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Rev No.	Date (YYYY-MM-DD)	Description of Change	Prepared by (Name & Signature)	Approved by (Name & Signature)
Issue 1 Rev 0	2013-01-18	Cancels and replaces TSP/10/034-1, TSP/10/004 and all previous issues	S. Kimitei	G. Owuor

FOREWORD

This specification has been prepared by the Research and Development Department in collaboration with the Technical Services and Transmission Departments all of The Kenya Power and Lighting Company Limited (abbreviated as KPLC) and it lays down requirements for 132kV Current Transformers. It is intended for use by KPLC in purchasing the equipment.

1. SCOPE

1.1 This specification is for newly manufactured current transformers for use with electrical measuring instruments and electrical protective devices for system highest voltage of 145kV at power frequency of 50Hz.

1.2 This specification covers Types/CT Ratios given in clause 4.3.

The Type/CT Ratio required will be stated in the schedule of requirements in the tender.

1.3 The specification also covers inspection and test of the current transformer as well as schedule of Guaranteed Technical Particulars to be filled, signed by the manufacturer and submitted for tender evaluation.

The specification stipulates the minimum requirements for 132kV current transformers acceptable for use in the company and it shall be the responsibility of the supplier to ensure adequacy of the design, good engineering practice, adherence to the specification and applicable standards and regulations as well as ensuring good workmanship in the manufacture of the current transformers for The Kenya Power & Lighting Company.

The specification does not purport to include all the necessary provisions of a contract.

2. REFERENCES

The following standards contain provisions which, through reference in this text constitute provisions of this specification. Unless otherwise stated, the latest editions (including amendments) apply.

IEC 60044-1: Instrument Transformers – Part 1: Current Transformers

IEC 60815: Guide for the selection of insulators in respect of polluted conditions

3. TERMS AND DEFINITIONS

For the purpose of this specification the definitions given in the reference standards shall apply.

4. REQUIREMENTS

4.1 SERVICE CONDITIONS

4.1.1 Site Conditions

The current transformer shall be suitable for continuous outdoor operation in tropical areas inland, cities and suburbs of cities, along the coast and with the following conditions:

(a) Altitude: upto 2,200 metres above sea level.

(b) Temperature: average of +30ºC with a minimum of -1ºC and max +40 ºC

(c) Humidity: up to 95%,

(d) Pollution: Design pollution level to be taken as "Very *Heavy*" (Pollution level IV) according to IEC 60815.

(e) Isokeraunic level: 180 thunderstorm days per year

4.1.2 System Conditions

The current transformer will be connected to overhead system operating at a nominal voltage of 132kV and maximum voltage of 145kV, 50Hz and are generally of earthed construction i.e. with continuous aerial earth wire.

4.2 MATERIALS, DESIGN AND CONSTRUCTION

4.2.1 The current transformer (CT) shall be designed and manufactured to IEC 60044-1 and the requirements of this specification.

4.2.2 All materials used shall be new and of the best quality and of the class most suitable for working under the conditions specified and shall withstand the variations of temperatures and atmospheric conditions arising under working conditions without undue distortion or deterioration or the setting up of undue stresses in any part, and

also without affecting the strength and suitability of the various parts for the work which they have to perform.

4.2.3 The design shall ensure satisfactory operation under such sudden variations of load and voltage as may be met with under working conditions on the system, including those due to short circuits.

4.2.4 All parts of the transformer, including insulators with their mountings, shall be designed so as to avoid pockets in which water can collect.

4.2.5 The current transformer shall be outdoor; oil insulated and hermetically sealed type. The insulator portion of the current transformer shall be made of high-grade brown-glazed porcelain.

4.2.6 The current transformer shall be suitable for vertical installation on a steel structure.

4.2.7 All parts and components of the current transformer shall be resistant to atmospheric corrosion.

4.2.8 The current transformer shall have primary, secondary and earth terminals.

4.2.9 Primary Terminal

4.2.9.1 The primary terminal shall be of high conductivity copper, tin-plated, suitable for connection of both copper and aluminium conductors.

4.2.9.2 It shall have palm clamp connectors suitable for both stranded conductor and tube connection.

4.2.9.3 Conductor overall diameter shall be 18.3mm to 25mm and busbar tubes of 76.2mm diameter.

4.2.10 Secondary Terminals

4.2.10.1 The secondary terminals of the current transformer shall be wired to a terminal box and earthed at one point.

4.2.10.2 The terminal box shall be weatherproof with a cable plate at the bottom and shall be covered with removable plate.

4.2.10.3 The terminal box shall be capable of accommodating up to 12 secondary terminals each suitable for conductor size of up to 3.2mm diameter.

4.2.11 The current transformer shall have cores as per clause 4.3. The ratio selection shall be done on the secondary side.

4.2.12 The protection cores shall be suitable for conventional overcurrent and for true transformation of the fully asymmetrical fault currents.

4.3 Ratings

The ratings of the current transformer shall be as indicated in Table 1.

Table 1: Ratings

Description		Requirements			
Rated voltage and frequency		145kV, 50Hz			
Minimum creepage of insulator		4495mm			
Minimum lightning impulse withstand voltage		750kV (peak)			
Minimum power frequency withstand voltage		325kV (rms)			
Overload factor		1.5			
Rated short circuit withstand		31.5kA, 3 seconds			
Type of CT		TYPE I	TYPE II	TYPE III	TYPE IV
Rated primary current		600A	100A	50A	800A
CT ratio		600/300/1-1-1-1	100/50/1-1-1	50/25/1-1-1	800/400/200/1-1-1-1
Rated secondary current		1A	1A	1A	1A
Accuracy class and rated burden	Core 1	Class 0.5, 15VA	Class 0.5, 15VA	Class 0.5, 15VA	Class 0.5, 15VA
	Core 2	Class 5P20, 15VA	Class 5P20, 15VA	Class 5P20, 15VA	Class 5P20, 15VA
	Core 3	Class X, V_k= 350V, Ik< 30mA	Class X, V_k= 350V, Ik< 30mA	Class X, V_k = 350V, Ik< 30mA	Class X, V_k = 350V, Ik< 30mA
	Core 4	Class X, V_k= 350V, Ik< 30mA	-	-	Class X, V_k = 350V, Ik< 30mA

4.4 Quality Management System

4.4.1 The supplier shall submit a quality assurance plan (QAP) that will be used to ensure that the transformer design, material, workmanship, tests, service capability,

maintenance and documentation, will fulfill the requirements stated in the contract documents, standards, specifications and regulations. The QAP shall be based on and include relevant parts to fulfill the requirements of ISO 9001:2008.

4.4.2 The Manufacturer's Declaration of Conformity to applicable standards and copies of quality management certifications including copy of valid and relevant ISO 9001: 2008 certificate shall be submitted with the tender for evaluation.

4.4.3 The bidder shall indicate the delivery time of the current transformers, manufacturer's monthly & annual production capacity and experience in the production of the type and size of items being offered. A detailed list & contact addresses (including e-mail) of the manufacturer's previous customers for similar type of current transformers sold in the last five years as well as reference letters from at least four of the customers shall be submitted with the tender for evaluation.

5. TESTS AND INSPECTION

5.1 The current transformer shall be inspected and tested in accordance with the requirements of this specification and IEC 60044-1. It shall be the responsibility of the supplier to perform or to have performed the tests specified.

5.2 Copies of previous Type Test Certificates and Type Test Reports issued by a third party testing laboratory that is accredited to ISO/IEC 17025 shall be submitted with the tender for the purpose of technical evaluation. The accreditation certificate for the third party testing laboratory shall also be submitted with the tender (all in English Language).

Copies of Type Test Reports to be submitted shall include the following tests as per IEC 60044-1:

5.2.1 Short-time current tests;
5.2.2 Temperature rise test;
5.2.3 Lightning impulse test (with both positive and negative polarity – fifteen consecutive impulses of each polarity);
5.2.4 Wet test for outdoor type transformers;
5.2.5 Determination of errors;
5.2.6 Capacitance and dielectric dissipation factor;
5.2.7 Chopped lightning impulse withstand test;
5.2.8 Partial discharge test;
5.2.9 Transmitted overvoltage test;
5.2.10 Mechanical test;
5.2.11 Radio interference voltage (RIV) test;

5.2.12 Accuracy of measuring current transformers.

5.3 Routine test reports for the current transformers to be supplied shall be submitted to KPLC for approval before shipment/delivery of the goods. KPLC Engineers (2) will witness tests at the factory before shipment.

Tests to be witnessed by KPLC Engineers at the factory shall include all tests required by IEC 60044-1 and the the following:

5.3.1 Verification of terminal markings;
5.3.2 Power-frequency withstand test on primary winding;
5.3.3 Partial discharge measurement;
5.3.4 Power-frequency withstand tests on secondary winding;
5.3.5 Inter-turn overvoltage test;
5.3.6 Determination of errors;
5.3.7 Visual inspection;
5.3.8 Capacitance and dielectric dissipation factor;
5.3.9 Partial discharge test;
5.3.10 Accuracy of measuring current transformers;
5.3.11 Rated knee point emf, maximum exciting current, secondary winding resistance and turns ratio of class x current transformers.

5.4 Upon delivery of the current transformers, KPLC will inspect them and may perform or have performed any of the relevant tests in order to verify compliance with the specification. The supplier shall replace/rectify without extra or additional charge to KPLC, current transformers which upon examination, test or use fail to meet any of the requirements in the specification.

6. MARKING AND PACKING

6.1 The current transformer shall be fitted with a permanent rating plate indicating the following:

a) The manufacturer's name or identification mark;
b) The type reference number and serial number;
c) The rated primary and secondary current;
d) The rated frequency;
e) The rated output and the corresponding accuracy class of the cores;
f) The highest voltage of equipment (e.g. 145kV);
g) The rated insulation level;
h) The class of insulation;
i) The short-time current ratings and time;

j) The rated continuous thermal current;
k) Additional requirements for Class x shall be as per IEC 60044-1.

All the marking shall be by engraving (or superior method) and shall be permanent and legible.

6.2 The terminals shall be marked clearly and indelibly and in accordance with IEC 60044-1. The terminal marking shall consist of letters followed by numbers. The letters shall be in block capitals.

6.3 The current transformers shall be delivered packed in wooden crates firmly bound together to avoid damage during transportation and storage.

7. DOCUMENTATION

7.1 The bidder shall submit its tender complete with technical documents required by Annex A (Guaranteed Technical Particulars) for tender evaluation. The technical documents to be submitted (all in English language) for tender evaluation shall include the following:

a) Guaranteed Technical Particulars;
b) Copies of the Manufacturer's catalogues, brochures, drawings and technical data;
c) Sales records for the last five years and at least four customer reference letters;
d) Details of manufacturing capacity and the manufacturer's experience;
e) Copies of required type test reports by a third party testing laboratory accredited to ISO/IEC 17025;
f) Copy of accreditation certificate for the testing laboratory.

7.2 The successful bidder (supplier) shall submit the following documents/details to The Kenya Power & Lighting Company for approval before manufacture:

a) Guaranteed Technical Particulars,
b) Design Drawings with details of current transformer to be manufactured for KPLC,
c) Quality assurance plan (QAP) that will be used to ensure that the design, material, workmanship, tests, service capability, maintenance and documentation will fulfil the requirements stated in the contract documents, standards, specifications and regulations. The QAP shall be based on and include relevant parts to fulfil the requirements of ISO 9001:2008
d) Detailed test program to be used during factory testing,
e) Marking details and method to be used in marking the current transformers,
f) Manufacturer's undertaking to ensure adequacy of the design, good engineering practice, adherence to the specification and applicable standards and regulations

as well as ensuring good workmanship in the manufacture of the current transformers for The Kenya Power & Lighting Company

g) Packaging details (including packaging materials).

7.3 A set of three (3) original hard cover installation and technical manuals for the instrument transformers shall be supplied with the equipment during delivery.

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ANNEX A: Guaranteed Technical Particulars *(to be filled and signed by the Manufacturer and submitted together with relevant copies of the Manufacturer's catalogues, brochures, drawings, technical data, sales records, four customer reference letters, details of manufacturing capacity, the manufacturer's experience and copies of complete type test certificates and type test reports for tender evaluation, all in English Language)*

Tender No .....

Clause Number	Description	**Bidder's Offer** *(indicate details of the current transformer offered)*
-	Name of the Manufacturer, address and Country of manufacture	
	Name & address of Bidder	
	Type/Model Number offered	
Clause Number as per specification *(please refer to the specification)*		
1.	Scope	
	It shall be the responsibility of the supplier to ensure adequacy of the design, good engineering practice, adherence to the specification and applicable standards and regulations as well as ensuring good workmanship in the manufacture of the current transformers for The Kenya Power & Lighting Company	
2	Applicable Standards	
3	Terms and Definitions	
4.1.1	Site Conditions	
4.1.2	System Conditions	
4.2.1	Design Standard	
4.2.2	Materials	
4.2.3	Variations of load & voltage	
4.2.4	Rain water	
4.2.5	Outdoor, oil insulated & hermetically sealed type	
	Insulator portion of brown porcelain	
4.2.6	Vertical installation on a steel structure	
4.2.7	All parts & components to be corrosion resistant	
4.2.8	Primary, secondary and earth terminals	
4.2.9.1	Primary terminal to be high conductivity copper, tin plated	
4.2.9.2	Primary terminal to have palm clamp connector with 2No. U-bolts	
4.2.9.3	Clamp suitable for conductor overall diameter of	

Clause Number	Description		Bidder's Offer *(indicate details of the current transformer offered)*			
	18.3mm to 25mm and tubes of 76.2mm diameter					
4.2.10.1	Secondary terminals wired to terminal box & earthed					
4.2.10.2	Terminal box shall be weather-proof with cable plate at bottom					
4.2.10.3	Terminal box with 12 terminals & conductor size of 3.2mm diameter					
4.2.11	Ratio selection on the secondary side					
4.2.12	Protection cores suitable for conventional overcurrent and for true transformation of the fully asymmetrical fault currents					
4.3	Rated voltage and frequency					
	Minimum creepage distance of insulator					
	Minimum lightning impulse withstand voltage					
	Minimum power frequency withstand voltage					
	Overload factor					
	Rated short circuit withstand					
	Type of CT		**TYPE I**	**TYPE II**	**TYPE III**	**TYPE IV**
	Rated primary current					
	CT ratio					
	Rated secondary current					
	Accuracy class and rated burden	Core 1				
		Core 2				
		Core 3				
		Core 4				
4.4.1	Quality Assurance Plan to be based on ISO 9001:2008					
4.4.2	Declaration of conformity to IEC 60044-1					
	Copy of ISO 9001:2008 certificate submitted					
4.4.3	Customer reference list for last five years and four customer reference letters					
	Manufacturer's experience					
	Manufacturer's capacity (number of units per month)					
5.1	Test Standard					
	Responsibility of testing of transformer & manufacturer's capability to test					

Clause Number	Description		Bidder's Offer *(indicate details of the current transformer offered)*
5.2	Copies of type test reports to IEC 60044-1 submitted with tender for evaluation:	Short-time current tests	
		Temperature rise test	
		Lightning impulse test (with both positive and negative polarity – fifteen consecutive impulses of each polarity)	
		Wet test for outdoor type transformers	
		Determination of errors	
		-Capacitance and dielectric dissipation factor; -Chopped lightning impulse withstand test; -Partial discharge test; -Transmitted overvoltage test; -Mechanical test; -Radio interference voltage (RIV) test; -Accuracy of measuring current transformers	
		Rated knee point emf, maximum exciting current, secondary winding resistance and turns ratio of class x current transformers	
5.3	Routine Tests to IEC 60044-1& Factory Acceptance Tests	Verification of terminal markings	
		Power-frequency withstand test on primary winding	
		Partial discharge measurement	
		Power-frequency withstand tests on secondary winding	
		Inter-turn overvoltage test	
		Determination of errors	
		Visual inspection	
		-Capacitance and dielectric dissipation factor; -Partial discharge test; -Accuracy of measuring current transformers	
		Rated knee point emf, maximum	

Clause Number	Description		Bidder's Offer *(indicate details of the current transformer offered)*
		exciting current, secondary winding resistance and turns ratio of class x current transformers	
5.4	Inspection and test by KPLC during delivery before acceptance to stores		
6.1	Marking	Items to be marked to include those required by clause 6.1 of this specification	
		Method of marking to ensure it is permanent and legible	
6.2	The terminals shall be marked clearly and indelibly and in accordance with IEC 60044-1. The terminal marking shall consist of letters followed by numbers. The letters shall be in block capitals.		
6.3	Each current transformer shall be packed in wooden crate firmly bound together to avoid damage during transportation and storage		
7.1	List of documents submitted with tender for evaluation		
7.3	List of documents to be submitted by supplier to KPLC for approval before manufacture		
7.4	A set of three (3) original hard cover installation and technical manuals for the instrument transformers shall be supplied with the equipment during delivery		
Other details required with the tender	Weight of complete current transformer, kg		
	Material of tank (to suit stated service conditions)		
	Weight of oil, kg		
	Weight of insulator, kg		
	Manufacturer's warranty and guarantee for the complete current transformer		
	Manufacturer's Letter of Authorization		
	Deviations from tender specifications (indicate supporting documents submitted)		

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Manufacturer's Name, Signature, Stamp and Date