFR	MINIATURE SUBSTATION TYPE'B' 500 KVA 11 / 6,6 KV / 415V DUAL RATIO DYN11 3MM THICK PAINTED AVOCADO DRY TYPE TRFR ITEM SPECIFICATION NO. CP_TSSPEC_005
23	3711	MSS TB 500KVA SR DYN11 6MM THICK AV SF6 DRY TYPE TRFR	HIGH RISK AREAS MINIATURE SUBSTATION TYPE'B' 500 KVA 11KV / 415V SINGLE RATIO DYN11 6MM THICK PAINTED AVOCADO DRY TYPE TRFRITEM SPECIFICATION NO. CP_TSSPEC_005
24	3712	MSS TB 500KVA DR DYN11 6MM THICK AV SF6 DRY TYPE TRFR	HIGH RISK AREAS MINIATURE SUBSTATION TYPE'B' 500 KVA 11 / 6,6 KV / 415V DUAL RATIO DYN11 6MM THICK PAINTED AVOCADO DRY TYPE TRFR ITEM SPECIFICATION NO. CP_TSSPEC_005
25	4364	MSS TB 500KVA SR DYN11 3MM THICK AV SF6 FREE OIL TYPE TRFR	MINIATURE SUBSTATION TYPE'B' 500 KVA 11KV / 415V SINGLE RATIO DYN11 3MM THICK PAINTED AVOCADO, SF6 FREE RMU, OIL TYPE TRFR ITEM SPECIFICATION NO. CP_TSSPEC_005

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26	4365	MSS TB 500KVA DR DYN11 3MM THICK AV SF6 FREE OIL TYPE TRFR	MINIATURE SUBSTATION TYPE'B' 500 KVA 11 / 6,6 KV / 415V DUAL RATIO DYN11 3MM THICK PAINTED AVOCADO, SF6 FREE RMU, OIL TYPE TRFR ITEM SPECIFICATION NO. CP_TSSPEC_005
27	4369	MSS TB 500KVA SR DYN11 6MM THICK AV SF6 FREE OIL TYPE TRFR	HIGH RISK AREAS MINIATURE SUBSTATION TYPE'B' 500 KVA 11KV / 415V SINGLE RATIO DYN11 6MM THICK PAINTED AVOCADO, SF6 FREE, OIL TYPE TRFR ITEM SPECIFICATION NO. CP_TSSPEC_005
28	4370	MSS TB 500KVA DR DYN11 6MM THICK AV SF6 FREE OIL TYPE TRFR	HIGH RISK AREAS MINIATURE SUBSTATION TYPE'B' 500 KVA 11 / 6,6 KV / 415V DUAL RATIO DYN11 6MM THICK PAINTED AVOCADO, SF6 FREE RMU, OIL TYPE TRFR ITEM SPECIFICATION NO. CP_TSSPEC_005
29	4379	MSS TB 500KVA SR DYN11 3MM THICK AV SF6 FREE DRY TYPE TRFR	MINIATURE SUBSTATION TYPE'B' 500 KVA 11KV / 415V SINGLE RATIO DYN11 3MM THICK PAINTED AVOCADO SF6 FREE RMU, DRY TYPE TRFR ITEM SPECIFICATION NO. CP_TSSPEC_005
30	4380	MSS TB 500KVA DR DYN11 3MM THICK AV SF6 FREE DRY TYPE TRFR	MINIATURE SUBSTATION TYPE'B' 500 KVA 11 / 6,6 KV / 415V DUAL RATIO DYN11 3MM THICK PAINTED AVOCADO, SF6 FREE RMU, DRY TYPE TRFR ITEM SPECIFICATION NO. CP_TSSPEC_005
31	4383	MSS TB 500KVA SR DYN11 6MM THICK AV SF6 FREE DRY TYPE TRFR	HIGH RISK AREAS MINIATURE SUBSTATION TYPE'B' 500 KVA 11KV / 415V SINGLE RATIO DYN11 6MM THICK PAINTED AVOCADO, SF6 FREE RMU, DRY TYPE TRFR ITEM SPECIFICATION NO. CP_TSSPEC_005
32	4384	MSS TB 500KVA DR DYN11 6MM THICK AV SF6 FREE DRY TYPE TRFR	HIGH RISK AREAS MINIATURE SUBSTATION TYPE'B' 500 KVA 11 / 6,6 KV / 415V DUAL RATIO DYN11 6MM THICK PAINTED AVOCADO, SF6 FREE RMU, DRY TYPE TRFR ITEM SPECIFICATION NO. CP_TSSPEC_005
33	426	MSS TB 630KVA DR DYN11 3MM THICK AV SF6 OIL TYPE TRFR	MINIATURE SUBSTATION TYPE'B' 630 KVA 11 / 6,6 KV / 415V DUAL RATIO DYN11 3MM THICK PAINTED AVOCADO OIL TYPE TRFR ITEM SPECIFICATION NO. CP_TSSPEC_005
34	3586	MSS TB 630KVA DR DYN11 6MM THICK AV SF6 OIL TYPE TRFR	HIGH RISK AREAS MINIATURE SUBSTATION TYPE'B' 630 KVA 11 / 6,6 KV / 415V DUAL RATIO DYN11 6MM THICK PAINTED AVOCADO OIL TYPE TRFR ITEM SPECIFICATION NO. CP_TSSPEC_005
35	3709	MSS TB 630KVA DR DYN11 3MM THICK AV SF6 DRY TYPE TRFR	MINIATURE SUBSTATION TYPE'B' 630 KVA 11 / 6,6 KV / 415V DUAL RATIO DYN11 3MM THICK PAINTED AVOCADO DRY TYPE TRFR ITEM SPECIFICATION NO. CP_TSSPEC_005
36	3713	MSS TB 630KVA DR DYN11 6MM THICK AV SF6 DRY TYPE TRFR	HIGH RISK AREAS MINIATURE SUBSTATION TYPE'B' 630 KVA 11 / 6,6 KV / 415V DUAL RATIO DYN11 6MM THICK PAINTED AVOCADO DRY TYPE TRFR ITEM SPECIFICATION NO. CP_TSSPEC_005
37	4366	MSS TB 630KVA DR DYN11 3MM THICK AV SF6 FREE OIL TYPE TRFR	MINIATURE SUBSTATION TYPE'B' 630 KVA 11 / 6,6 KV / 415V DUAL RATIO DYN11 3MM THICK PAINTED AVOCADO, SF6 FREE RMU, OIL TYPE TRFR ITEM SPECIFICATION NO. CP_TSSPEC_005
38	4371	MSS TB 630KVA DR DYN11 6MM THICK AV SF6 FREE OIL TYPE TRFR	HIGH RISK AREAS MINIATURE SUBSTATION TYPE'B' 630 KVA 11 / 6,6 KV / 415V DUAL RATIO DYN11 6MM THICK PAINTED AVOCADO, SF6 FREE, OIL TYPE TRFR ITEM SPECIFICATION NO. CP_TSSPEC_005
39	4381	MSS TB 630KVA DR DYN11 3MM THICK AV SF6 FREE DRY TYPE TRFR	MINIATURE SUBSTATION TYPE'B' 630 KVA 11 / 6,6 KV / 415V DUAL RATIO DYN11 3MM THICK PAINTED AVOCADO, SF6 FREE RMU, DRY TYPE TRFR ITEM SPECIFICATION NO. CP_TSSPEC_005

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40	4385	MSS TB 630KVA DR DYN11 6MM THICK AV SF6 FREE DRY TYPE TRFR	HIGH RISK AREAS MINIATURE SUBSTATION TYPE'B' 630 KVA 11 / 6,6 KV / 415V DUAL RATIO DYN11 6MM THICK PAINTED AVOCADO DRY TYPE TRFRITEM SPECIFICATION NO. CP_TSSPEC_005
41	427	MSS TB 1000KVA DR DYN11 3MM THICK AV SF6 OIL TYPE TRFR	MINIATURE SUBSTATION TYPE'B' 1000 KVA 11 / 6,6 KV / 415V DUAL RATIO DYN11 3MM THICK PAINTED AVOCADO OIL TYPE TRFR ITEM SPECIFICATION NO. CP_TSSPEC_005
42	3587	MSS TB 1000KVA DR DYN11 6MM THICK AV SF6 OIL TYPE TRFR	HIGH RISK AREAS MINIATURE SUBSTATION TYPE'B' 1000 KVA 11 / 6,6 KV / 415V DUAL RATIO DYN11 6MM THICK PAINTED AVOCADO OIL TYPE TRFR ITEM SPECIFICATION NO. CP_TSSPEC_005
43	3710	MSS TB 1000KVA DR DYN11 3MM THICK AV SF6DRY TYPE TRFR	MINIATURE SUBSTATION TYPE'B' 1000 KVA 11 / 6,6 KV / 415V DUAL RATIO DYN11 3MM THICK PAINTED AVOCADO DRY TYPE TRFR ITEM SPECIFICATION NO. CP_TSSPEC_005
44	3714	MSS TB 1000KVA DR DYN11 6MM THICK AV SF6 DRY TYPE TRFR	HIGH RISK AREAS MINIATURE SUBSTATION TYPE'B' 1000 KVA 11 / 6,6 KV / 415V DUAL RATIO DYN11 6MM THICK PAINTED AVOCADO DRY TYPE TRFRITEM SPECIFICATION NO. CP_TSSPEC_005
45	4367	MSS TB 1000KVA DR DYN11 3MM THICK AV SF6 FREE OIL TYPE TRFR	MINIATURE SUBSTATION TYPE'B' 1000 KVA 11 / 6,6 KV / 415V DUAL RATIO DYN11 3MM THICK PAINTED AVOCADO OIL TYPE TRFR ITEM SPECIFICATION NO. CP_TSSPEC_005
46	4372	MSS TB 1000KVA DR DYN11 6MM THICK AV SF6 FREE OIL TYPE TRFR	HIGH RISK AREAS MINIATURE SUBSTATION TYPE'B' 1000 KVA 11 / 6,6 KV / 415V DUAL RATIO DYN11 6MM THICK PAINTED AVOCADO SF6 FREE OIL TYPE TRFR ITEM SPECIFICATION NO. CP_TSSPEC_005
47	4382	MSS TB 1000KVA DR DYN11 3MM THICK AV SF6 FREE DRY TYPE TRFR	MINIATURE SUBSTATION TYPE'B' 1000 KVA 11 / 6,6 KV / 415V DUAL RATIO DYN11 3MM THICK PAINTED AVOCADO SF6 FREE DRY TYPE TRFR ITEM SPECIFICATION NO. CP_TSSPEC_005
48	4386	MSS TB 1000KVA DR DYN11 6MM THICK AV SF6 FREE DRY TYPE TRFR	HIGH RISK AREAS MINIATURE SUBSTATION TYPE'B' 1000 KVA 11 / 6,6 KV / 415V DUAL RATIO DYN11 6MM THICK PAINTED AVOCADO SF6 FREE DRY TYPE TRFR ITEM SPECIFICATION NO. CP_TSSPEC_005