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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- Technology Management

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DOCUMENT HISTORY:

BBB 8402: MEDIUM VOLTAGE DISTRIBUTION AND SUPPLY TRANSFORMERS IN ACCORDANCE WITH SANS 780.

(For nominal system voltages up to 33 kV)

Dates Amended	Author	Version	Amendments
29/04/2008	D O Schulz	2	Old specification
10/11/2016	L Makhathini	3	• Standards and publications • Constructional Requirement has been added • Rating Plate has been added
06/06/2018	L Makhathini	4	On appendix 1 and 2, the Yes/no: has been confusing on selection. It has been changed to yes ☐ no ☐ To tick in the correct box

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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.
BBB 8205	High voltage supply transformers in accordance with IEC 60076 AND BS 171. (For nominal system voltages 33 kV up to 132 kV)

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 ± 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 / Single phase

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.

7.1.2 The tap changing gear shall be externally, manually operated, positively locking, off load type. The arrangement shall be such that excessive backlash will not affect the making of proper contact when the tap changing gear is operated in either direction. Rotary type having high-pressure type contacts shall be used.

7.1.3 Single phase winding connection with 100%, 102.5%, 105% must have external tapping bushing to SANS 780.

7.1.4 The transformer main tank cover joint shall be welded.

7.1.5 The welded joint shall be designed to permit removal of the weld with minimum damage to the mating flanges so that they will be suitable for re-welding.

7.1.6 The tank cover of large transformers shall be fitted with handles or lifting lugs (200kVA and higher)

7.1.7 Where drain valves are fitted on the transformer, it shall be steel fittings and not brass. The drain valves shall be lockable.

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.

7.3 RATING PLATE

A non—corrosive metal plate shall be fixed to each transformer tank (not cooling tubes), giving the following information:

- Maker's name
- Maker's serial No.
- Transnet freight rail's serial No. (Left blank)
- Rated output in MVA
- Frequency
- Secondary voltage and current
- Primary voltage and current
- Primary voltage tappings
- Transformer reactance (%)
- Transformer impedance (%)
- Vector diagram
- Diagram of connections
- Quantity of oil in litres
- Conservator fitted with bag.
- Total mass of transformer inclusive of oil in kg
- Transport mass of transformer in kg.
- Year of manufacture

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 (depot)) (tick in the correct box)

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	

6.0

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 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 CT Ratio: _____

8.2 CT Class: _____

8.3 CT Rating VA: _____

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 under base	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: _____

_____

_____

_____

INFORMATION TO BE PROVIDED BY TENDERERS

(Tick in the correct box)

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