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Kenya Power

ENCLOSURES FOR METERING EQUIPMENT.

Part 2: LOW VOLTAGE ENCLOSURES AND ACCESSORIES FOR SMART METERING OF COMMERCIAL AND INDUSTRIAL CUSTOMERS — SPECIFICATION

A Document of the Kenya Power & Lighting Co. Ltd

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0.1 Circulation List

COPY NO.	COPY HOLDER
1	Manager, Standards
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REVISION OF KPLC STANDARDS

To keep abreast of progress in the industry, KPLC Standards shall be regularly reviewed. Suggestions for improvements to approved standards, addressed to the Manager, Standards department, are welcome.

Issued by: Head of Section, Standards Development	Authorized by: Head of Department, Standards
Signed:	Signed:
Date: 2018-02-06	Date: 2018-02-06

0.2 Amendment Record

Rev No.	Date (YYYY-MM-DD)	Description of Change	Prepared by (Name & Signature)	Approved by (Name & Signature)
Issue 1 Rev 0	2018-02-06	New Issue	Rotich Benard	Dr. Eng. P. Kimemia

FOREWORD

This specification has been prepared by the Standards Department in collaboration with the Customer Service- Large Power Customers, both of the Kenya Power and Lighting Co. Ltd, here known as Kenya Power. This specification lays down requirements for Low Voltage (LV) Enclosures and Accessories for use in Advanced Metering Infrastructure (AMI) system for large industrial and large commercial customers.

These customers include three phase whole current customers and three phase CT metered customers for LV.

This specification was prepared to establish requirements for enclosures and accessories for metering commercial and industrial customers to be used at Kenya Power.

Other Kenya Power specification dealing with enclosures and falling under the Kenya Power specification code *TSP/14/006*, and under the general title *Enclosures for Metering Equipment* is as listed below:

TSP/14/006-1: Specification for Enclosures for Metering Equipment (Pole Mounted).

The following are members of the team that developed this specification:

Name	Department
Patricia N. Ngaanga	Energy Management
Peter Wanyonyi	Energy Management
Felix Juma Saidi	Energy Management
Rotich Benard	Standards

1. SCOPE

1.1 This specification covers design, manufacture, inspection, testing and delivery of LV Enclosures and Accessories for use in Advanced Metering Infrastructure (AMI) system for large industrial and large commercial customers. These enclosures and accessories are:

a. LV metering enclosures,

b. Isolation circuit breakers,

c. CTs and PTs

d. Hand-held units

e. Associated accessories for metering installations.

1.2 The LV Enclosures and Accessories shall be used in three-phase 400 V whole current and CT connected customers with various CT ratios.

2. REFERENCES (NORMATIVE)

The following standards contain provisions which through reference in this text constitute provisions of this specification. For dated editions, the cited edition shall apply; for undated editions, the latest edition of the referenced document shall apply.

BS EN 10088-2:2014: Stainless steels —Part 2: Technical delivery conditions for sheet/plate and strip of corrosion resisting steels for general purposes

IEC 60529:1989+AMD1:1999+AMD2:2013: Degrees of protection provided by enclosures (IP Code)

IEC TS 60815-1:2008: Selection and dimensioning of high-voltage insulators intended for use in polluted conditions - Part 1: Definitions, information and general principles

IEC 60947-2:2016: Low-voltage switchgear and controlgear - Part 2: Circuit-breakers

IEC 61869-2:2012: Instrument transformers - Part 2: Additional requirements for current transformers

IEC 61869-4:2013: Instrument transformers - Part 4: Additional requirements for combined transformers.

IEC 62208:2011: Empty enclosures for low-voltage switchgear and controlgear assemblies - General requirements

IEC 62262:2002: Degrees of protection provided by enclosures for electrical equipment against external mechanical impacts (IK code)

ISO 1461: Hot dip galvanized coatings on fabricated iron and steel articles — Specifications and test methods

KP1/6C/4/1/TSP/14/020: Current and Potential Transformer Connected Meters — Specification

KP1/6C/4/1/TSP/14/022: Specification for Low Voltage Ring Type Measuring Current Transformer

3. DEFINITIONS AND ABREVIATION

For this specification, the definitions and abbreviations given in the reference standards shall apply. In addition, the following shall also apply:

AMI: Advanced Metering Infrastructure

CTs: Current Transformers

LCD: Liquid Crystal Display

LV: Low Voltage

PTs/VTs: Potential/Voltage Transformers

4. REQUIREMENTS

4.1 Service conditions

The LV Smart Metering Enclosures and Accessories shall be suitable for use outdoors in tropical areas and harsh climatic conditions including areas exposed to:

a) Altitudes of up to 2200m above sea level

b) Humidity of up to 95%

c) Average ambient temperature of +30°C with a minimum of -1°C and a maximum of +40°C, in direct sunlight,

d) Pollution: Design pollution level to be taken as "*Heavy*" (Pollution level III) for inland and "*Very Heavy*" (Pollution level IV) for coastal applications in accordance with IEC 60815.

e) *Isokeraunic* levels of up to 180 thunderstorm days per year.

4.2 LVCT Metering Enclosure

4.2.1 General Requirements

4.2.1.1 The Enclosure shall house the controllable circuit breaker, smart meter, Communication devices, CTs and connection cables.

4.2.1.2 The Enclosure shall be a smart equipment. The data from meter shall be accessed both locally and remotely.

4.2.1.3 The smart meter, controllable circuit breaker, communication devices, CTs and connection cables shall be pre-wired such that the installer shall connect only the supply and load cables at the site the equipment is to be installed.

4.2.2 Technical requirements

4.2.2.1 The meter Enclosure along with the doors shall be fabricated from stainless steel and capable of withstanding mechanical, electrical and thermal stresses as well as the effects of humidity as per IEC 62262.

4.2.2.2 The meter Enclosure shall be made from stainless steel plate of designation 1.4404 (ASTM A240's 316L) as per EN 10088-2 or its equivalent and have adequate mechanical strength to withstand rough handling as may be expected in normal use.

4.2.2.3 The stainless-steel plate of the meter enclosure shall have a minimum thickness of 1 mm.

4.2.2.4 The Enclosure shall be contrasted with a roof tapering down for easy flow of rainwater.

4.2.2.5 The Enclosure shall be constructed to IP65 degree of protection as per IEC 60529 and IEC 62208:2011 standards.

4.2.2.6 The Enclosure shall be constructed to allow adequate dissipation of heat

4.2.2.7 The Enclosure door shall be vandal proof. The Enclosure shall be fixed with inside hinges such that door hinges cannot be removed from outside.

4.2.2.8 The Enclosure shall allow for over 120° (degrees) door opening. The Enclosure shall be easy to operate when the door is opened on hinges. A suitable lever to hold the door in the open position shall be installed.

4.2.2.9 The Enclosure shall be fitted with suitable fixing brackets with provision for pole mounting, free standing on a concrete plinth or wall mounting.

4.2.2.10 The free standing Enclosure shall be suitably designed with 4-member support.

4.2.2.11 The Enclosure shall be equipped with two (2) earth terminals on opposite sides.

4.2.2.12 Stainless steel, brass or hot dipped galvanized (as per ISO 1461) fasteners shall be used for fabricating the cabinet.

4.2.2.13 The Enclosure shall have a provision for locking and sealing, and shall be able to send an alert if opened. The door shall be equipped with pivot, outer lead bonder is unacceptable

4.2.2.14 The copper bus bars in the enclosure/ cabinet shall be arranged so that it is easy to connect incoming & outgoing cables.

4.2.2.15 The busbar installation in the enclosure/cabinet shall always be stable when open/closed and heat stabilized.

4.2.2.16 The antenna of Enclosure shall be extracted through a hole, and be fixed outside the Enclosure.

4.2.2.17 The antenna shall be made from weather resistant materials or protected appropriately.

4.2.2.18 The enclosure shall have up-down structure and left-right structure, and shall be of independent design for up-down/left-right door lock.

4.2.2.19 The Enclosure shall leave enough space to install meters, LV CTs, Controllable breaker, and related equipment. Space between meters and cabinet shall be more than 60mm, space between meters & controlled breaker shall be more than 80mm.

4.2.2.20 The Enclosure shall have a nameplate at the bottom of the front, the nameplate shall be durable and clearly marked with the following details:

a) Manufacturer's name and mark
b) Model
c) Standard of manufacture
d) Date of manufacture.

4.2.2.21 The Enclosure shall have a warning of electrical hazard: HATARI! /DANGER!

4.2.2.22 The cabinet shall have front transparent provision window for viewing the meter LCD display screen.

4.2.2.23 The Enclosure shall have accessories to meet different installation scenarios such as hang, embed, ground and pole.

4.2.2.24 Cabinet and mounting plate shall be with proper install location solution and proper operation space.

4.2.3 **Meter installation**

4.2.3.1 Meters shall be installed conveniently, safely and firmly:

4.2.3.2 Meters shall be installed in the cabinet other than the cabinet door.

4.2.3.3 Meters shall be vertical installed and all the mounting hole shall be fixed by bolting.

4.2.3.4 The mounting hole shall be of threaded hole or other hole type which assure one operator can fix bolt of the cabinet front.

4.2.4 **Current Transformer Installation**

4.2.4.1 One set of current transformers shall be exactly the same i.e. same manufacturer, item type, rated current (voltage), transformation ratio, accuracy class, secondary capacity.

4.2.4.2 The incoming cable polarity of the same stoichiometric point of current (voltage) shall be consistent.

4.2.4.3 Current transformers in the cabinet shall be connected directly to the meter.

4.2.4.4 The CTs shall be supported appropriately.

4.2.4.5 The nameplate of CT shall be visible after installation.

4.2.4.6 The CTs rated current shall be 1.5 times of load current when device is normal running.

4.2.4.7 The CTs to be used in LVCT metering shall meet all requirements in the Kenya Power specification *KP1/6C/4/1/TSP/14/020 – Specification for Low Voltage Ring Type Measuring Current Transformer* (that shall be attached with the tender documents).

4.3 LV Circuit Breaker

4.3.1 The circuit breaker shall comply with IEC 60947-2 standard.

4.3.2 The rated current of circuit breaker shall be configured to be 1.5-2 times of rated capacity.

4.3.3 The circuit breaker shall comprise of two parts i.e. One mechanical breaker and the other part should be operation controlled by meter signal to switch on or off.

4.3.4 The circuit breaker controller shall support both manual and automatic mode

4.4 Hand-Held Unit (HHU)

The hand-held units shall meet the requirements given in the Kenya Power specification *KP1/6C/4/1/TSP/14/020* (that shall be attached with the tender documents).

5. TESTS AND ACCEPTANCE REQUIREMENTS

5.1 The LV metering enclosures and accessories shall be tested and inspected in accordance with the relevant requirements of IEC 60529, IEC 60947-2, IEC 60208 and this specification. It shall be the responsibility of the manufacturer to perform or to have performed all the tests specified.

5.2 The following tests shall be carried out on the LV CBs as per IEC 60947-2:

a) Temperature-rise
b) Tripping limits and characteristics
c) Dielectric properties
d) Operational performance capability
e) Overload performance (where applicable)
f) Short-circuit breaking capacities
g) Short-time withstand current (where applicable)
h) Performance of integrally fused circuit-breakers

6. MARKING AND PACKING

6.1 Marking

6.1.1 In addition to markings required elsewhere in the specification, each enclosure and accessory shall be marked in accordance with the relevant IEC standard and shall include the following:

a) Name of manufacturer and country
b) Type/Model reference number
c) Ratings (voltage, current, insulation, frequency etc.)
d) Serial number
e) Month and year of manufacture
f) The words, "**Property of KPLC.**"

6.1.2 The information in 6.1.1 shall be marked legibly, indelibly and permanently on each component. The marking shall be forged or stamped with a steel die before galvanizing. The marks shall be distinct, durable, and conspicuous.

6.2 Packaging

6.2.1 The enclosures and accessories shall be packed in a manner as to protect it from any damage in transportation and repeated handling.

6.2.2 Each assembly and package of items associated with the enclosures and accessories shall be suitably marked. A packing and parts list shall be provided.

APPENDICES

APPENDIX A: TESTS AND INSPECTION (NORMATIVE)

A.1. The enclosures and accessories for metering shall be inspected and tested in accordance with the requirements of IEC 60529, IEC 60947-2, IEC 62208 and this specification. It shall be the responsibility of the manufacturer to perform or to have performed all the tests specified.

A.2. The enclosures and accessories shall be subject to Factory Acceptance Tests(FATs) at the manufactures' works before dispatch. FATs shall be witnessed by two Engineers appointed by Kenya Power.

A.3. The acceptance of any quantity of assemblies (A.2. above) shall in no way relieve the supplier of his responsibility for meeting all the requirements of this specification and shall not prevent subsequent rejection if such material is later found to be defective.

A.4. Triplicate copies of test reports shall be completed for all enclosures and accessories and submitted to Kenya Power for approval before shipment.

A.5. On receipt of the equipment, Kenya Power shall inspect and may perform or have performed any of the relevant tests to verify compliance with the specification. The manufacturer shall replace without charge to Kenya Power, equipment which upon examination, test or use fail to meet any or all the requirements in the specification.

APPENDIX B: QUALITY MANAGEMENT SYSTEM (NORMATIVE)

B.1. The supplier shall submit a Quality Assurance Plan (QAP) that will be used to ensure that the design, material, workmanship, tests, service capability, maintenance and documentation of the dead-ends 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 9001:2008/2015

B.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 or 2015 certificate, shall be submitted with the tender for evaluation.

B.3. The bidder shall indicate the delivery time of the large power metering enclosures and accessories, manufacturer's monthly and annual production capacity and experience in the production of the type and size of items being offered. A detailed list and contact addresses (including e-mail) of the manufacturer's previous customers outside the country of manufacture for the enclosures and accessories sold in the last five years together with reference letters from four of the customers shall be submitted with the tender for evaluation.

APPENDIX C: TECHNICAL DOCUMENTATION (NORMATIVE)

C.1. The bidder shall submit its tender complete with technical documents required for tender evaluation. The technical documents to be submitted (all in English language) for tender evaluation shall include the following:

a) Detailed hard copy design drawings of the enclosures and accessories done on AutoCAD, detailing dimensions, layout, wiring and schematic. The drawings shall include 3-D views to scale with all dimensions and tolerances;

b) Fully-filled clause by clause Guaranteed Technical Particulars (GTPs)- Appendix D - stamped and signed by the manufacturer.

c) Copies of previous Test Certificates and Test Reports certified by the relevant International or National Testing/ Standards Authority of the country of manufacture or ISO/IEC 17025/ILAC accredited testing laboratory (including certificate of accreditation for laboratory), all in English Language.

d) Copies of the Manufacturer's catalogues, brochures, pictures and technical data;

e) Details of the manufacturer's experience;

f) Packaging details (including packaging materials).

C.2. The successful bidder (supplier) shall submit the following documents/details to The Kenya Power & Lighting Company for approval before manufacture:

a) Detailed hard copy design drawings of the enclosures and accessories done on AutoCAD, detailing dimensions, layout, wiring and schematic. The drawings shall include 3-D views to scale with all dimensions and tolerances;

b) Fully filled clause by clause Guaranteed Technical Particulars (GTPs) stamped and signed by the manufacturer **(these are not the ones submitted with the tender)**:

c) Detailed test Program to be used during factory testing;

d) Marking details and method to be used in marking the equipment;

e) Packaging details (including packaging materials and marking and identification of component packages).

C.3. Copies of Test Reports to be submitted shall include the results of the appropriate type tests made on not less than three items identical in all essential details with those to be supplied.

C.4. Routine and sample test reports for the enclosures and accessories to be supplied shall be submitted to Kenya Power for approval before shipment/delivery of the goods.

APPENDIX D: GUARANTEED TECHNICAL PARTICULARS (GTPS) — NORMATIVE

(to be filled, stamped and signed by the Supplier and submitted together with relevant copies of the Manufacturer's catalogues, brochures, drawings, technical data, sales records for previous five years, four customer reference letters, details of suppliers' capacity and experience; and copies of complete test certificates and test reports for tender evaluation or approval, all in English Language, as per clauses C.1 and C.2)

Tender No. .....

Bidder's name and Address.....

Clause number	KPLC requirement	Bidder's offer
Manufacturer's Name and address		Specify
Country of Manufacture		Specify
Bidder's Name and address		Specify
1.1	Scope of supply	List
1.2	Scenarios that the enclosures are used	List
2.	Applicable Standards	Specify
3.	Definitions and abbreviation	Specify
4.	**REQUIREMENTS**	
4.1	Service Conditions	Specify
4.2	**LVCT Metering Enclosure Requirements**	
4.2.1.1	What the enclosure houses	List
4.2.1.2	Data from meter is accessed both locally and remotely	Specify
4.2.1.3	Enclosure wired such that the installer will connect the supply and load cables only at the site to be installed	State
4.2.2.1	Enclosures along with the doors are fabricated from stainless steel and capable of withstanding mechanical, electrical and thermal stresses	Specify
4.2.2.2	Enclosure's stainless-steel plate material designation and standard	Specify
4.2.2.3	Enclosure plate thickness	Specify
4.2.2.4	Enclosure roofing for easy flow of rainwater	Specify
4.2.2.5	Enclosure protection class as per IEC 60529	Specify
4.2.2.6	Enclosure allows adequate dissipation of heat	Specify
4.2.2.7	Enclosure door hinges cannot be removed from outside	Specify

Clause number	KPLC requirement	Bidder's offer
4.2.2.8	Enclosure allows for over 120 degrees door opening	Specify
4.2.2.9	Enclosure is free standing and suitably designed with 4-member support	Specify
4.2.2.10	Enclosure has provision for pole mounting, free standing on a concrete plinth or wall mounting	Specify
4.2.2.11	Cabinet equipped with earth terminal	Specify
4.2.2.12	Type of screws used	State
4.2.2.13	Enclosure/ cabinet has a provision for sealing and locking	State
4.2.2.14	Copper bus bars in the enclosure are arranged so that it is easy to connect incoming & outgoing cables	State
4.2.2.15	Busbar installation in the Enclosure is always stable when open/closed	State
4.2.2.16	Antenna is fixed outside the Enclosure.	specify
4.2.2.17	Material of the antenna	specify
4.2.2.18	Enclosure is of up-down structure and left-right structure with independent up-down/left-right door lock	State
4.2.2.19	Space between meters and cabinet shall be more than 60mm, space between meters & controlled breaker shall be more than 80mm	State
4.2.2.20	Nameplate details	State
4.2.2.21	Enclosure has a warning of electrical hazard HATARI! /DANGER	State
4.2.2.22	Front window has transparent provision for viewing the meter LCD display screen	specify
4.2.2.23	Enclosure has accessories to meet different installation scenarios	specify
4.2.2.24	Cabinet and mounting plate has proper install location solution and proper operation space	specify
4.2.3.1	Meters are installed conveniently, safely and firmly	specify
4.2.3.2	Meters are installed in the cabinet and not on the door	specify
4.2.3.3	Meters are vertically installed and all the mounting hole fixed by bolting	specify
4.2.3.4	Mounting holes type	specify
4.2.4.1	A set of current transformers are exactly the same	specify
4.2.4.2	Incoming cable polarity of the same stoichiometric point of current (voltage) is consistent	specify
4.2.4.3	Current transformers in the cabinet are connected directly to the meter	specify
4.2.4.4	CTs are supported appropriately	specify
4.2.4.5	Nameplate of the CT is visible after installation	specify
4.2.4.6	CT's rated current is 1.5 times of load current when device is normal	specify

Clause number	KPLC requirement	Bidder's offer
	running	
4.2.4.7	The specification that the CTs for LVCT metering complies to	State
4.3.1	Standard which the circuit breaker complies	specify
4.3.2	Rated current of circuit breaker viz-a-viz rated capacity	State
4.3.3	Two parts of circuit breaker	List
4.3.4	Circuit breaker controller supports both manual and automatic mode	State
4.4	The specification that the hand-held unit complies to	Specify
5.1	Standards for testing and inspecting the metering enclosures and accessories	List
5.2	Tests to be carried out on the LV CBs	List
6.1	**Marking**	
6.1.1	Information to be marked legibly and indelibly:	List
6.1.2	Method of marking	Specify
6.2	**Packing**	
6.2.1	Enclosures and accessories shall be packed in a manner as to protect it from any damage in transportation and repeated handling	Specify
6.2.2	All packing cases shall be marked legibly and correctly	Specify
APPENDICES		
A	**TESTS AND INSPECTION (NORMATIVE)**	
A1	It's the responsibility of the manufacturer to perform tests in accordance with relevant standards	State
A2	KPLC Engineers (2) will witness acceptance tests at the factory	State
A3	Acceptance in A.2. above does not relieve the supplier of his responsibility for meeting all the requirements of this specification	State
A4	Triplicate copies of test reports shall be completed for all enclosures and accessories and submitted to Kenya Power for approval before shipment	specify
A5	Supplier replaces without charge to KPLC, any items which upon examination, test or use fail to meet any or all of the requirements in this specification	State
B	**QUALITY MANAGEMENT SYSTEM (NORMATIVE)**	
B1	QAP	State
B2	Manufacturer's Declaration of Conformity to applicable standards and Copies of quality management certifications attached	State
B3	Delivery time, Production capacity & experience of the manufacturer	State
C	**TECHNICAL DOCUMENTATION (NORMATIVE)**	
C1	Technical documents to be submitted with tender documents	

Clause number	KPLC requirement	Bidder's offer
	a. Detailed hard copy design drawings of the enclosures and accessories done on AutoCAD	state
	b. Fully-filled clause by clause Guaranteed Technical Particulars (GTPs)- Appendix D - stamped and signed by the manufacturer	state
	c. Copies of previous Test Certificates and Test Reports certified by the relevant body	state
	d. Copies of the Manufacturer's catalogues, brochures, pictures and technical data	Specify
	e. Details of the manufacturer's experience	State
	f. Packaging details (including packaging materials).	State
C2	Documents to be submitted for approval before manufacture	
	a. Detailed drawing to scale with all dimensions and tolerances	State
	b. Fully filled clause by clause Guaranteed Technical Particulars (GTPs) stamped and signed by the manufacturer (these are not the ones submitted with the tender);	State
	c. Detailed test Program to be used during factory testing;	State
	d. Marking and packing details	State
C3	Copies of Test Reports to be submitted shall include the results of the appropriate type tests made on not less than three items identical in all essential details with those to be supplied	State
C4	Routine and sample test reports for the metering enclosures to be supplied shall be submitted to KPLC for approval before shipment/delivery of the goods	State

** Words like 'agreed', 'confirmed', 'As per KPLC specifications', etc. shall not be accepted and shall be considered non-responsive.*

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Manufacturer's Name, Signature, Stamp and Date