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FOREWORD

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2016

INTRODUCTION

City Power makes use of distribution transformers in the provision of electricity to its customers. Efficiency and reliability of transformers is critical in terms of meeting statutory Quality of Supply parameters as well as customer satisfaction and cost-effective network operation. It is therefore essential that the transformers comply with relevant standards and specifications.

1 SCOPE

This specification defines City Power's requirements for ground-mounted, oil immersed distribution and dry-type transformers rated at up to 1 MVA and intended for operation at primary voltages of 6,6 and/or 11 kV.

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 555, *Unused and reclaimed mineral insulating oils for transformers and switchgear*

SANS 780, *Distribution Transformers*

SANS 60076-11, Dry Type Transformers

SANS 1091, National Colour Standard

SANS 876, *Cable terminations and live conductors within air-insulated enclosures (insulation co-ordination) for rated a.c. voltages from 7,2 kV and up to and including 36 kV*

SANS 1332, *Accessories for medium voltage power cables (3,8/6,6 kV to 19/33 kV)*

SANS 1037, *Standard ceramic transformer bushings*

SANS 60137, *insulated bushings for alternating voltages above 1000 V*

SANS 9000, *Quality management systems — Fundamentals and vocabulary*

SANS 9001, *Quality management systems — Requirements*

SANS ISO 18001, *Occupational health and safety management systems – Requirements*

CP_TSSPEC_023, *Specification for mechanical torque shear connectors*

CP_TSSPEC_029, *Specification for adjustable cable clamps*

CP_TSSPEC_030, *Specification for metal cable glands*

CP_TSSPEC_078, *Specification for notices, danger and warning signs*

CP_TSSPEC_081, *Specification for thermal indicator stickers*

3 DEFINITIONS AND ABBREVIATIONS

The definitions and abbreviations in the above documents shall apply to this specification.

4 REQUIREMENTS

4.1 General

4.1.1 All transformers shall comply with SANS 780 for oil immersed and SANS 60076-11 for Dry-type transformer and this specification.

4.1.2 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.

4.1.3 In accordance with SANS 780 and SANS 60076-11, the following construction details shall be applicable:

a) Transformers shall have bolted lids;

b) Robust oil level indicators (glass, not Perspex) are required;

c) Drain valves are not required;

d) Transformers shall be provided with wheels for increased mobility.

4.1.4 All transformers shall be three phase with a Dyn 11 vector group.

4.1.5 The MV nominal voltage shall be 6,6/11 kV (dual ratio). The rated voltage (U_m) of the transformer shall be 7,2 kV and 12 kV for 6,6 kV and 11 kV systems respectively. The transformer shall be capable of operating continuously at U_m without loss of life due to over-fluxing of the core.

4.1.6 The rated impulse voltage withstand level (BIL) and the rated short-duration power frequency withstand rms voltage (1 minute) of the transformer (including cable termination enclosures) shall be as specified in Table 1 below.

Table 1: Rated insulation levels

Rated voltage(kV rms)	BIL (kV peak)	Rated short-duration power frequency withstand rms. voltage (kV rms – 1 minute)
12 or 7,2	95	28
0,415	30	8

4.1.7 All oil immersed transformers shall be supplied filled with new insulating oil complying with SANS 555. The oil level must be at least 150 mm above any live part.

4.1.8 All transformers shall be supplied with a self-adhesive temperature rise thermal indicator sticker complying with CP_TSSPEC_081 which shall indicate any overloading that occurs. The sticker shall be situated alongside the tap-changer and shall change colour if the tank temperature exceeds 88˚C.

4.1.9 All neutral conductors within the transformer shall have the same cross-sectional area as the phase conductors and in addition shall be rated to carry the full phase current continuously.

4.1.10 The final colour of the transformers shall be Avocado Green (C12 of SANS 1091).

4.1.11 Any transformer faults occurring within the first 12 (twelve) months of a transformer being put into service, and that cannot be explained adequately by City Power personnel will be referred to the supplier. Such faults must be investigated by the supplier and a detailed written report submitted to City Power within one month of the supplier being notified of the fault. The supplier's portion of the cost of the investigation will be for the supplier's account, and City Power will not entertain any claims in this respect.

4.1.12 The distribution transformers covered by this specification are required to be installed in chambers with access openings of limited dimensions. The orientation and dimensions of all transformers covered by this specification shall be designed such that any transformer can be rolled on its wheels into a chamber with a door width of 1,4 m without the need for removal of any part of the transformer. The transformer height shall not exceed 1,8 m and the length shall not exceed 2,0 m.

4.1.13 All windings (MV and LV) shall be copper. Aluminium windings shall not be accepted.

4.1.14 If an alternative to oil immersed distribution transformers is to be provided, (e.g. Dry type distribution transformers), all data sheets and type test reports shall be submitted as per SANS 60076-11.

4.2 No-load secondary voltage

4.2.1 The transformers shall have a no-load secondary voltage of 415 V at the 11 kV principal tap.

4.3 Tapping connections

4.3.1 The transformers shall have a tapping range of -6 %, -3 %, 0 %, +3 % and +6 %, achieved by an off-load (off-circuit) tapping switch.

4.3.2 The operation of the off-load tapping switch shall be such that by turning the tap handle clockwise, the tap position number is increased in accordance with Table 2 below.

Table 2: Off-load tapping switch connection

Tap position number	Primary voltage (%)	No-load secondary voltage
1	106	415
2	103	415
3	100	415
4	97	415
5	94	415

4.4 Earthing terminals

4.4.1 Each transformer earth terminal shall be a 30 mm long boss, with an M12 thread throughout, welded to the transformer tank. The boss shall be fitted with a M12 × 25 mm setscrew, washer and spring washer. The boss and the set screw shall be stainless steel of grades 304 and 316 respectively.

4.4.2 An earthing terminal, as described above, shall be provided on the transformer tank, at a height not exceeding 100 mm above ground level. This terminal shall be protected by a removable steel cover at least 3 mm thick and secured by at least four studs and nuts. The purpose of this cover is to protect the main earth conductors from theft and/or vandalism.

4.4.3 An earthing terminal shall be welded to the centre of the side wall of the MV cable box at a height of 100 mm from the gland plate.

4.4.4 An earthing terminal shall be welded adjacent to the LV neutral bushing within the LV cable box.

4.4.5 A suitable removable tinned copper bus bar shall be fitted to bond the LV neutral transformer bushing and the LV earth terminal.

4.5 Dual ratio transformers

4.5.1 Where dual-ratio transformers are specified, the changeover from 6,6 kV to 11 kV shall be carried out by means of a suitable changeover switch. The changeover switch control handle shall be capable of being locked in either position by means of a padlock with a 6 mm diameter shackle. The switch control handle shall be positive in action and the selected arrangement of the winding clearly indicated. It shall not be possible for the switch to be left other than in a position where the winding is connected for either a 6,6 kV or 11 kV supply. A cover or similar arrangement shall be fitted over the switch handle clearly marked “DUAL RATIO CHANGEOVER SWITCH” in red lettering. The cover shall require the use of a tool to remove it. It shall not be possible to place the cover over the tap selector switch. In addition, the changeover switch itself shall be marked with the two positions so that it is possible, by inspection alone, to determine whether the winding is connected for 6,6 kV or 11 kV.

4.5.2 Dual ratio transformers shall carry a warning notice fixed to the transformer in a prominent position, bearing the following legend in red:

WARNING

6,6/11 kV Dual Ratio Transformer
Check that the transformer windings are correctly connected.

4.5.3 In addition to the above, one reversible brass tag engraved or stamped “CONNECTED FOR 11 kV” on one side and “CONNECTED FOR 6,6 kV” on the other, shall be bolted or screwed (not glued) adjacent to the rating plate near the tap changer and dual ratio changeover switch, where it can easily be observed.

Note: Designs where the reversible tag referred to above is fitted to the cover arrangement of the ratio changeover switch shall also be accepted.

4.5.4 The tap selector switch shall be clearly and indelibly marked with a permanently affixed (not glued) label bearing the words “TAP SWITCH”. All labels shall be so placed such that no confusion exists as to the function of the ratio changeover switch or the tap selector switch.

4.6 MV cable box

4.6.1 The MV cable box shall be air filled and shall be positioned on the side of the transformer tank around the MV bushing, and shall comply in all respects with the requirements of SANS 876.

4.6.2 The MV cable box shall be secured to the main tank by means of at least four M12 studs and nuts, to facilitate the removal of the cable box, should this be required. The cable box flange shall be turned inwards such that the cover described in 4.6.3 shall be required to be removed before the cable box can be removed. A suitable gasket shall be fitted between the cable box and the main tank.

4.6.3 The MV cable box shall be fitted with a removable flat cover/lid. This cover/lid shall be secured by at least 20 bolts or nuts, depending on the mounting arrangement.

4.6.4 The three MV bushings shall be positioned horizontally in a straight line as indicated in Figure A.1 of this specification. The minimum distance from the MV bushing centre line to the gland plate shall be 800 mm to allow for core crossing and termination within the enclosure.

4.6.5 The MV cable box shall be fitted with a removable gland plate to allow for the termination of an MV cable with an outside diameter of 90 mm. To this end, the gland plate shall be fitted with two

pre-drilled/punched holes of 110 mm diameter positioned in accordance with the requirements of SANS 876. Each hole shall be fitted with a rubber grommet in accordance with Figure A.12 of SANS 876. Refer to figure A.2 of this specification for cable box layout.

4.6.6 Dimensions between bushing centres (i.e. phase-to-phase and phase-to-ground) within the MV cable box shall be as indicated in Figure A.1.

4.6.7 The clearances in the MV cable boxes shall be suitable for an 11 kV unscreened separable connector (Type 3) termination complying with SANS 053. In addition, the cable box shall allow for the connection, per phase, of two extendable screened connectors (Type 4) complying with SANS 053 so that transformers may be paralleled.

Note: The onus rests on the transformer manufacturer to ensure that the transformer design allows for the connection of the terminations detailed above.

4.6.8 A cable support clamp in accordance with CP_TSSPEC_029 shall be provided directly below the MV cable box for the purpose of supporting the MV cable. The cable support clamp shall be attached to a suitable mounting bracket.

4.6.9 A warning sign complying with CP_TSSPEC_078 shall be fitted to the cover/lid of the MV cable box. If pop-rivets are used to attach the sign to the cover, only aircraft pop-rivets will be acceptable. Normal pop-rivets are not acceptable.

4.7 LV cable box

4.7.1 The LV cable box shall be air filled and shall be positioned on the side of the transformer tank, and shall be similar in construction to the MV cable box.

4.7.2 The LV cable box shall have one bushing per phase and shall be suitable for the termination of the type and number of cables indicated in Table 3 below. The minimum clearance (i.e. 60 mm between live metal parts phase-to-phase and phase-to-earth) shall be maintained taking into account the lugs and fasteners required to connect the cable to the bushing. City Power makes use of mechanical shear connectors complying with CP_TSSPEC_023.

Table 3: LV cable requirements

Transformer rating (kVA)	Cable size (mm^2)	Number of cables
315	185	1
500	185	2
1000	185	4

4.7.3 The LV bushings shall be supplied with a flag suitable for the connection of the LV cables specified in Table 3 above. The flag shall have two holes for the 315 and 500 kVA, and four holes for the 1 000 kVA transformers, each fitted with an M12 x 40 mm set screw, flat washer and nut.

4.7.4 A removable, 3 mm thick 3CR12 gland plate shall be provided as indicated in Figure A.3. The gland plate shall be fitted with mechanical glands that comply with CP_TSSPEC_030 and that are suitable for the termination of the cables detailed in the table above. The cable gland hole diameter(s) shall be 63 mm.

4.7.5 A warning sign complying with CP_TSSPEC_078 shall be fitted to the cover/lid of the LV cable box. If pop-rivets are used to attach the sign to the cover, only aircraft pop-rivets will be acceptable. Normal pop-rivets are not acceptable.

4.8 MV bushings

4.8.1 Outdoor immerged bushings shall comply with the relevant requirements of SANS 1037 (ceramic) and SANS 60137.

4.8.2 Bushings within cable connected boxes shall comply with the relevant requirements of SANS 876 and SANS 60137.

4.8.3 All bushings other than bushings intended for cable connected boxes and for indoor and enclosed installations (for example, a miniature substation), shall be of the outdoor type and shall be clamped at the base of the bushing.

4.8.4 MV bushings shall have an M12 stem.

4.8.5 Bushings shall have a creepage distance of 31mm/kV.

4.8.6 MV bushings shall be suitable for the connection of Type 3 and Type 4 terminations in accordance with SANS 012. In the case of Type 4 terminations, it shall be noted that extensible separable connectors may be connected in a tandem ("piggyback") configuration.

4.9 Losses

4.9.1 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.

4.9.2 The economic life of a transformer is assumed to be 30 years.

4.9.3 The values of parameters C_i and C_c are determined during the tender process as per the design prototype of the transformer.

4.9.4 Regardless of the use of the capitalization formula, the losses shall not be greater than those given in table 4 below.

Table 4 – Maximum losses

Rated power (kVA)	Component losses - No-load loss (W)	Load loss (W)
315	450	3 600
500	630	5 200
1000	1070	8 900

Item	Tolerance
a) Total losses See	+10 % of the total losses
b) Measured component losses See Note 1	+15 % of each component loss, provided that the tolerance for total losses is not exceeded

4.9.5 Load and no-load losses, the percentage impedance 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 ºC, in accordance with SANS 780.

4.10 Sound level

4.10.1 All transformers shall not exceed the maximum sound levels provided in the table 5 below.

Table 5 – Maximum sound levels for distribution transformers

Rated Power kVA	Maximum audio-sound level dB(A)
315	50
500	52
1000	56

5 TESTS

5.1 Type Tests

The following type tests shall be performed on each design and in accordance with SANS 780 and SANS 60076-11:

a) Temperature rise test

b) Full wave lightning impulse test (LI) for dry type transformers

c) Determination of sound level

d) Short circuit (sc) trip test and transformer short circuit withstand test (CSP transformers) for oil immersed transformers

e) Cable connected boxes test for oil immersed transformers

f) Zero sequence impedance test for oil immersed transformers

g) Overload temperature rise test for oil immersed transformers

h) Partial discharge measurement for dry type transformers

5.2 Routine tests

The following routine tests shall be performed in accordance with SANS 780 and SANS 60076-11 on each transformer:

a) Measurement of winding resistance

b) Measurement of voltage ratio and phase displacement

c) Measurement of short circuit impedance and load loss

d) Measurement of no-load loss and current

e) Applied voltage test (AV)

f) Induced voltage withstand test (IVW)

g) Measurement of paint thickness for oil immersed transformers

h) Tightness test

6 MARKING AND PACKAGING

6.1 Each transformer shall bear the SANS 780 and SANS 60076-11 for Dry type mark of approval.

6.2 Two transformer rating plates are required – one on each side of the transformer (i.e. one adjacent to the tap changer and dual ratio changeover switch, and the other at the opposite end of the tank). In addition to the requirements of the relevant clauses of SANS 780 and SANS 60076-11 for Dry type, each transformer rating plate shall have the following information:

a) Year of manufacture;

b) City Power order number; and

c) City Power SAP number.

6.3 The primary voltage, secondary voltage, transformer rating (in kVA), vector group, mass and City Power SAP number shall be clearly marked, in durable white paint, on the tank in letters not less than 50 mm high (e.g. 11000/6600/415 V Dyn 11 500 kVA 2 500 kg SAP No. 5306).

7 DOCUMENTATION

7.1 Single copies of type test certificates, in English, shall be submitted.

7.2 Type test certificates shall be arranged in the sequence given in the A and B schedules of this specification and shall be clearly marked with the number and title given in the Schedules (e.g. 31 - Temperature rise test). Any additional test certificates shall be marked “Additional Tests” and kept separate from the specified test certificates.

8 TRAINING

8.1 The following certified training course shall be offered for City Power’s staff:

a) Correct procedure for the storage, handling and operation of transformers.

8.2 The associated costs for the certified training course in 8.1 shall be given per person and shall be fixed for the period of the contract.

9 QUALITY MANAGEMENT

A quality management system shall be set up in order to assure the quality during manufacture, installation, removal, transportation and disposal of distribution transformer .Guidance on the requirements for a quality management system may be found in the following standards: ISO 9001:2015. The details shall be subject to agreement between the purchaser and supplier.

10 HEALTH AND SAFETY

A health and safety plan shall be set up in order to ensure proper management and compliance during manufacture, installation, removal, transportation and disposal of distribution transformer. Guidance on the requirements of a health and safety plan shall be found in ISO 45001:2018 standards. The details shall be subject to agreement between City Power and the Supplier.

11 ENVIRONMENTAL MANAGEMENT

An environmental management plan shall be set up in order to ensure the proper environmental management and compliance is adhered to during manufacture, installation, removal, transportation and disposal of distribution transformer. Guidance on the requirements for an environmental management system shall 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.

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ANNEX A - BIBLIOGRAPHY

Eskom technical specification SCSSCAAY1, Ground-mounted oil-immersed power transformers up to 2 MVA and 33 kV with MV and LV cable boxes

CP_TSSPEC_077, Specification for ground mounted distribution transformers

ANNEX B - REVISION INFORMATION

DATE	REV. NO.	NOTES
June 2006	0	First issue
June 2013	1	General Editing Updating new study committee Addition of clause 4.1.14-dry type-Transformers
Jan 2018	2	Added dry type technical schedule NRS Changed to SANS
March 2022	3	General editing Updated type and routine tests Added sound level requirements
March 2025	4	General editing Added new work group committee Remove corrugated tank Remove single ratio transformers

ANNEX C - TECHNICAL SCHEDULES A AND B

1 MVA Dual Ratio Transformer (SAP 5269)

Schedule A: Purchaser's specific requirements
Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub-clause of CP_TSSPEC_164	Description		Schedule A	Schedule B
1		Name of manufacturer		Required	
2		Place of manufacture		Required	
3	1	Primary voltage	kV	6,6/11	
4	4.2.1	Secondary voltage	V	415	
5	4.7	Rated power	kVA	1 000	
6	6.1	Does transformer bear SABS mark?	Yes/No	Yes	
7		SABS permit number		Required	
8	4.1.12	Transformer dimensions (height) – max.	mm	1800	
9	4.1.12	Transformer dimensions (width) – max.	mm	1400	
10	4.1.12	Transformer dimensions (length) – max.	mm	2000	
11		Sound level – max	dB	56	
12		MV bushing material		Required	
13	4.8	MV bushing creepage distance	Mm/kV	31	
14		LV bushing material		Porcelain/ Resin	
15	4.8	LV bushing creepage distance	Mm/kV	31	
16		LV compression gland(s) size		No. 6	
17	4.1	MV winding material		Copper	
18	4.1	LV winding material		Copper	
19	4.9*	Impedance at principal tapping	%	4,5 to 5,5	

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: _____

TECHNICAL SCHEDULES A AND B

1 MVA Dual Ratio Transformer (SAP 5269)

Schedule A: Purchaser's specific requirements
Schedule B: Guarantees and technical particulars of equipment offered

20	**5.1**	**Type tests in accordance with SANS 780:**			
21		a) temperature rise test	Ref. No.	Required	
22		b) Determination of sound level	Ref. No.	Required	
23		c) Cable connected boxes test		Required	
24		d) Zero sequence impedance		Required	
25		e)Overload temperature rise test		Required	
26	**5.2**	**Routine tests as per SANS 780:**			
27		a) measurement of winding resistance	Ref. No.	Required	
28		b) measurement of voltage ratio and check of phase displacement	Ref. No.	Required	
29		c) measurement of short-circuit impedance and load loss	Ref. No.	Required	
30		d) measurement of no-load loss and current	Ref. No.	Required	
31		e) separate source test	Ref. No.	Required	
32		f) induced voltage withstands voltage test	Ref. No.	Required	
33		g) measurement of paint thickness	Ref. No.	Required	
34		h) Tightness test	Ref. No.	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

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TECHNICAL SCHEDULES A AND B

DEVIATION SCHEDULE

1 MVA Dual Ratio Transformer (SAP 5269)

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_164**	**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 letters Signature

Full name of company: _____

TECHNICAL SCHEDULES A AND B

500 kVA Dual Ratio Transformer (SAP 5306)

Schedule A: Purchaser's specific requirements
Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub-clause of CP_TSSPEC_164	Description		Schedule A	Schedule B
1		Name of manufacturer		Required	
2		Place of manufacture		Required	
3	1	Primary voltage	kV	6,6/11	
4	4.2.1	Secondary voltage	V	415	
5	4.7	Rated power	kVA	500	
6	6.1	Does transformer bear SABS mark?	Yes/No	Yes	
7		SABS permit number		Required	
8	4.1.12	Transformer dimensions (height) – max.	mm	1800	
9	4.1.12	Transformer dimensions (width) – max.	mm	1400	
10	4.1.12	Transformer dimensions (length) – max.	mm	2000	
11		Sound level – max	dB	52	
12		MV bushing material		Required	
13	4.8	MV bushing creepage distance	mm/kV	204,6	
14		LV bushing material		Porcelain/Resin	
15	4.8	LV bushing creepage distance	mm/kV	12.865	
16		LV compression gland(s) size		No. 6	
17	4.1	MV winding material		Copper	
18	4.1	LV winding material		Copper	
19	4.9*	Impedance at principal tapping	%	4,5 to 5,5	
20	**5.1**	**Type tests in accordance with SANS 780:**			
21		a) temperature rise test	Ref. No.	Required	
22		b) thermal trip test (for CSP transformers)	Ref. No.	Required	
23		c) Cable connected boxes test			
24		d) Zero sequence impedance			
25		e)Overload temperature rise test			
26	**5.2**	**Routine tests as per SANS 780:**			
27		a) measurement of winding resistance	Ref. No.	Required	
28		b) measurement of voltage ratio and check of phase displacement	Ref. No.	Required	
29		c) measurement of short-circuit impedance and load loss	Ref. No.	Required	

30		d) measurement of no-load loss and current	Ref. No.	Required	
31		e) separate source test	Ref. No.	Required	
32		f) induced voltage withstands voltage test	Ref. No.	Required	
33		g) measurement of paint thickness	Ref. No.	Required	
34		h) Tightness test	Ref. No.	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: _____

TECHNICAL SCHEDULES A AND B

DEVIATION SCHEDULE

500 kVA Dual Ratio Transformer (SAP 5306)

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_164**	**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: _____

TECHNICAL SCHEDULES A AND B

315 kVA Dual Ratio Transformer (SAP 5308)

Schedule A: Purchaser's specific requirements
Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub-clause of CP_TSSPEC_164	Description		Schedule A	Schedule B
1		Name of manufacturer		Required	
2		Place of manufacture		Required	
3	1	Primary voltage	kV	6,6/11	
4	4.2.1	Secondary voltage	V	415	
5	4.7	Rated power	kVA	315	
6	6.1	Does transformer bear SABS mark?	Yes/No	Yes	
7		SABS permit number		Required	
8	4.1.12	Transformer dimensions (height) – max.	mm	1800	
9	4.1.12	Transformer dimensions (width) – max.	mm	1400	
10	4.1.12	Transformer dimensions (length) – max.	mm	2000	
11		Sound level – max	dB	50	
12		MV bushing material		Required	
13	4.8	MV bushing creepage distance	mm/kV	31	
14		LV bushing material		Porcelain/ Resin	
15	4.8	LV bushing creepage distance	mm/kV	31	
16		LV compression gland(s) size		No. 6	
17	4.1	MV winding material		Copper	
18	4.1	LV winding material		Copper	
19	4.9*	Impedance at principal tapping	%	4,0 to 5,0	

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: _____

TECHNICAL SCHEDULES A AND B

315 kVA Dual Ratio Transformer (SAP 5308)

Schedule A: Purchaser's specific requirements
Schedule B: Guarantees and technical particulars of equipment offered

20	**5.1**	**Type tests in accordance with SANS 780:**			
21		a) temperature rise test	Ref. No.	Required	
22		b) Determination of sound level	Ref. No.	Required	
23		e) Cable connected boxes test		Required	
24		f) Zero sequence impedance		Required	
25		g)Overload temperature rise test		Required	
26	**5.2**	**Routine tests as per SANS 780:**			
27		a) measurement of winding resistance	Ref. No.	Required	
28		b) measurement of voltage ratio and check of phase displacement	Ref. No.	Required	
29		c) measurement of short-circuit impedance and load loss	Ref. No.	Required	
30		d) measurement of no-load loss and current	Ref. No.	Required	
31		e) separate source test	Ref. No.	Required	
32		f) induced voltage withstands voltage test	Ref. No.	Required	
33		g) measurement of paint thickness	Ref. No.	Required	
34		h) Tightness test	Ref. No.	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: _____

TECHNICAL SCHEDULES A AND B

DEVIATION SCHEDULE

315 kVA Dual Ratio Transformer (SAP 5308)

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_164**	**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 letters Signature

Full name of company: _____

ANNEX D - TECHNICAL SCHEDULES A AND B

1 MVA DRY TYPE Dual Ratio Transformer (SAP 3631)

Schedule A: Purchaser's specific requirements
Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub-clause of CP_TSSPEC_164	Description		Schedule A	Schedule B
1		Name of manufacturer		Required	
2		Place of manufacture		Required	
3	1	Primary voltage	kV	6,6/11	
4	4.2.1	Secondary voltage	V	415	
5	4.7	Rated power	kVA	1 000	
6	6.1	Does transformer bear SABS mark?	Yes/No	Yes	
7		SABS permit number		Required	
8	4.1.12	Transformer dimensions (height) – max.	mm	1800	
9	4.1.12	Transformer dimensions (width) – max.	mm	1400	
10	4.1.12	Transformer dimensions (length) – max.	mm	2000	
11		Sound level - max	dB	56	
12		MV bushing material		Required	
13	4.8	MV bushing creepage distance	mm/kV	31	
14	4.8	LV bushing material		Porcelain/ Resin	
15		LV bushing creepage distance	mm	31	
16	4.1	LV compression gland(s) size		No. 6	
17	4.1	MV winding material		Copper	
18	4.1	LV winding material		Copper	
19		Impedance at principal tapping	%	4,5 to 5,5	

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: _____

TECHNICAL SCHEDULES A AND B

1 MVA DRY TYPE Dual Ratio Transformer (SAP 3631)

Schedule A: Purchaser's specific requirements
Schedule B: Guarantees and technical particulars of equipment offered

20	**5.1**	**Type tests in accordance with SANS 780:**			
21		a) temperature rise test	Ref. No.	Required	
22		b) Full wavelightning impulse test	Ref. No.	Required	
23		c) Determination of sound level d) Partial discharge	Ref. No.	Required	
24	**5.2**	**Routine tests as per SANS 780:**			
25		a) measurement of winding resistance	Ref. No.	Required	
26		b) measurement of voltage ratio and check of phase displacement	Ref. No.	Required	
27		c) measurement of short-circuit impedance and load loss	Ref. No.	Required	
28		d) measurement of no-load loss and current	Ref. No.	Required	
29		e) separate source test	Ref. No.	Required	
30		f) induced voltage withstands voltage test	Ref. No.	Required	
31		g) measurement of paint thickness	Ref. No.	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: _____

TECHNICAL SCHEDULES A AND B

DEVIATION SCHEDULE

1 MVA DRY TYPE Dual Ratio Transformer (SAP 3631)

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_164**	**Proposed deviation**

Note: Ticks, Cross [√, X], Astrick [*], 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: _____

TECHNICAL SCHEDULES A AND B

500 KVA DRY TYPE Dual Ratio Transformer (SAP 3632)

Schedule A: Purchaser's specific requirements
Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub-clause of CP_TSSPEC_164	Description		Schedule A	Schedule B
1		Name of manufacturer		Required	
2		Place of manufacture		Required	
3	1	Primary voltage	kV	6,6/11	
4	4.2.1	Secondary voltage	V	415	
5	4.7	Rated power	kVA	500	
6	6.1	Does transformer bear SABS mark?	Yes/No	Yes	
7		SABS permit number		Required	
8	4.1.12	Transformer dimensions (height) – max.	mm	1800	
9	4.1.12	Transformer dimensions (width) – max.	mm	1400	
10	4.1.12	Transformer dimensions (length) – max.	mm	2000	
11		Sound level - max	dB	52	
12		MV bushing material		Required	
13	4.8	MV bushing creepage distance	mm/kV	31	
14		LV bushing material		Porcelain/ Resin	
15	4.8	LV bushing creepage distance	mm/kV	12.865	
16		LV compression gland(s) size		No. 6	
17	4.1	MV winding material		Copper	
18	4.1	LV winding material		Copper	
19	4.9	Impedance at principal tapping	%	4,5 to 5,5	

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: _____

TECHNICAL SCHEDULES A AND B

500 KVA DRY TYPE Dual Ratio Transformer (SAP 3632)

Schedule A: Purchaser's specific requirements
Schedule B: Guarantees and technical particulars of equipment offered

20	**5.1**	**Type tests in accordance with SANS 780:**			
21		a) temperature rise test	Ref. No.	Required	
22		b) Full wavelightning impulse test	Ref. No.	Required	
23		c) Determination of sound level d) Partial discharge	Ref. No.	Required	
24	**5.2**	**Routine tests as per SANS 780:**			
25		a) measurement of winding resistance	Ref. No.	Required	
26		b) measurement of voltage ratio and check of phase displacement	Ref. No.	Required	
27		c) measurement of short-circuit impedance and load loss	Ref. No.	Required	
28		d) measurement of no-load loss and current	Ref. No.	Required	
29		e) separate source test	Ref. No.	Required	
30		f) induced voltage withstands voltage test	Ref. No.	Required	
31		g) measurement of paint thickness	Ref. No.	Required	

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

500 KVA DRY TYPE Dual Ratio Transformer (SAP 3632)

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_164**	**Proposed deviation**

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

315 KVA DRY TYPE Dual Ratio Transformer (SAP 3633)

Schedule A: Purchaser's specific requirements
Schedule B: Guarantees and technical particulars of equipment offered

Item	Sub-clause of CP_TSSPEC_164	Description		Schedule A	Schedule B
1		Name of manufacturer		Required	
2		Place of manufacture		Required	
3	1	Primary voltage	kV	6,6/11	
4	4.2.1	Secondary voltage	V	415	
5	4.7	Rated power	kVA	315	
6	6.1	Does transformer bear SABS mark?	Yes/No	Yes	
7		SABS permit number		Required	
8	4.1.12	Transformer dimensions (height) – max.	mm	1800	
9	4.1.12	Transformer dimensions (width) – max.	mm	1400	
10	4.1.12	Transformer dimensions (length) – max.	mm	2000	
11		Sound level - max	dB	50	
12		MV bushing material		Required	
13	4.8	MV bushing creepage distance	mm/kV	204,6	
14		LV bushing material		Porcelain/ Resin	
15	4.8	LV bushing creepage distance	mm/kV	12.865	
16		LV compression gland(s) size		No. 6	
17	4.1	MV winding material		Copper	
18	4.1	LV winding material		Copper	
19	4.9*	Impedance at principal tapping	%	4,0 to 5,0	

Note:s 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: _____

TECHNICAL SCHEDULES A AND B

315 KVA DRY TYPE Dual Ratio Transformer (SAP 3633)

Schedule A: Purchaser's specific requirements
Schedule B: Guarantees and technical particulars of equipment offered

20	**5.1**	**Type tests in accordance with SANS 780:**			
21		a) temperature rise test	Ref. No.	Required	
22		b) Full wavelightning impulse test	Ref. No.	Required	
23		c) Determination of sound level d) Partial discharge	Ref. No.	Required	
24	**5.2**	**Routine tests as per SANS 780:**			
25		a) measurement of winding resistance	Ref. No.	Required	
26		b) measurement of voltage ratio and check of phase displacement	Ref. No.	Required	
27		c) measurement of short-circuit impedance and load loss	Ref. No.	Required	
28		d) measurement of no-load loss and current	Ref. No.	Required	
29		e) separate source test	Ref. No.	Required	
30		f) induced voltage withstands voltage test	Ref. No.	Required	
31		g) measurement of paint thickness	Ref. No.	Required	

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

315 KVA DRY TYPE Dual Ratio Transformer (SAP 3633)

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_164**	**Proposed deviation**

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

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ANNEX E – STOCK ITEMS

Material Group: TRANS-DST

Item	SAP No.	SAP Short Description	SAP Long Description
1	5269	TX 1 MVA DR DYN11 AV	TRANSFORMER, DISTRIBUTION, GROUND MOUNTED, 1 000 kVA, DUAL RATIO 11/6,6/0,415 kV, Dyn 11 VECTOR GROUP, AVOCADO. ITEM SPECIFICATION CP_TSSPEC_164.
2	5306	TX 500 KVA DR DYN11 AV	TRANSFORMER, DISTRIBUTION, GROUND MOUNTED, 500 kVA, DUAL RATIO 11/6,6/0,415 kV, Dyn 11 VECTOR GROUP, AVOCADO. ITEM SPECIFICATION CP_TSSPEC_164.
3	5308	TX 315 KVA DR DYN11 AV	TRANSFORMER, DISTRIBUTION, GROUND MOUNTED, 315 kVA, DUAL RATIO 11/6,6/0,415 kV, Dyn 11 VECTOR GROUP, AVOCADO. ITEM SPECIFICATION CP_TSSPEC_164.
4	3631	TX DRY TYPE 1 MVA DR DYN11 AV	TRANSFORMER DRY TYPE, DISTRIBUTION, GROUND MOUNTED, 1 000 kVA, DUAL RATIO 11/6,6 /0,415 kV, Dyn 11 VECTOR GROUP, AVOCADO. ITEM SPECIFICATION CP_TSSPEC_164.
5	3632	TX DRY TYPE 500 KVA DR DYN11 AV	TRANSFORMER DRY TYPE, DISTRIBUTION, GROUND MOUNTED, 500 kVA, DUAL RATIO 11/6,6 /0,415 kV, Dyn 11 VECTOR GROUP, AVOCADO. ITEM SPECIFICATION CP_TSSPEC_164.
6	3633	TX DRY TYPE 315 KVA DR DYN11 AV	TRANSFORMER DRY TYPE, DISTRIBUTION, GROUND MOUNTED, 315 kVA, DUAL RATIO 11/6,6 /0,415 kV, Dyn 11 VECTOR GROUP, AVOCADO. ITEM SPECIFICATION CP_TSSPEC_164.