



A Division of Transnet SOC Limited

TECHNOLOGY MANAGEMENT

SPECIFICATION

OUTDOOR, HIGH VOLTAGE, ALTERNATING CURRENT DISCONNECTORS COMBINED WITH EARTHING SWITCHES

Author:	Chief Engineering Technician Technology Management	B.L Ngobeni
Approved:	Senior Engineer Technology Management	S. Smit
Authorised:	Chief Engineer Technology Management	N. Gobhozi

Date: 07 November 2021

Circulation Restricted To:

Transnet and Relevant Third Parties

"I acknowledge that this document contains personal information as defined in the Protection of Personal Information Act, 2013 (the "Act"). By accessing/using this document, I consent to the processing of personal information in accordance with the requirements of the Act. Personal information contained herein will only be used for purposes of this document."

© This document as a whole is protected by copyright. The information herein is the sole property of Transnet SOC Ltd. It may not be used, disclosed or reproduced in part or in whole in any manner whatsoever, except with the written permission of and in a manner permitted by the proprietors.

LIST OF AMENDMENTS TO THE SPECIFICATION

Version No.	Date Issued	Clause No.	Page No.	Remarks
1	18 th Oct 2004	All	All	Original Document.
2	2021	All	All	Document template changed.
				All the Clauses re-arranged and background added.

TABLE OF CONTENTS

1.0	SCOPE.....	4
2.0	BACKGROUND	4
3.0	NORMATIVE REFERENCES	4
3.1	ISO STANDARD:.....	4
3.2	SANS STANDARD:	4
3.3	TRANSNET'S PUBLICATIONS	4
4.0	SERVICE CONDITIONS	5
4.1	ENVIRONMENTAL CONDITIONS.....	5
4.2	MECHANICAL SERVICE CONDITIONS	5
4.3	ELECTRICAL SERVICE CONDITIONS.....	5
5.0	TECHNICAL REQUIREMENTS.....	5
6.0	TESTING AND INSPECTIONS	7
7.0	RATING PLATE AND INSTRUCTION LABELS.....	7
8.0	DOCUMENTATION REQUIREMENTS.....	7
9.0	QUALITY ASSURANCE	7
10.0	PACKAGING, STORAGE AND HANDLING	7
11.0	GUARANTEE AND DEFECTS	8
12.0	METHOD OF TENDERING	8
	APPENDIX A: SCHEDULE OF REQUIREMENTS.....	9
	ANNEXURE B: TECHNICAL DATA SHEET	10

1.0 SCOPE

- 1.1 This specification details Transnet's requirements for the supply of outdoor, 2 or 3 phase, 50 hertz AC disconnects combined with automatic earthing switches for high voltage supplies.
- 1.2 Equipment is required for installation at the end of overhead transmission lines to control the power supply to traction substations and step- down points and shall consist of a 2 pole for 25kV AC or 3 pole for 3kV DC substations. Disconnects to be connected to the line and provided with facilities to earth the "load" side of the circuit.
- 1.3 This specification contains schedule of requirements (Appendix A) which must be completed by the relevant Transnet Representative.
- 1.4 This specification contains technical datasheet (Annexure B) which must be completed by the tenderer and must be submitted as part of the tender documents.

2.0 BACKGROUND

- 2.1 Traction substations are supplied via transmission lines from Eskom and in some areas, the local municipality. The supply point is connected to the high voltage yard of Transnet traction substations via AC disconnecting switches.

AC disconnect switches are used for isolating the Eskom/Municipal supply from the traction substation in order to conduct maintenance on the load side. This AC disconnects are electrical interlocked with primary circuit breakers and are provided with automatic earthing contacts blades that operate during opening. AC disconnects should be operated under no-load (off-load) condition.

3.0 NORMATIVE REFERENCES

Unless otherwise specified all materials used, equipment developed and supplied shall comply with the latest edition of the relevant International Organization for Standardization (ISO), South African National Standards (SANS) or Transnet publications.

3.1 ISO STANDARD:

- 3.1.1 ISO 9001 Quality Management systems.

3.2 SANS STANDARD:

- | | |
|-----------------|--|
| SANS 121: | Hot dip galvanized coatings on fabricated iron and steel articles. |
| SANS 10280: | Overhead power lines for conditions prevailing in South Africa
Part 1: Safety. |
| SANS 60273: | Characteristics of indoor and outdoor post insulators for systems with nominal voltages greater than 1000 V. |
| SANS 60529: | Degrees of protection provided by enclosures (IP Code). |
| SANS 60815: | Selection and dimensioning of high-voltage insulators intended for use in polluted conditions. |
| SANS 62271-102: | High voltage switchgear and controlgear part 102: Alternating Current disconnectors and earthing switches. |

3.3 TRANSNET'S PUBLICATIONS

- | | |
|-----------|--|
| BBF3690 | Electrical Safety Instructions. |
| CEE.0224: | Drawings, catalogues, instruction manuals, spares list for electrical equipment supplied under contract. |

4.0 SERVICE CONDITIONS

4.1 ENVIRONMENTAL CONDITIONS

Altitude:	0 - 1800 m above sea level
Relative humidity:	10% to 90%
Ambient temperature:	-10° C to +55°C
Wind pressure:	750 Pa
Lightning conditions:	20 ground flashes/km ² per annum
Pollution:	Heavily salt laden with industrial pollutants including diesel- electric locomotive emissions.

4.2 MECHANICAL SERVICE CONDITIONS

- 4.2.1 Traction substations are situated next to railway lines and the equipment will therefore be subjected to vibration. The design must take appropriate counter measures to ensure reliability of equipment that is sensitive to vibration.

4.3 ELECTRICAL SERVICE CONDITIONS

- 4.3.1 The incoming high voltage supply to the traction substations shall be 44/66/88/132KV or 220kV AC depending on the electrical supply from Eskom and Municipality at a frequency of 50 ± 2.5 Hz.
- 4.3.2 The AC supply voltage can vary within $\pm 5\%$ of the nominal system r.m.s voltage. Under crippled conditions the supply voltage can drop to as low as minus 15% of the nominal r.m.s voltage.

5.0 TECHNICAL REQUIREMENTS

5.1 DISCONNECTS COMBINED WITH EARTHING SWITCHES

- 5.1.1 The combined disconnectors and earthing switches shall be designed, manufactured and tested in accordance with SANS 62271-102.
- 5.1.2 Disconnectors and earthing switches shall have been type tested to verify performance and safety. Proof of these tests in the form of type test certificates shall be included in the tender documents.
- 5.1.3 The disconnectors shall be provided with a means for earthing the "load" side of the circuit, either by means of a separate earthing switch interlocked with its operating mechanism or contacts so placed that when the disconnect is in the "open" position, the "load" side is earthed.
- 5.1.4 The disconnectors shall be of the air-break type with the blades operating in a horizontal plane.
- 5.1.5 The operation mechanism of the disconnectors shall either be manual for DC traction substations or motor operated for AC traction substations.
- 5.1.6 The operating mechanism shall be constructed of anti-corrosive material to prevent sticking due to rust. All ferrous material shall be galvanised.
- 5.1.7 The operating handle shall be provided with suitable attachments to enable it to be locked in the up (closed) position and in the down (open and earthed) position by standard locks, supplied by Transnet maintenance manager (Electrical).
- 5.1.8 The operating assembly shall be fixed at a satisfactory operating height of approximately 1m from the bottom of the structure.

- 5.1.9 A mechanism shall be provided to mechanically (Only required for DC subs) and electrically interlock (All substations) the operating handle with the associated primary circuit breaker to ensure that operation is only possible when the circuit breaker is in the "open" position. It must, however be possible to close the primary circuit breaker when the earthing switch is in the "earthed" position.
- 5.1.10 Electrical contacts shall be fitted to interlock the operating handle with the associated primary circuit breaker. In the event of accidental operation or movement of the operating handle the primary circuit breaker shall be tripped before the main contacts of the AC disconnects start opening.
- 5.1.11 A notice with the following inscription shall be mounted next to the operating mechanism:
"DO NOT OPERATE UNDER LOAD".
- 5.1.12 For disconnectors operated only by motor operating mechanism in AC traction substations, the motor shall be able to be operated by supply voltage of 48/110V DC from the substation batteries.
- 5.1.12.1 The motor shall be easy to operate, light in weight and able to be housed in a compact enclosure.
- 5.1.12.2 The motor shall be energy efficient and able to be operated for several times without draining the existing battery supply power.
- 5.1.12.3 The complete unit shall able to perform interlocking functions and be manual operated.
- 5.1.12.4 The motor enclosure shall have a protection degree of IP65 in accordance to SANS 60529.

5.2 SUPPORT STRUCTURES

- 5.2.1 The combined AC disconnects and earthing switches shall be rigidly mounted on robust, hot-dipped galvanised supporting steel structures or pedestals in accordance with SANS 121.
- 5.2.2 The supporting steel structures or pedestals shall provide a minimum clearance of 3,6 metres (up to 88 kV) or 4,1 metres (above 88 kV) from the lowest "live" high voltage connection to finished yard level. Outline drawings submitted with tenders must indicate the actual clearances proposed.

5.3 CONNECTIONS

- 5.3.1 All high voltage connections must be of the solderless, concentric grip, or other approved solderless type, and must be of adequate cross-sectional area to suit both electrical and mechanical requirements. All connections to the disconnects must be flexible so as not to affect smooth operation of the blade mechanism.

5.4 POST INSULATORS

- 5.4.1 All post insulators shall be designed, manufactured and tested in accordance with SANS 60273.
- 5.4.2 Creepage distances for heavy polluted atmospheres shall be in accordance with SANS 60815

5.5 CLEARANCES

- 5.5.1 The following minimum safety clearances shall be maintained between any live conductor and earthed metal as stated in SANS 10280: -

Table 1: Safety clearances

Nominal phase to phase r.m.s system voltage	44kV	66kV	88kV	132kV	220kV
Highest phase-to-phase r.m.s voltage for equipment.	48kV	72kV	100kV	145kV	245kV
Safety clearance	540mm	770mm	1000mm	1450mm	2100mm

6.0 TESTING AND INSPECTIONS

- 6.1 The tests shall be done in accordance with SANS 62271-102.
- 6.2 Transnet reserves the right to be present at all tests and inspections as called for in this clause.
- 6.3 The responsibility of arranging the tests called for in this clause rests with the successful tenderer.
- 6.4 Transnet reserves the right by prior arrangement to inspect the equipment at any stage during manufacture.
- 6.5 A Transnet Freight Rail, Technology Management (Electrical Technology) department representative may request any additional test deemed necessary to ensure compliance.

7.0 RATING PLATE AND INSTRUCTION LABELS

- 7.1 All nameplates and labels shall be in English.
- 7.2 Screws or rivets shall fix labels other than interchangeable labels.
- 7.3 All labels shall be made of composite sandwich type plastic material of the following colour combinations:
 - 7.3.1 Identification labels: White lettering on Black background. Letters must be of sufficient size to be clearly legible from a distance of 3m.
 - 7.3.2 Danger labels: White lettering on Red background. Letters must be of sufficient size to be clearly legible from a distance of 3m.
- 7.4 The following is the list of labels to be used:
 - On (1)
 - Off (0)
 - Open (Verb.)
 - Close (Verb.)

8.0 DOCUMENTATION REQUIREMENTS

- 8.1 The following technical documentations shall be submitted with tender:
 - 8.1.1 One hard copy of the technical specification and detailed drawings.
 - 8.1.2 One hard copy of the method of installation.
 - 8.1.3 One hard copy of maintenance manual.
 - 8.1.4 One hard copy of design and type test certificates to verify conformance to the requirements.
- 8.2 Supplier shall advise on how to dispose the equipment at the end of its operating life, taking into consideration environmental requirements and regulations.

9.0 QUALITY ASSURANCE

- 9.1 The successful tenderer shall maintain a Quality Management System (QMS) based on or certified to ISO 9001.

10.0 PACKAGING, STORAGE AND HANDLING

- 10.1 The equipment shall be packed in such a manner that it will be adequately protected during handling and transportation.

11.0 GUARANTEE AND DEFECTS

- 11.1 The appointed tenderer shall guarantee that the supplied AC disconnects with earthing switch conforms to Transnet's requirements.
- 11.2 The appointed tenderer shall accept liability for makers' defects, which may appear in design, material and workmanship.
- 11.3 The appointed tenderer shall provide all information regarding guarantees and warranties in writing

12.0 METHOD OF TENDERING

- 12.1 Tenderers shall indicate clause-by-clause compliance document with the specification. This shall take the form of a separate document listing each of the specification's clause and sub-clause numbers, indicating the individual statements of compliance or non-compliance.
- 12.2 The tenderer shall motivate statement of non-compliance, as per 12.1.
- 12.3 Tenderers shall submit comprehensive literature consisting of detailed technical specifications, general constructional details and principal dimensions, maintenance schedules, datasheets, together with clear illustrations of the equipment offered.
- 12.4 Any items offered in accordance with other standards will be considered at the sole discretion of Transnet. The tenderer shall supply full details stating where the item differs from these specifications as well as supplying a copy (in English) of the recognized standard specification(s) with which it complies. Any deviations must be approved by Transnet Freight Rail, Technology Management (Electrical Technology) department in writing.
- 12.5 Failure to comply with clauses 12.1, 12.2, 12.3 and 12.4 could preclude a tenderer from consideration.
- 12.6 In the event of any conflict between the various submitted relevant documents, the order of precedence shall be, and in consultation with Transnet Freight Rail, Technology Management (Electrical Technology) department:
 - a) Legal and safety requirements.
 - b) This Specification.

END

APPENDIX A: SCHEDULE OF REQUIREMENTS

(To be completed by Transnet Representative)

- 1.0 Required for..... (AC/DC) traction substation
- 2.0 Number of sets required.....
- 3.0 Supply system Voltage:..... kV, 50 Hz, (3 phase/2 phase)

AC DISCONNECTS WITH EARTHING SWITCH

- 4.0 Rated voltage:.....kV
- 5.0 Rated frequency: 50 Hz

- 6.0 Special requirements:
-
-
-
-
-

Completed by:

Capacity

Signature

Date

"I acknowledge that this document contains personal information as defined in the Protection of Personal Information Act, 2013 (the "Act"). By accessing/using this document, I consent to the processing of personal information in accordance with the requirements of the Act. Personal information contained herein will only be used for purposes of this document."

ANNEXURE B: TECHNICAL DATA SHEET

(To be completed by the tenderers and submitted as part of their tender)

AC DISCONNECTS WITH EARTHING SWITCH

1. Name of manufacturer:.....
2. Type number:.....
3. Number of poles:.....
4. Outdoor (Yes/No):.....
5. Rated voltage:.....
6. Rated insulation level:.....
7. Rated 1 minute power frequency withstand voltage:.....
8. Rated lightning impulse withstand voltage:.....
9. Rated frequency:.....
10. Rated normal current:.....
11. Rated short circuit making current:.....
12. Rated short time withstand current:.....
13. Mass of complete unit:.....
14. Minimum clearance in air:
 - 14.1 Between poles:.....
 - 14.2 To earth:.....
 - 14.3 For isolating distance:.....
15. Type of closing mechanism:.....
16. Height above ground:.....
17. Length of insulator (taut string measurement):.....
18. Insulators type test certificate:.....

"I acknowledge that this document contains personal information as defined in the Protection of Personal Information Act, 2013 (the "Act"). By accessing/using this document, I consent to the processing of personal information in accordance with the requirements of the Act. Personal information contained herein will only be used for purposes of this document."