Joburg
a world class African city

City Power
Johannesburg

		REFERENCE	REV
TITLE	**SPECIFIC REQUIREMENTS FOR 6.6 kV UP TO AND INCLUDING 132 kV VOLTAGE TRANSFORMERS**	**CP_TSSPEC_120**	**3**
		DATE:	**SEPTEMBER 2022**
		PAGE:	**1** OF **27**

COMPILED BY	FUNCTIONAL RESP	APPROVED BY	APPROVED BY
H. SOMO SNR. ENGINEER: SECONDARY PLANT RESEARCH & DEVELOPMENT	**M. PRAVANO** CHIEF ENGINEER: SECONDARY PLANT	**S. RASEBOKA** CHIEF ENGINEER RESEARCH & DEVELOPMENT	**F. MPHAPHULI** GENERAL MANAGER (ACTING) ENGINEER STANDARDS
N. MALULEKE CHIEF OPERATING OFFICER			

TABLE OF CONTENTS

FOREWORD

Recommendations for corrections, additions or deletions should be addressed to the:
Chief Engineer:
Research and Development
City Power Johannesburg (Pty) Ltd
P O Box 38766
Booysens
2016

1 INTRODUCTION

City Power as the electricity distributer holds a mandate to distribute electricity to enhance the livelihood and wellbeing of the residents and customers in and around the City of Johannesburg, as well as the safety of its employees. The above mentioned mandate relies on the efficiency and effectiveness of its electricity network, as well as the quality of instruments that are being used in the distribution process. City Power's requires 6.6 kV up to and including 132 kV voltage transformers.

2 SCOPE

City Power requires supply of voltage transformers that will be to provide isolation between the main primary circuit and the secondary control and measuring devices. This isolation shall be achieved by magnetically coupling the two circuits as detailed in the following sub sections. The scope entails requirements for the supply and delivery of 6.6 kV, up to and including 132 kV voltage transformers in line with normative references.

3 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 below 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 60815 - 1 & 2:2009, Selection and dimensioning of high-voltage insulators intended for use in polluted conditions

SANS 61869-1:2013, Instrument transformers Part 1: General requirements

SANS 61869-3:2013 Edition, Part 3: Additional requirements for inductive voltage transformers

SANS 121/ISO 1461, Hot dip galvanized coatings on fabricated iron and steel articles – Specification and test methods.

SANS 2063, Metallic and other inorganic coatings – Thermal spraying – Zinc, aluminium and their alloys.

SANS 12944-5/ISO 12944-5, Paints and varnishes – Corrosion protection of steel structure by protective paint systems – Part 5: Protective paint system.

SANS 61869-3/IEC 61869-2, Inductive VTs – Part 3: Additional requirements for inductive voltage transformers.

SANS 60529/IEC 60529, Degrees of protection provided by enclosures (IP Code).

SANS 60269-2/IEC 60269-2, Low-voltage fuses – Part 2: Supplementary requirements for fuses for

use by authorized persons (fuses mainly for industrial application) – Examples of standardized systems of fuses A to K.

SANS 60282-1/IEC 60282-1, High-voltage fuses – Part1: Current-limiting fuses.

SANS 60815-1/IEC/TS 60815-1, Selection and dimensioning of high-voltage insulators intended for use in polluted conditions – Part 1: Definitions, information and general principles.

SANS 60815-2/IEC/TS 60815-2, Selection and dimensioning of high-voltage insulators intended for use in polluted conditions – Part 2: Ceramic and glass insulators for a.c. systems.

SANS 60815-3/IEC/TS 60815-3, Selection and dimensioning of high-voltage insulators intended for use in polluted conditions – Part 3: Polymer insulators for a.c. systems.

NRS 030:2020 4

SANS 60947-7-1/IEC 60947-7-1, Low-voltage switchgear and controlgear – Part 7-1: Ancillary equipment – Terminal blocks for copper conductors.

SANS 61462/IEC 61462, Composite hollow insulators – Pressurized and unpressurized insulators for use in electrical equipment with rated voltage greater than 1 000 V – Definitions, test methods, acceptance criteria and design recommendations

4 DEFINITIONS AND ABBREVIATIONS

For the purposes of this document, the definitions given in SANS 61869-3:2011 shall apply.

5 REQUIREMENTS

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.

5.1 Environmental Conditions.

a. Ambient air temperature: -10 °C to 40 °C;
b. Altitude: not exceeding 1 800 m;
c. Daily average humidity: not exceeding 95 %;
d. Wind pressure: not exceeding 700 Pa (equivalent to 34 m/s); and
e. Level of atmospheric pollution: very heavy

5.2 General Requirements

5.2.1 The voltage transformer shall be provided with a power winding that complies with the voltage rating and the continuous current rating.

5.2.2 Provision shall be made for the connection of a 50 x 3 mm flat copper earth tail with respect to the earth mat connection.

5.3 Creepage distance for outdoor applications

5.3.1 The unified specific creepage distance (USCD) shall be standardized to the "very heavy" pollution level in accordance with site pollution severity category "e" in SANS 60815-1, i.e. 54 mm/kV in relation to the maximum operating voltage across the primary insulation.

5.3.2 The creepage distance shall be as specified in SANS 60815-2 or SANS 60815-3, as appropriate.

5.3.3 The required total creepage distance shall be calculated and specified in millimetres.

5.3.4 For voltage levels up to and including 145 kV, a specific creepage distance (SCD) of 31 mm/kV in relation to the highest r.m.s. phase-to-voltage (Um) should be calculated.

5.4 Insulation levels

5.4.1 The rated insulation levels of the VTs shall comply with table 1.

5.4.2 The voltage transformers shall be suitable for operation on a system that has insulation levels as specified in this document.

5.5 General requirements for insulating materials

5.5.1 Insulating materials shall withstand the conditions of service in normal use.

5.5.2 Only service experience or adequate approved tests shall be the basis for assigning rational temperature limits for the insulation.

5.5.3 Where new materials and new systems are involved, appropriate functional tests shall be the basis for the selection.

5.6 Details of the insulation materials shall be stated where required.

NOTE For guidance on the use of recognized systems of thermal classes of electrical insulation, and the procedures for evaluation of new insulation systems, see IEC 60085.

5.6.1 Environmental requirements for materials All materials used in the construction of the VTs and the impact from eventual disposal, shall be declared to have the reasonable minimum negative influence on the environment.

5.6.2 This impact shall be based on environmental performance tests.

5.6.3 Details of insulation materials shall be stated in schedule B. In the case of VTs rated above 145 kV, the insulation creepage distance shall be specified in the schedules.

5.6.4 The default value is for a very heavy pollution class, the value in brackets is the value for the heavy pollution class

6 DESIGN DETAILS

6.1 General

VTs shall be capable of operating continuously under the service conditions stated without exceeding the temperature limits specified in SANS 61869-3:2011.

6.2 Rated voltage factor

6.2.1 For phase-ground VTs, the voltage factor shall be designed for at least 1,9 Um for a duration of not less than 8 h.

6.2.2 For phase-phase VTs with an isolated-neutral ("floating"), the voltage factor shall be at least 1, 2 Um continuous.

6.3 Accuracy class designation

6.3.1 The accuracy class designation (see table 2, where P stands for class P) required for the

6.3.2 VT shall be as specified in accordance with tables 11 and 12 in SANS 61869-3:2011.

6.3.3 The standard secondary voltage for utilities in South Africa is 110 V/√3 (see 5.1.2(a) in SANS 61869- 3:2011.

6.3.4 Where a voltage other than 110V/√3 is required, this shall be specified in the technical schedule.

6.3.5 For specific requirements, see tables 2 and 3.

6.3.6 Core steel details shall be stated where required in technical schedule.

6.3.7 Three-phase VTs shall be suitable for transforming zero phase sequence voltages.

6.3.8 The three phases and the neutral point shall be provided at the secondary terminals.

6.3.9 The primary winding star point should be solidly earthed.

6.4 Short-circuit protection

6.4.1 In the case of outdoor VTs, protection against short-circuits shall be provided by 32 A HRC fuses or MCBs in the secondary winding circuits.

6.4.2 Short-circuit protection of indoor VTs shall typically be provided by medium-voltage fuses in the primary winding circuits in accordance with SANS 60282-1, and low-voltage fuses in the

secondary circuits in accordance with SANS 60269-2. Details of the requirements shall be provided by the purchaser in the technical schedules.

6.4.3 The secondary fuses shall be in accordance with fuse system G in SANS 60269-2 (fuse-Links) with offset base contact, formerly known as the "British Standard clip-in fuse system",

6.4.4 The fuse system have the following requirements:

a. fuses shall be mounted in the secondary terminal box and fuses shall be fitted in the phase conductor and a bolted link shall be fitted in the neutral conductor.

b. The supplier shall state, in schedule B, the calculated primary and secondary short-circuit currents for a short circuit on the secondary terminals, assuming zero source impedance.

6.5 Constructional requirements

6.5.1 Secondary terminals

6.5.1.1 The bushings used for bringing the secondary connections through the tank into the secondary terminal box shall not be used as the secondary terminals for service connections, unless approved.

6.5.1.2 Studs shall have centre distances of not less than 25 mm. A minimum clearance of 12 mm shall be maintained between terminals.

6.5.1.3 The secondary terminals shall be rail-mounted, and shall be of the spring-loaded screw clamp type of width 10 mm, in accordance with SANS 60947-7-1.

6.5.1.4 The terminals shall accept two back-to-back hook blade lugs.

6.5.2 Secondary terminal boxes

6.5.2.1 Each VT shall be fitted with a secondary terminal box located in an accessible position and provided with an easily removable (preferably slip-on) weather-proof cover.

6.5.2.2 When in place, the cover shall be secured to the corresponding terminal box by means of at least an M8 stainless steel set screw, or otherwise approved method.

6.5.2.3 The type of terminal box shall be stated in schedule B and, subject to approval, shall be either:

a. integrally cast with the voltage transformer case; or

b. a steel box welded to the main tank.

6.5.2.4 The terminal box with the cover fixed in place shall have a degree of protection of at least IP56 in accordance with SANS 60529.

6.5.2.5 The secondary terminal box shall have an opening, at the bottom, for vertical entry of the secondary control cables. The opening shall be covered externally by an undrilled, removable gland plate of brass (of minimum thickness 2 mm), aluminium alloy (of minimum thickness 3 mm) or stainless steel (of minimum thickness 2 mm).

6.5.2.6 Unless otherwise specified, this gland plate, and the opening, shall have an effective area of at least 75 mm by 50 mm.

6.5.2.7 This area shall be stated in schedule B. Access to the gland-plate opening shall be left unobstructed for cables that enter the terminal box vertically from below.

6.5.2.8 The distance between the bottom terminals and the gland plate shall be at least 75 mm.

6.5.2.9 The terminal box shall be fitted with a breathing vent of diameter at least 10 mm. This vent shall be situated in the bottom of the box, shall be made of non-corroding material and shall be designed to prevent the entry of insects.

6.5.2.10 The beginning and the end of each secondary winding shall be wired to suitable terminals accommodated in the terminal box.

6.5.2.11 An earth stud shall be provided for earthing of the primary winding neutral and secondary windings inside the terminal box. The earth stud shall be of diameter at least 6 mm, and shall have an external connection to the main earthing system.

6.5.3 Tank earthing terminals

6.5.3.1 An earthing flag of 5 mm × 50 mm × 100 mm (minimum), with two 14 mm holes at 50 mm centres, shall be arranged vertically. The flag shall be situated in close proximity to a tank mounting bolt hole on the same side as the terminal box.

6.5.3.2 In the case of painted tanks, the underside of transformer tank mounting flanges should be zinc metal sprayed, and should not be painted to allow earthing to be achieved through the mounting surfaces.

NOTE Alternative designs shall be submitted for approval.

6.5.4 Hollow core insulators

6.5.4.1 Insulators shall comply with SANS 60815-2 and SANS 61462.

6.5.4.2 The name of the manufacturer of the HV insulators shall be stated in schedule B and detailed drawings of the insulator shall be supplied with the tender.

6.5.4.3 Permission shall be obtained from the purchaser before a change of insulator supplier during the course of a contract.

6.5.4.4 For guidance on the use of recognized systems of thermal classes of electrical insulation and the procedures for evaluation of new insulation systems, see IEC 60085.

6.5.4.5 Corrugated tanks are not acceptable. Tanks and fittings shall be of such shape that water cannot collect at any point on the outside surfaces.

6.5.5 Mounting arrangement for outdoor VTs

The base mounting arrangement for VTs shall be such that it can be bolted to a support structure, with mounting holes arranged on the corners of a square of dimensions not exceeding those specified in schedule A.

6.5.6 Corrosion protection

6.5.6.1 Unless otherwise approved, all ferrous parts associated with current transformers shall be either:

a. hot-dip galvanized in accordance with SANS 121, the coating thickness not less than 90 □m; or

b. zinc-metal sprayed in accordance with SANS 2063, the coating thickness not less than 80 □m.

6.5.6.2 Metallization shall be followed by a base coat and top coat in accordance with SANS 12944

NOTE Electroplating on ferrous material is not acceptable.

6.5.6.3 All materials shall be inherently corrosion-resistant or treated against corrosion for the design life time of the equipment.

6.5.7 Primary terminals for post-type VTs

6.5.7.1 Primary terminals and their associated parts, mounted on the voltage transformers as in service, shall be able to withstand the mechanical tests in 9.3 of SANS 61869-3:2011 without leakage, distortion, cracking or other failure.

6.5.7.2 Primary terminals shall be of the type specified in schedule A, and details of the terminals shall be stated in schedule B. Where stems are specified, these shall have a terminal length of 125 mm and a diameter of 26 mm. For VTs rated above 245 kV, special conditions apply and the conditions shall be stated in schedule A.

6.5.7.3 Primary terminals and their components shall be of an approved material of adequate conductivity and shall be suitably protected against corrosion. Non-ferrous terminals shall be electro-tinned to comply with, classification Cu/Sn/12/f in BS 1872 without subsequent heat treatment or machining. Ferrous terminals shall be galvanized.

6.5.7.4 All terminal arrangements shall be tested mechanically in accordance with 9.3 in SANS 61869-3:2011.

6.5.7.5 With regard to this test, the design factor of safety shall be not less than 2.

6.5.7.6 Terminal orientation will be as specified in schedule A.

Table 1 - Standard voltages and insulation levels of voltage transformers

1	2	3	4
Nominal system r.m.s. phase-to-phase voltage *Un* **kV**	**Highest r.m.s. voltage for equipment *Um*** **kV**	**Rated lightning impulse peak withstand voltage** **kV**	**Rated short-time power-frequency r.m.s. withstand voltage (IEC 60044-2)** **kV**
6,6	7,2	75	22
11	12	95	28
20.5	24	150	50
33	36	200	70
88	100	450	185
132	145	650	275

Table 2 - Three phase indoor/outdoor voltage transformers with 2 secondary windings and a residual winding

1	**2**	**3**	**4**	**5**
Winding number	**Accuracy class**	**Burden per Phase VA**	**Voltage factor and rated time**	**Type**
1	0,2	50	1,9 continuous	4 wire – 5 limb
2	1,0/3P	50		
Residual	6P	50		

Table 3 - Single phase indoor/outdoor voltage transformers with 2 secondary windings and a residual winding.

1	2	3	4
Winding number	**Accuracy class**	**Burden per Phase VA**	**Voltage factor and rated time**
1	0,2	100	1,9 continuous
2	3P	100	
Residual	6P	50	

Table 4 - Partial discharge test levels for voltage transformers

1	2	3	4	5	6	7
Type of main insulation	**Test procedure**	**Pre-stress voltage U_p** kV	**Minimum duration of U_p** s	**Measuring voltage U_s** kV	**Minimum duration of U_s** s	**Maximum permissible partial discharge q above the background level** pC
Fluid (for example, oil/gas)	-	Power-frequency voltage as per table 1	60	1,3 U_m	60	10
Dry(for example, cast resin)	1		60	$1,5(\sqrt{2}/\sqrt{3})$ U_m	60	10
	2		60	$1,2(\sqrt{2}/\sqrt{3})$ U_m	180	1

7 TESTS

Valid and approved type test certificates specified in SANS 61869-3:2011 shall be provided for each type test per fully assembled voltage transformer of each type and rating at an approved test facility. The certificates of the tests shall be included in the test reports. Type tests shall be followed by routine tests.

7.1 Type tests

7.1.1 Each fully assembled voltage transformer shall be subjected to the following routine tests at the manufacturer's work station:

a. Temperature rise test;

b. Short-time current test;

c. Lightning impulse test;

d. Switching impulse test;

e. Wet test for outdoor type transformers;

f. Determination of errors; and

g. Measurement of radio interference voltage (RIV).

7.1.2 All the above-mentioned tests can be found in SANS 61869-3:2011.

7.1.3 The test voltages shall be in accordance with the insulation levels specified in table 1.

7.2 Routine tests 6.2.1

7.2.1 Each fully assembled voltage transformer shall be subjected to the following routine tests at the manufacturer's work station:

a. verification of terminal markings;

b. power-frequency withstand test on primary winding;

c. partial discharge measurement;

d. power-frequency withstand test on secondary winding;

e. power-frequency withstand test, between sections; and

f. determination of errors. All the above-mentioned tests can be found in SANS 61869-3:2011.

7.2.2 The order of the above tests is not prescribed but the determination of errors shall be performed after the other tests have been completed.

7.2.3 Repeated power-frequency overvoltage tests on primary windings shall be performed at 80 % of the specified test voltage.

7.3 Special tests

7.3.1 Where so specified in schedule A, special tests will be performed and may be specified as either type tests or routine tests. If special tests are required, the details of the facility shall be provided in schedule B. The special tests can be required during the tender adjudication, during the manufacturing process or before the installation of the VT.

7.3.2 The following tests are performed upon agreement between the manufacturer and the purchaser:

a. chopped impulse test on primary winding;

b. measurement of capacitance and dielectric dissipation factor;

c. mechanical tests; and

d. transmitted overvoltage measurement.

e. All the above-mentioned tests can be found in SANS 61869-3:2011.

7.3.3 6.3.3 The results of dissipation factor tests on inductive VTs are design dependent and can be difficult to assess for some designs. Therefore, if applicable, for testing uniformity of production, the test circuit, the method and test voltages shall be agreed upon between the manufacturer and the purchaser.

NOTE For VTs that are intended for service at altitudes that exceed the altitudes at which the type tests and routine tests apply, corrections as set out in IEC 61869-1 should be done. 6.4 Test certificates

8 DOCUMENTATION

8.1 Technical product catalogue and operating and installation manuals shall be provided.

8.2 Full detailed dimensions drawings shall be provided.

8.3 A copy of all type test reports shall be provided.

8.4 A copy of the proposed routine test reports shall be provided.

8.5 All tests shall be fully documented in English and shall be signed and stamped by the purchaser's inspector(s), and copies shall be forwarded to the purchaser.

8.6 The copies shall include test certificates, bound together in one volume, recording the results of type tests, routine tests and special tests (if applicable) carried out on one fully assembled voltage transformer of each type.

8.7 Routine test certificates Each VT shall be delivered with one copy of all routine test certificates together with a copy of the excitation curve that shows clearly where the knee-point occurs for each core.

8.8 These certificates and curves shall be packed in a waterproof container and housed inside the terminal box of the respective VT.

8.9 If specified in schedule A, three sets of descriptive pamphlets and instruction books that cover the equipment offered shall be supplied to the purchaser as soon as possible, but not later than the delivery date of the voltage transformers.

8.10 A complete set of test certificates, as specified in 6.4.1 and 6.4.2, shall be included in each instruction book.

8.11 The instruction books shall include details of the recommended oil-sampling procedures, together with the necessary sectional and other sketches of oil-sampling devices provided and recommended maintenance and inspections to be done during the life of the equipment.

9 Marking, labelling and packaging

Recorded information on the following is required:

9.1 long-term storage of spare voltage transformers;

9.2 handling or preparation for transport with details of lifting and support positions; and

9.3 correct handling and slinging methods

10 TRAINING

10.1 The following certified training courses, for City Power's staff, shall be provided:

10.1.1 Operating, and

10.1.2 Maintenance of all components of the voltage transformer.

10.2 The associated costs for the certified training courses in 7, 1 shall be given per person and shall be fixed for the period of the contract.

11 QUALITY MANAGEMENT

A quality management system shall be set up in order to assure the quality of the oil spillage clean up. Guidance on the requirements for a quality management system may be found in the following standards: SANS ISO 9000, SANS ISO 9001, SANS ISO 9002, SANS ISO 9003 and SANS ISO 9004. The details shall be subject to agreement between the purchaser and supplier.

12 HEALTH AND SAFETY MANAGEMENT

A Health and Safety Plan/System shall be set up in order to ensure proper management and compliance of the Product during manufacture, operation, maintenance, and disposal phase/s. Guidance on the requirements of a Health and Safety Plan/System may be found in OHSAS 18001:2007/ISO 45001:2018 standards. This is to ensure that the asset/service conforms to standard operating procedures and City Power SHERQ Policy. The details shall be subject to agreement between City Power and the Supplier/Contractor.

13 ENVIRONMENTAL MANAGEMENT

An environmental management plan shall be set up in order to assure the proper environmental management of manufacture, operation, and maintenance and disposal phase/s oil spillage clean up and rehabilitation. Guidance on the requirements for an environmental management system may be found in ISO 14001 standards. The details shall be subject to agreement between City Power and the service provider. This is to ensure that the asset created conforms to environmental standards and City Power SHERQ policy

Annex A – Bibliography

ESKOM SCSSCAAP9: *Rev.1, Corrosion protection specification for distribution equipment manufactured from 3CR12 stainless steel and mild steel*

ESKOM DSP0012: *Rev 4; Distribution voltage transformers: specific requirements for voltage manufactured in accordance with NRS 030, up to and including 132 kV.*

CP_TSSPEC_120: Rev 1; Specification for 88 kV Voltage Transformers (VT).

CP_TSSPEC_141: Rev 0; Specification for 33 kV Voltage Transformers (VT).

Annex B – Revision information

DATE	REV. NO.	NOTES
August 2006	0	First issue
October 2006	1	Revised in accordance with the new format Additional 132 kV voltage transformer specification Additional clauses 4,1; 4,2 and 5 to 7 Changed bibliography Eskom document to DSP0012
June 2013	2	Changed the name of the specification to include all voltages. Included the tables 1 until 4 Updated Technical schedules A and B for inductive
August 2022	3	Replace NRS requirements with SANS requirements Update ISO requirements

Annex C- Technical schedule A and B for Inductive Voltage Transformers

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

Item	NRS 030	Description		Schedule A	Schedule B
1	4.1	**General requirements**			
		a) 1-phase or 3-phase voltage transformer?		_____	xxxxxxx
		b) Indoor or Outdoor use?		_____	xxxxxxx
		c) Winding 1 specification:			
		• Rated burden per phase	VA	_____	_____
		• Accuracy class		_____	_____
		d) Winding 2 specification:			
		• Rated burden per phase	VA	_____	_____
		• Accuracy Class		_____	_____
		e) Rated primary phase-to-ground voltage	kV	_____/√3	xxxxxxx
		f) Rated secondary phase-to-ground voltage	V	110/√3	xxxxxxx
		g) Voltage factor		1.9	_____
		h) Time for voltage factor	hr	8 hours	_____
		i) Number of core limbs for a 3-phase voltage transformer		5	xxxxxxxx
		j) HV Neutral earthed (Yes/No)?		_____	xxxxxxx
		k) Draw-out (rail) type or hinged type3-phase voltage transformer?		_____	xxxxxxx
NOTE: TICKS [✓✗], ASTERISK [*], WORD [NOTED], OR TBA [TO BE ADVISED] WILL NOT BE ACCEPTED.					

Tender Number: _____

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

Full name of company: _____

Annex C- Technical schedule A and B for Inductive Voltage Transformers (continued)

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

Item	NRS 030	Description		Schedule A	Schedule B
2	4.1	**Is a power winding required (Yes/No)**		_____	xxxxxxxx
		If Yes:			
		a) Rated secondary voltage (220V or 110V)?	V	_____	xxxxxxxx
		b) Rated continuos current of secondary winding?	A	_____	_____
3	4.1(a)	**Service Conditions:**			
		Altitude	m	1800	xxxxxxxx
		Ambient temperature	Min °C	-10	xxxxxxxx
			Max °C	40	xxxxxxxx
		Relative humidity	%	90	xxxxxxxx
		Lightning area		Yes	xxxxxxxx
	Level of pollution that the equipment will be subjected to			Very heavy	xxxxxxxx
4	**When erection is not required:**				
	a) Access to stores by			Road	xxxxxxxx
	b) To be off-loaded from transport by supplier			Yes	xxxxxxxx
NOTE: TICKS [✓✗], ASTERISK [*], WORD [NOTED], OR TBA [TO BE ADVISED] WILL NOT BE ACCEPTED.					

Tender Number: _____

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

Full name of company: _____

Annex C- Technical schedule A and B for Inductive Voltage Transformers (continued)

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

Item	NRS 030	Description		Schedule A	Schedule B
5		**When erection is required**			
		a) Access to site by		Road	xxxxxxxx
		b) To be off-loaded from transport by supplier		Yes	xxxxxxxx
		c) Crane available for off-loading		No	xxxxxxxx
		d) Distance from off-loading point to operation position	m	_____	xxxxxxxx
		e) Nature of ground to be traversed (eg gravel road, earth road, tar road)		_____	xxxxxxxx
		f) Rise to fall of ground level	m	_____	xxxxxxxx
		g) Erection on prepared steel structures (Yes/No)		_____	xxxxxxxx
		h) Construction power supply available (Yes/No)		_____	xxxxxxxx
		i) Is mounting structure to be provided by the supplier (Yes/No)		_____	xxxxxxxx

NOTE: TICKS [✓✗], ASTERISK [*], WORD [NOTED], OR TBA [TO BE ADVISED] WILL NOT BE ACCEPTED.

Tender Number: _____

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

Full name of company: _____

Annex C- Technical schedule A and B for Inductive Voltage Transformers (continued)

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

Item	NRS 030	Description		Schedule A	Schedule B
6	4.1(b)	**System Details**			
		a) Maximum symmetrical 3-phase fault current	kA	_____	xxxxxxxx
		b) Nominal system r.m.s phase to phase voltage (Un). See Table 1.	kV	_____	xxxxxxxx
		c) Highest r.m.s. phase to phase voltage for equipment (Um). See Table 1	kV	_____	xxxxxxxx
		d) Rated lightning impulse peak withstand voltage. See Table 1.	kV	_____	xxxxxxxx
		e) Rated short time power frequency r.m.s. withstand voltage. See Table 1.	kV	_____	xxxxxxxx
		f) Rated power frequency	Hz	_____	xxxxxxxx
7	4.1(c)	**Manufacturer of voltage transformer offered**			
		a) Manufacturer		xxxxxxxx	_____
		b) Manufacturer's type designation		xxxxxxxx	_____
9		**Minimum Insulator creepage distance**	**mm/kV**	**31**	xxxxxxxx

NOTE: TICKS [✓✗], ASTERISK [*], WORD [NOTED], OR TBA [TO BE ADVISED] WILL NOT BE ACCEPTED.

Tender Number: _____

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

104 Full name of company: _____

Annex C- Technical schedule A and B for Inductive Voltage Transformers (continued)

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

Item	NRS 030	Description	Schedule A	Schedule B
10	4.1.3	**Insulation materials**		
		a) Primary insulation medium	xxxxxxxx	———
		b) Secondary insulation medium	xxxxxxxx	———
		c) Core insulation medium	xxxxxxxx	———
		d) Main insulation (oil, gas, resin, dry)	xxxxxxxx	———
11	4.1.4	**Oil-insulated voltage transformers**		
		a) Type of oil	xxxxxxxx	———
		b) Quantity of oil	xxxxxxxx	———
		c) Expansion accommodation method	xxxxxxxx	———
		d) Oil to be certified PCB free(zero count)	Yes	xxxxxxxx
		e) Oil sample required	Yes	xxxxxxxx
		f) Sealing arrangement	xxxxxxxx	———
		g) Oil level indicators	Yes	———
		h) Oil sample valve required (yes/No)	———	xxxxxxxx
12	4.1.5	**Gas insulated voltage transformer**		
		a) Type of gas	SF6	———
		b) Method of sealing	xxxxxxxx	———

NOTE: TICKS [✓✗], ASTERISK [*], WORD [NOTED], OR TBA [TO BE ADVISED] WILL NOT BE ACCEPTED.

Tender Number: _____

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

Full name of company: _____

Annex C- Technical schedule A and B for Inductive Voltage Transformers (continued)

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

Item	NRS 030	Description		Schedule A	Schedule B
13	4.1.6	**Dry type voltage transformers**			
		Is the core included in the encapsulated (yes/No)		xxxxxxxx	_____
		If No: Details of core treatment		xxxxxxxx	_____
14		**Are primary fuses required for 3-phase voltage transformers (Yes/No)**		_____	xxxxxxxx
		If Yes:			
		a) Current rating	A	_____	_____
		b) Location		xxxxxxxx	_____
15		**Is secondary protection required?**		**Yes**	
		a) By means of fuses		_____	xxxxxxxx
		b) Current rating	A	_____	
		c) Secondary earthing via white phase or neutral		_____	xxxxxxxx
16		**Short –circuit current**			
		a) Calculated secondary short-circuit current	kA	xxxxxxxx	_____
		b) Maximum permissible duration secondary short-circuit current	s	A	xxxxxxxx
		c) Fuse/MCB operating time for secondary short-circuit	s	xxxxxxxx	_____
		d) Calculated primary current for a secondary short-circuit assuming zero source impedance	A	xxxxxxxx	_____
		e) Drawing showing method of mounting secondary fuses /MCBs		Yes	xxxxxxxx

NOTE: TICKS [✓✗], ASTERISK [*], WORD [NOTED], OR TBA [TO BE ADVISED] WILL NOT BE ACCEPTED.

Tender Number: _____

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

Full name of company: _____

Annex C- Technical schedule A and B for Inductive Voltage Transformers (continued)

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

Item	NRS 030	Description		Schedule A	Schedule B
17	4.3.1.3	**Is a residual voltage winding required (Yes/No)**		_____	xxxxxxxx
		If Yes:			
		a) Rated burden	VA	_____	_____
		b) Rated secondary voltage			xxxxxxxx
		c) Accuracy class		_____	_____
18	4.3.1.6	**Details of primary winding neutral (earth) terminal**		xxxxxxxx	_____
19	4.3.2	**Cores Steel details**			
		a) Core steel details required:			
		• B/H curve		xxxxxxxx	_____
		• Thickness of Lamina		xxxxxxxx	_____
		• Annealed		xxxxxxxx	_____
		• Grade		xxxxxxxx	_____
20	4.3.4	**Secondary terminal box**			
		a) Number of fuses/MCBs		xxxxxxxx	_____
		b) Manufacturer of fuses/MCBs		xxxxxxxx	_____
		c) Type of fuses/MCBs		xxxxxxxx	_____
		d) Diameter of secondary earthing terminal	mm	xxxxxxxx	_____
		e) HV winding earth end to be brought out, with link to earth terminal (Yes/No)		_____	
		f) LV winding earth end to be brought out, with link to earth terminal (Yes/No)		_____	

NOTE: TICKS [✓✗], ASTERISK [*], WORD [NOTED], OR TBA [TO BE ADVISED] WILL NOT BE ACCEPTED.

Tender Number: _____

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

Full name of company: _____

Annex C- Technical schedule A and B for Inductive Voltage Transformers (continued)

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

Item	NRS 030	Description		Schedule A	Schedule B
21	4.3.4.4	**Dimensions of secondary terminal box:**			
		a) Length	mm	xxxxxxxx	_____
		b) Depth	mm	xxxxxxxx	_____
		c) Height	mm	xxxxxxxx	_____
22		**Minimum effective gland area of secondary terminal box/gland plate: length x width**	**mm**	**100 x 75**	_____
23		**Bolted earth link or removable earth link**		_____	xxxxxxxx
24	**4.3.6**	**Post type VT mounting arrangement**			
		Holding down bolts to be arranged to fall within a square of maximum dimensions	m	_____	xxxxxxxx
		Outline drawing provided (Yes/No)		_____	xxxxxxxx
		Diameter of the bolt holes to be:	mm	_____	xxxxxxxx
25	**4.3.6**	**Metal Finish**			
		• Finish offered on metallic parts		xxxxxxxx	_____
		• Finish offered on non metallic parts		xxxxxxxx	_____
26	**4.4**	**Primary terminals (Post type VT)**			
		a) Type of primary terminal (Stem/Pad)?		_____	xxxxxxxx
		b) Material of primary terminal (aluminium/electro tinned copper)?		_____	xxxxxxxx

NOTE: TICKS [✓✗], ASTERISK [*], WORD [NOTED], OR TBA [TO BE ADVISED] WILL NOT BE ACCEPTED.

Tender Number: _____

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

Full name of company: _____

Annex C- Technical schedule A and B for Inductive Voltage Transformers (continued)

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

Item	NRS 030	Description		Schedule A	Schedule B
26	4.4	**Primary terminals (Post type VT) continued**			
		c) Overall dimension of stem type primary terminal			
		• Length	mm	_____	_____
		• Diameter	mm	_____	_____
		• Orientation (Vertical/Horizontal)?		_____	xxxxxxxx
		d) Overall dimensions of pad type primary terminal			
		• Hole spacing	mm	_____	_____
		• Hole diameter	mm	_____	_____
		• Length	mm	_____	_____
		• Thickness	mm	_____	_____
		e) Diameter of tank earthing terminal	mm	xxxxxxxx	_____
27	4.6	**Rating plates and diagram plates**			
		a) Materials used for rating plates		xxxxxxxx	_____
		b) Materials used for diagram plates		xxxxxxxx	_____
		c) Method of fixing diagram and rating plates		xxxxxxxx	_____

NOTE: TICKS [✓✗], ASTERISK [*], WORD [NOTED], OR TBA [TO BE ADVISED] WILL NOT BE ACCEPTED.

Tender Number: _____

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

Full name of company: _____

Annex C- Technical schedule A and B for Inductive Voltage Transformers (continued)

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

Item	NRS 030	Description		Schedule A	Schedule B
28	4.7.2.1	**Drawing numbers for post type voltage transformers**			
		a) Outline dimension		xxxxxxxx	_____
		b) Assembly		xxxxxxxx	_____
		c) Terminal box		xxxxxxxx	_____
		d) Terminal marking		xxxxxxxx	_____
		e) Rating plate		xxxxxxxx	_____
		f) Diagram plate		xxxxxxxx	_____
		g) Drawing quantity required		_____	xxxxxxxx
29		**Drawing numbers for three-phase VT's and units built into circuit breakers**		xxxxxxxx	_____
30		**Drawing number of magnetisation curve showing voltage/exciting current**		xxxxxxxx	_____
31		**Test certificates of individual routine tests are required and shall be placed in the terminal box**		**Yes**	xxxxxxxx
32		**Quantity of drawings and literature required with tender, if other than six**		_____	xxxxxxxx
33		**Number of instruction books and descriptive pamphlets per order, if other than three.**		_____	xxxxxxxx
34		**Number of copies of routines test certificates if other than six.**		_____	xxxxxxxx

NOTE: TICKS [✓✗], ASTERISK [*], WORD [NOTED], OR TBA [TO BE ADVISED] WILL NOT BE ACCEPTED.

Tender Number: _____

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

Full name of company: _____

Annex C- Technical schedule A and B for Inductive Voltage Transformers (continued)

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

Item	NRS 030	Description		Schedule A	Schedule B
35		**Storage for outdoor-type voltage transformers** Guides on:			
		a) Storage		xxxxxxxx	_____
		b) Transportation		xxxxxxxx	_____
		c) Handling and slinging		xxxxxxxx	_____
36	5.1	**Type tests**			
		a) Are valid type test results available (Yes/No)?		xxxxxxxx	_____
		b) If No, are type tests to be performed?		Yes	xxxxxxxx
		c) If required where are type tests to be carried out?		xxxxxxxx	_____
37	5.2	**Routine tests**			
		Is a tangent delta test required (Yes/No)?			xxxxxxxx
38		**Test procedure for cast resin encapsulated voltage transformers (procedure 1 or 2). See Table 4**		xxxxxxxx	_____
39		**Miscellaneous**			
		a) Oil quantity	ℓ	xxxxxxxx	_____
		b) Overall dimensions of voltage transformer			
		• Height	mm	xxxxxxxx	_____
		• Length	mm	xxxxxxxx	_____
		• Width	mm	xxxxxxxx	_____
		• Total mass of voltage transformer	kg	xxxxxxxx	_____

NOTE: TICKS [✓✗], ASTERISK [*], WORD [NOTED], OR TBA [TO BE ADVISED] WILL NOT BE ACCEPTED.

Tender Number: _____

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

Full name of company: _____

TECHNICAL SCHEDULES A AND B FOR SPECIFIC REQUIREMENTS FOR 6.6 kV UP TO AND INCLUDING 132 kV VOLTAGE TRANSFORMERS

DEVIATION SCHEDULE

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_120**	**Proposed deviation**

Tender Number: _____

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

Full name of company: _____

Annex D – Stock item

It is not intended that City Power should keep stock of these items.