



A Division of Transnet SOC Limited

TECHNOLOGY MANAGEMENT

SPECIFICATION

REQUIREMENTS FOR 160 SQUARE MILLIMETRE ALL ALUMINIUM JUMPER CONDUCTOR

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1.0 SCOPE

- 1.1. This specification details Transnet's requirements for the design of the 160 mm² all aluminium conductor to be used as a jumper on overhead track equipment.
- 1.2. The jumper shall be used on the 3kV DC and 25kV AC electrification systems.
- 1.3. This specification contains the schedule of requirements (Annexure A) which shall be completed by the supplier and shall be submitted as part of the tender documents.
- 1.4. This specification contains technical datasheet (Annexure B) which shall be completed by the supplier and shall be submitted as part of the tender documents.

2.0 NORMATIVE REFERENCES

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

2.1. IEC STANDARD

IEC 60228, Conductors of insulated cables.

2.2. SANS STANDARDS

SANS 182-2, Conductors for overhead electrical transmission lines - Part 2: Stranded aluminium conductor.

SANS 182-3, Conductors for overhead electrical transmission lines - Part 3: Aluminium conductors, steel reinforced.

SANS 9001, Quality management systems – Requirements.

SANS 6282-3, Test methods for bare conductors and conductors of insulated electric cables Part 3: Mechanical tests.

SANS 60287-1-1, Electrical cables – calculation of the current rating Part 1-1: current rating equations (100% load factor) and calculation of losses – general.

3.0 SERVICE CONDITIONS

3.1. 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.

3.2. MECHANICAL SERVICE CONDITIONS

- 3.2.1. The jumpers shall withstand severe vibrations as it will be installed on overhead track equipment above rail.

3.3. ELECTRICAL SERVICE CONDITIONS

The conductor shall be used on the following electrical systems in table 1.

Table 1: System voltages

Systems	3kV DC	25kV AC
Lowest voltages	2.4 kV	19 kV
Highest voltages	3.9 kV	30 kV

4.0 TECHNICAL REQUIREMENTS

- 4.1. These technical requirements are for an all-aluminum soft stranded jumper to equalize current between the contact wire, the catenary and the feeder wire.
- 4.2. The material used to design and manufacture the conductor to be as a jumper shall be pure aluminium in H9 condition and should comply with the requirements given in SANS182-2.
- 4.3. The required cross-sectional area of the conductor shall be 160 mm^2 .
- 4.4. The number of strands in a conductor shall be 37.
- 4.5. The diameter of a single strand shall be 2.36 mm flexible class 2 conductor in accordance to IEC 60228.
- 4.6. The layer configuration of the conductor shall be to the sequence of 1-6-12-18/ C-Z-S-Z concentrically, whereby the outmost layer is right hand (Z).
- 4.7. The lay lengths and lay ratios mentioned in clause 4.6 shall conform to SANS 182-1.
- 4.8. The resistance of the conductor shall not be more than $0.178 \Omega/\text{km}$ at 20°C .
- 4.9. The breaking force according to SANS 182-3 shall not be less than 28.9kN.
- 4.10. The conductor current ratings namely: continuous current, 5 minutes rating and 1-minute rating shall be specified on the datasheet.

5.0 TESTING AND INSPECTIONS

- 5.1. Transnet reserves the right to be present at all tests and inspections as called for in this clause.
- 5.2. The responsibility of arranging the tests called for in this clause rests with the successful tenderer.
- 5.3. A Transnet Freight Rail, Technology Management (Electrical Technology) department representative may request any additional test deemed necessary to ensure compliance.
- 5.4. All certificates of the listed tests shall be supplied to TFR Technology Management for verification and inspection.
- 5.5. Test methods to be carried out to determine whether the conductor complies with the technical requirement shall be in accordance to SANS 6283.
- 5.6. Sampling applied shall confirm to section 6 of SANS 182-2.
- 5.7. The tensile strength of the conductor shall be tested.
- 5.8. The elongation of break of the conductor shall be tested.

6.0 RATING PLATE, MARKINGS AND INSTRUCTION LABELS

- 6.1. Each drum shall bear the following information legibly and permanently marked on a firmly cheek of the drum with a letter dimension of not less than 50mm:
- 6.2. The original equipment manufacturer's trade name or trademark.

- 6.3. Reference area (37/2.36, **160 ,mm²**, AAC) and material of conductor (Aluminium Jumper conductor).
- 6.4. Reference area and material of conductor.
- 6.5. Nominal length in meters.
- 6.6. Gross mass in kg.
- 6.7. Dated Batch Number.

7.0 DOCUMENTATION REQUIREMENTS

- 7.1. Drawings and technical documentation shall be submitted with tender.
- 7.2. The manufacturer shall provide one soft copy and two hard copies of the technical specification.
- 7.3. The manufacturer shall provide design and type test certificates to verify conformance to the requirements and these must be submitted with tender documents.
- 7.4. Supplier shall advise how to proceed with the equipment at the end of its operating life, taking into consideration environmental requirements and regulations.

8.0 QUALITY ASSURANCE

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

9.0 PACKAGING, STORAGE AND HANDLING

- 9.1. Unless otherwise specified by the purchaser, the conductor shall be packed on a robust drum or reel that has a barrel of diameter 580 mm.
- 9.2. Where wooden drums or wooden reels are used, the moisture content of the wood used for fabrication of the drums or reels shall not exceed 15% to comply with clause 5.1.3 of SANS 182-2.
- 9.3. Each reel shall bear the following information legibly and indelibly marked on a firmly attached label or printed on a cheek of the reel.

10.0 GUARANTEE AND DEFECTS

- 10.1. The appointed tenderer shall guarantee that the supplied conductor conforms to Transnet's requirements.
- 10.2. The appointed tenderer shall accept liability for makers' defects, which may appear in design, material and workmanship.

11.0 METHOD OF TENDERING

- 11.1. 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.
- 11.2. Statement of non-compliance shall be motivated by the tenderer, as per 11.1.
- 11.3. Tenderers shall submit comprehensive literature consisting of detailed technical specifications, general constructional details and principal dimensions, maintenance schedules if necessary, datasheets, together with clear illustrations of the equipment offered.
- 11.4. Any items offered in accordance with other standards will be considered at the sole discretion of Transnet Freight Rail, Technology Management, Electrical Technology Department. 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 the relevant Transnet Freight Rail, Technology Management, Electrical Technology Department in writing.
- 11.5. Failure to comply with clauses 11.1, 11.2, 11.3 and 11.4 could preclude a tenderer from consideration.
- 11.6. 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.

APPENDIX A: TECHNICAL DATA SHEET

(To be completed by the relevant Transnet Freight Rail Representative)

No.	Details	Values
1	Name of the depot/location	
2	Electrification line type	
3	Name of the conductor	Aluminium Jumper conductor
4	Total required length	
5	Conductor size	37/2.36, 160 mm², AAC

Completed by

Designation

Signature

Date

ANNEXURE B: TECHNICAL DATA SHEET

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

No.	Details of the conductor	Values	Unit
a)	Cross-sectional area of the conductor		mm^2
b)	Number of strands		Strands
c)	Conductor Lay ratio		
d)	Conductor breaking force		kN
	Current ratings:		
e)	Continuous rating		A
f)	5 Minutes rating		A
g)	1 Minute rating		A
h)	Resistance per km at 20 degrees		Ohms/km