



**TRANSNET**  
freight rail

## TECHNOLOGY MANAGEMENT

### SPECIFICATION

# MEDIUM VOLTAGE DISTRIBUTION AND SUPPLY TRANSFORMERS IN ACCORDANCE WITH SANS 780. (For nominal system voltages up to 33 kV)

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## 1.0 SCOPE

- 1.1 This specification covers Transnet freight rail's requirements for single phase and three phase oil immersed type distribution and supply transformers for indoor or outdoor use in accordance with SANS 780.

## 2.0 BACKGROUND

- 2.1 Distribution and supply transformers are used on Transnet freight rail for the following applications:

- Supply transformers are used as step down transformers for power distribution of the 11kV and 6,6 kV Transnet freight rail reticulation systems and the 11 kV and 6,6 kV transmission line network.
- Distributions transformers are used as step down transformers for the provision of power at a required voltage.
- Distribution transformers are also used on the 11 kV and 6,6 kV transmission line system for step down supply points to signals relay rooms and for auxiliary supplies to traction substations etc.

## 3.0 STANDARDS AND PUBLICATIONS

The transformer shall comply with all relevant requirements of the latest edition of the specifications as listed in SANS 780.

### 3.1 SOUTH AFRICAN NATIONAL STANDARDS

SANS 121	Hot-dip Galvanized coatings for fabricated iron or steel articles.
SANS 780	Distribution Transformer.
SANS 1091	National colour standard.
SANS 9001	Quality Management systems – Requirements.

### 3.2 TRANSNET FREIGHT RAIL

CEE.0224.	Drawings, Catalogues, Instruction Manuals and Spares lists for Electrical Equipment supplied under contract.
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## 4.0 APPENDICES

The following appendices form an integral part of this specification:

Appendix 1:	Schedule of requirements.
Appendix 2:	Information provided by the tenderers.

## 5.0 TENDERING PROCEDURE

- 5.1 Tenderers shall indicate clause by clause compliance with the specification. This shall take the form of a separate document listing all the specifications clause numbers indicating the individual statement of compliance or non-compliance.
- 5.2 A statement of non-compliance shall be motivated by the tenderer.
- 5.3 Tenderers shall complete Appendix B. "Information to be provided by tenderers."
- 5.4 Tenderers shall submit descriptive literature consisting of detailed technical specifications, general constructional details and principal dimensions, together with clear illustrations of the equipment offered.
- 5.5 Failure to comply with clauses 5.1, 5.2, 5.3 and 5.4 could preclude a tender from consideration.

**6.0 SERVICE CONDITIONS.**

The transformers shall be designed to operate under the following conditions.

**6.1 ATMOSPHERIC CONDITIONS**

Altitude:	0 to 1800m above sea level.
Ambient temperature:	-5°C to +45 °C.
Relative humidity:	10% to 90%.
Lightning Conditions:	12 ground flashes per square kilometre per annum.
Pollution:	Heavily salt laden or polluted with smoke from industrial sources.

**6.2 ELECTRICAL CONDITIONS**

Frequency:	The AC high voltage supply will normally be supplied by Eskom. The frequency will be $50 \pm 2.5$ Hz.
Harmonics:	For the supply transformers installed at the traction substations to supply power to the 11 kV and 6,6 kV transmission lines systems, it can be expected that the low voltage winding of such transformers shall be subjected to the total voltage harmonic distortion of up to 27%. Distribution transformers that are used for step down points on the 11 kV and 6,6 kV transmission line systems to step down voltages to 400 V/ 230 V for signal relay rooms, auxiliary supplies to traction substations or any other application shall be subjected to the total voltage harmonic distortion of up to 27%.
No of Phases:	Three phase systems.

**7.0 TECHNICAL REQUIREMENTS****7.1 CONSTRUCTIONAL REQUIREMENTS**

7.1.1 The "schedule of requirements" Appendix 1 shall determine the constructural requirement of the transformers.

**7.2 PAINTING AND CORROSIVE PROTECTION.**

- 7.2.1 The corrosion protection and coatings both interior and external surfaces shall be in accordance with Clause 4.17 of SANS 780 and shall be suitable for coastal and heavily polluted conditions.
- 7.2.2 The transformer radiators shall be hot dipped galvanized in accordance with SANS 121 for coastal and heavily polluted conditions and be painted.
- 7.2.3 Internal surfaces of the conservator tank above oil level including the tank shall be protected from corrosion by varnishing, priming or painting as specified in clause 4.17.2 for coatings of interior services of SANS 780.
- 7.2.4 The conservator tank where required shall be painted white.
- 7.2.5 The finished external coats of paint of the transformer tank shall match the colour G12 for grey as specified in SANS 1091.

**8.0 DRAWINGS AND MAINTENANCE MANUALS**

8.1 Drawings, instruction manuals and spares lists shall be supplied in accordance with Transnet freight rail's specification CEE.0224.

8.2 Three copies of each of the following drawings shall be submitted to the responsible project manager for approval within 7 days of the order being placed.

8.2.1 Dimension drawings showing external arrangements of transformer.

8.2.2 External wiring diagrams for the transformer.

8.2.3 Vector diagram and rating plate.

## 9.0 INSPECTION AND TESTS

9.1 Transnet freight rail reserves the right to carry out inspection and any tests on the equipment at the works of the supplier/ manufacturer.

9.2 Arrangements must be made timeously with the Senior Engineer, Technology Management for inspections and tests prior to delivery.

9.3 All routine tests shall be carried out in accordance to SANS 780.

9.4 These tests shall be carried out at the manufacturers premises and shall be witnessed by Transnet freight rail's Quality Assurance staff.

9.5 Type test certificates for the same type of transformers with the validity of five years or less must be made available.

## 10.0 QUALITY ASSURANCE

10.1 The supplier must indicate what steps have been taken to implement a quality assurance system in terms of SANS 9001.

## 11.0 GUARANTEE AND DEFECTS

11.1 The contractor shall guarantee the transformer and accept liability for maker's defects, which may appear in design, materials and workmanship.

11.2 The guarantee period for the transformer shall expire after a period of 12 months commencing on the date of commissioning of the equipment.

END

## APPENDIX 1

**SCHEDULE OF REQUIREMENTS**  
(To be completed by client)

**SYSTEM DETAIL**

- 1.0 Transformer required for: \_\_\_\_\_ substation/location
- 2.0 Nominal system voltage: \_\_\_\_\_ kV
- 3.0 Number of phases: \_\_\_\_\_
- 4.0 Frequency: \_\_\_\_\_ Hz
- 5.0 Neutral point effectively earthed: \_\_\_\_\_ Yes/No

**TRANSFORMER DETAIL**

- 1.0 Type of transformer: Outdoor: \_\_\_\_\_ Indoor: \_\_\_\_\_
- 2.0 Number of phases: Single phase: \_\_\_\_\_ Three phase: \_\_\_\_\_
- 3.0 Rated power: \_\_\_\_\_ kVA
- 4.0 Impedance percentage %: \_\_\_\_\_
- 5.0 Primary voltage rating: \_\_\_\_\_ kV
- 6.0 Secondary voltage rating: \_\_\_\_\_ kV
- 7.0 Vector group: \_\_\_\_\_

**TANK TYPE**

- 1.0 Free-breathing \_\_\_\_\_ Yes/No
- 2.0 Sealed (Transformer main tank cover joint shall be welded) \_\_\_\_\_ Yes/No

**FITTINGS REQUIRED**

- 1.0 Conservator with oil level indication. \_\_\_\_\_ Yes/No
- 2.0 Silica gel breather \_\_\_\_\_ Yes/No
- 3.0 Gas and oil actuating relay with test and sample valves \_\_\_\_\_ Yes/No
- 4.0 Main tank drain valve \_\_\_\_\_ Yes/No
- 5.0 Indicating thermometer \_\_\_\_\_
- 5.1 Oil temperature \_\_\_\_\_ Yes/No
- 5.2 Winding temperature indication \_\_\_\_\_ Yes/No
- 6.0 Radiators. \_\_\_\_\_ Yes/No
- 7.0 Auxiliary wiring terminal box \_\_\_\_\_ Yes/No
- 8.0 Neutral current transformer required \_\_\_\_\_ Yes/No
- 8.1 Ratio: \_\_\_\_\_

- 8.2 Class: \_\_\_\_\_
- 8.3 VA Rating: \_\_\_\_\_
- 9.0 Off circuit tap switch required Yes/No
- 9.1 Number of tap positions: \_\_\_\_\_
- 10.0 Bushings required: Outdoor: \_\_\_\_\_ Indoor: \_\_\_\_\_
  - High voltage side Yes/No
  - Low voltage side Yes/No
- 11.0 Cable box required Yes/No
  - Number and types of cables per phase
  - High voltage side: \_\_\_\_\_
  - Low voltage side: \_\_\_\_\_
- 12.0 Neutral required
  - High voltage side Yes/No
  - Low voltage side Yes/No
  - Number and types of cables per neutral: \_\_\_\_\_
- 13.0 Mountings
  - 13.1 Pole mounting Yes/No
  - 13.2 Platform mounting Yes/No
  - 13.3 Flat underbase Yes/No
  - 13.4 Skid underbase Yes/No
  - 13.5 Wheels and axles Yes/No
  - 13.6 Lifting lugs Yes/No
  - 13.7 Jacking pads Yes/No
- 14.0 Dimensions (if critical)
  - Length: \_\_\_\_\_ mm. Breadth: \_\_\_\_\_ mm. Height: \_\_\_\_\_ mm
- 15.0 Special requirements: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

END

**APPENDIX 2**

**INFORMATION TO BE PROVIDED BY TENDERERS**

**1.0 GENERAL**

1.1 Manufacturers name: \_\_\_\_\_

**2.0 TRANSFORMER DETAIL**

1.0 Type of transformer: Outdoor: \_\_\_\_\_ Indoor: \_\_\_\_\_

2.0 Number of phases: Single phase: \_\_\_\_\_ Three phase: \_\_\_\_\_

3.0 Rated power: \_\_\_\_\_ kVA

4.0 Impedance (percentage) %: \_\_\_\_\_

5.0 Primary voltage rating: \_\_\_\_\_ kV

6.0 Secondary voltage rating: \_\_\_\_\_ kV

7.0 Tapping Switch.

No of positions: \_\_\_\_\_ %Steps: \_\_\_\_\_

8.0 Vector group: \_\_\_\_\_

9.0 Free Breathing Yes/No

10.0 Sealed Yes/No

11.0 Welded cover Yes/No

12.0 Method of Cooling: \_\_\_\_\_

13.0 Overall dimensions: Length \_\_\_\_\_ mm. Breadth \_\_\_\_\_ mm. Height \_\_\_\_\_ mm

14.0 Winding material: HV \_\_\_\_\_ LV \_\_\_\_\_

15.0 Mass of core and windings: \_\_\_\_\_ kg

16.0 Oil capacity: \_\_\_\_\_ (Litres)

17.0 Mass of transformer complete with oil: \_\_\_\_\_ kg

18.0 HV end turns insulation reinforced Yes/No

19.0 Type of breather and dehydrating agent: \_\_\_\_\_

20.0 The following information refers to the transformer when connected on the principal tapping and appropriate reference temperature for the class of insulation used.

20.1 Iron loss (Watts): \_\_\_\_\_

20.2 Copper loss at full load: \_\_\_\_\_ at \_\_\_\_\_ °C

20.3 Total load losses (Watts): \_\_\_\_\_ at \_\_\_\_\_ °C

20.4 Impedance at full load (percentage) \_\_\_\_\_ Z \_\_\_\_\_ X

20.5 Regulation at full load at: 1.0 PF \_\_\_\_\_ Percent, 0.8 PF \_\_\_\_\_ Percent at \_\_\_\_\_ °C



20.6 Efficiency at full load at: 1.0 PF \_\_\_\_\_ Percent, 0.8 PF \_\_\_\_\_ Percent at \_\_\_\_\_ °C

20.7 Temperature rise at rated voltage and power of:

Windings: \_\_\_\_\_ °C

Top oil: \_\_\_\_\_ °C

END

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