



TITLE:
SPECIFICATION FOR DISTRIBUTION TRANSFORMER Part 1: Pole Mounted Single Phase Oil Type Distribution Transformer

Doc. No.	KP1/3CB/TSP/10/001-01
Issue No.	2
Revision No.	0
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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, customer reference letters, details of manufacturing capacity, the manufacturer's experience and copies of type test certificates and type test reports for tender evaluation, all in English Language)*

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0.1 Circulation List

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1	Research & Development Manager
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3	Technical Services Manager
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0.2 Amendment Record

Rev No.	Date (YYYY-MM-DD)	Description of Change	Prepared by (Name & Signature)	Approved by (Name & Signature)
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FOREWORD

This specification has been prepared by the Research and Development Department in collaboration with the Technical Services Department both of the Kenya Power & Lighting Company Ltd (Kenya Power) and it lays down requirements for pole mounted single phase oil type distribution transformers. The specification is intended for use by Kenya Power in purchasing the transformers.

It is expected that manufacturers will provide energy efficient standard design transformers that will provide high level of efficiency and significant initial cost saving. The manufacturer shall also submit information which demonstrates satisfactory service experience with products which fall within the scope of this specification.

1. SCOPE

This specification is for newly manufactured oil-immersed, air-cooled, outdoor type pole mounted single phase distribution transformers for 11kV and 33kV distribution systems operated at 50 Hz.

The specification covers transformers of the following voltage ratios and ratings:

- 11000V/250V: 5 KVA, 15 KVA and 25 KVA.
- 33000V/250V: 25 KVA.

The specification also covers inspection and test of the 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 (including features to deter vandalism) for pole mounted single phase distribution transformers acceptable for use in the company (Kenya Power) and it shall be the responsibility of the Manufacturer to ensure adequacy of the design, good workmanship and good engineering practice in the manufacture of the transformers for Kenya Power.

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.

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

IEC 60076: Power transformers, **all parts**

IEC 60296: Specification for unused mineral insulating oil for transformers and switchgear.

IEC 60214: Tap-changers - Part 1: Performance requirements and test methods, Part 2: Application guide

IEC 60512: Connectors for electronic equipment

BS 381C: Specification for colours for identification coding and special purposes

3. TERMS AND DEFINITIONS

The terms and definitions given in the reference standards shall apply.

4. REQUIREMENTS

4.1 Service Conditions

4.1.1 Operating conditions

The transformer shall be suitable for continuous outdoor operation in tropical areas with the following conditions.

- (a) Altitude: upto 2,200 metres above sea level.
- (b) Temperature: average of +30°C with a minimum of -1°C and max +40 °C
- (c) Humidity: up to 95%,
- (d) Pollution: Design pollution level to be taken as "Heavy" (Pollution level III) according to IEC 815.
- (e) Isokeraunic level: 180 thunderstorm days per year

4.1.2 System characteristics

4.1.2.1 The transformer will be connected to overhead system which is of unearthed construction (i.e. without continuous aerial earth wire).

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4.1.2.2 The primary system is having a nominal voltage of 11000 volts and 33000 volts and system highest voltage of 12000 volts and 36000 volts respectively. The primary system is 2-wire 50 Hz and the secondary is 250 volts single phase 2-wire.

4.1.2.3 The Transformer shall be operated at a high loading factor. Loading shall be as per IEC 60076.

4.2 General Requirements

4.2.1 The transformer shall be outdoor, oil-immersed, of ONAN classification and core type or shell type (lamination stackings / wound core). All offers shall comply with the requirements of IEC 60076. Any deviations /additional requirements shall be as stated in this specification.

4.2.2 The transformer shall be a two winding type single-phase integral unit.

4.2.3 The transformer shall be hermetically sealed type with gas cushion of 60mm filled with dry air and bolted top cover.

4.2.4 The transformer and accessories shall be designed to facilitate operation, inspection, maintenance and repairs. All apparatus shall be designed to 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.

4.2.5 The design shall incorporate every reasonable precaution and provision for the safety of all those concerned in the operation and maintenance of the equipment keeping in view the regulatory requirements in Kenya.

4.2.6 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.

4.2.7 Corresponding parts liable to be replaced shall be interchangeable.

4.2.8 The design of fittings and accessories shall not allow for siphoning of oil by vandals. All fittings and accessories shall be secured -from the inside of the transformer and or have small openings that do not allow for oil siphoning.

4.2.9 All parts of the transformer, including bushings insulators with their mountings, shall be designed so as to avoid pockets in which water can collect. Rain water shall not collect

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anywhere on the top cover and gaskets shall be concealed by bent in the top cover of 90°.

4.2.10 All connections and contacts shall be of ample section and surface for carrying continuously the specified currents without undue heating and fixed connections shall be secured by bolts or set screws of ample size, adequately locked. Lock nuts shall be used on stud connections carrying current. All leads from the winding to the terminals and bushings shall be adequately supported to prevent injury from vibration including a systematical pull under short circuit conditions.

4.2.11 The transformer shall be designed to minimize the risk or accidental short-circuit caused by animals, birds or vermin.

4.2.12 The design and all materials and processes used in the manufacture of the transformer, shall be such as to reduce to a minimum the risk of the development of acidity in the oil.

4.2.13 Every care shall be taken to ensure that the design and manufacture of the transformers shall be such as to have minimum noise and vibration levels following good modern manufacturing practices. The maximum noise levels shall be in accordance to **NEMA Tr.1** standards and guaranteed values shall be stated in the bid.

4.2.14 Each transformer shall be suitable for single pole mounting. It shall be round tank design complete with pole mounting brackets for use on round concrete and wooden poles.

4.2.15 Drawings and documentation for each size of transformer offered shall be submitted with the tender, clearly detailing important dimensions, clearances, accessories, fittings and the features of the offered design that make it impossible for vandals to siphon oil from the transformer even after forceful breakage of accessory/fitting.

4.2.16 Design drawings (by the manufacturer) complete with manufacturer's technical specifications shall be submitted to Kenya Power for approval before manufacture. The design drawings shall be detailed and shall include the following:

- Overall dimensions of the transformer and relevant electrical clearances. This shall include all perspectives and respective weights of oil, core steel, copper/aluminium, paper and steel tank/core clamp structure.
- Core/coil/insulation dimensions, clearances and stacking/coil winding sequence detail.
- Drawing of nameplate to scale.
- Dimensional drawing of bushings, tap-changer and clamps.

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- e) Legend for all technical engineering drawings with manufacturer name, logo, model number, revision/drawing number and key
- f) Detailed drawing of surge arrestor mounting and constituent parts.
- g) All design drawings MUST BE stamped and signed by the manufacturer.

4.3 Ratings

4.3.1 The transformers shall be of the following ratings:

- (a) 11000V/250V: 5 KVA, 15 KVA and 25 KVA
- (b) 33000V/250V: 25 KVA.

4.3.2 (a) The transformer shall be capable of carrying its full normal rating continuously at any tap under the conditions stated in clause 4.1 without undue stress, overheating, or the temperature rise in the hottest region exceeding 55°C and 60°C in oil and windings respectively.

(b) The loading capabilities shall be demonstrated by a temperature rise test. This test shall be done in the presence of Kenya Power Representatives during factory acceptance testing.

4.3.3 The transformer shall be capable of withstanding the maximum fault level at its rated voltage and impedance for 2 seconds. The design should cater for the expected lifetime of the transformer.

4.3.4 The thermal ability to withstand short circuit shall be demonstrated by calculation as per IEC 60076-5 and the calculation shall be submitted with the tender. The duration of the current to be used for the calculation of the thermal ability to withstand short circuit shall be 2 seconds while the maximum permissible value of the average temperature of each winding shall be as per IEC 60076-5. As a minimum, the short-circuit apparent power of 11kV and 33kV systems shall be taken as 500MVA and 1000MVA respectively (as per IEC 60076-5) in order to obtain the value of the symmetrical short circuit current to be used for the design and tests.

4.3.5 The ability of the transformer to withstand the dynamic effects of short circuit shall be demonstrated by tests and complete test reports (including oscillograms and records of the condition of the transformer before and after the short-circuit test) shall be submitted for tender evaluation.

4.4 Winding and Connections

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