



A Division of Transnet SOC Limited

TECHNOLOGY MANAGEMENT

ELECTRICAL

SPECIFICATION

SPECIFICATION FOR SECTION INSULATORS FOR 3 kV DC OVERHEAD TRACK EQUIPMENT FOR BOTH HIGH AND LOW SPEED TRAFFIC

Author:	Technician in Training Section: Technology Management	N.C Mokhomo
Approved:	Engineer Section: Technology Management	S. Smit
Authorised:	Senior Engineer Section: Technology Management	L.O Borchard

Date: 23 June 2017

Circulation Restricted To:

Transnet and Relevant Third Parties

© 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.

"I acknowledge that this application contains personal information as defined in the Protection of Personal Information Act, 2013 (the "Act"). By accessing/using this application, I consent to the processing of my personal information in accordance with the requirements of the Act. I acknowledge that I cannot unreasonably withhold my consent. I acknowledge that the purpose for processing my personal information is in terms of this application."

INDEX

SECTION	CONTENT	PAGE
1.0	SCOPE.....	3
2.0	REFERENCE	3
2.1	AMERICAN STANDRDS AND TEST METHODS (ASTM).....	3
2.2	SOUTH AFRICAN NATIONAL STANDARD (SANS)	3
2.3	TRANSNET FREIGHT RAIL SPECIFICATION	3
3.0	METHOD OF TENDERING	3
4.0	SERVICE CONDITIONS.....	3
4.1	ENVIRONMENTAL CONDITIONS	3
4.2	MECHANICAL SERVICE CONDITIONS.....	4
4.3	ELECTRICAL CONDITIONS	4
5.0	DRAWING AND INSTRUTIONS.....	4
6.0	DESIGN REQUIREMENTS	5
7.0	TESTS.....	7
8.0	SPARES.....	8
9.0	SPECIAL TOOLS.....	8
10.0	PACKING	8
11.0	WARANTEE/AFTER SALES SUPPORT	8
12.0	APPENDIX 1: PANTOGRAPH DRAWING	9

1.0 SCOPE

- 1.1 This specification covers the Transnet Freight Rail's requirements for bi-directional 3 kV DC section insulators, excluding catenary insulation.
- 1.2 The section insulator is a device installed along with the contact wire for insulating two elementary sections of overhead track (OHT) where the pantograph current collection of the locomotive negotiates smoothly and maintaining the current continuity.

2.0 REFERENCES

Unless otherwise specified, all materials, equipment and testing methods shall comply with the current edition of the relevant IEC, SANS or Transnet Freight Rail publications where applicable.

The following specifications (latest edition) are referred to herein

2.1 American Standards and Test Methods (ASTM)

ASTM D2303 -97: 2004: Standard test method for liquid contaminant,
Inclined-plane tracking and erosion of insulating
Materials

2.2 South African National Standards (SANS)

SANS 60383-2: Insulators for overhead lines with a nominal voltage
above 1 000 V Part 2

2.3 Transnet Freight Rail Specifications

Transnet drawing no CEE – TA-0062: Standard Electrification symbols

2.4 Siemens Drawing

Siemens drawing 8WLO119-6zg30: Pantograph for DC Locomotive

3.0 METHOD OF TENDERING

- 3.1 Tenders shall indicate clause by clause compliance with this 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. This document can be used by tenders to elaborate on their response to a clause.
- 3.2 A statement of non-compliance shall be motivated by the tenderer.
- 3.3 Tenders shall submit descriptive literature consisting of a detailed technical specifications, general constructional details and principal dimensions, together with clear illustrations of the equipment offered.
- 3.4 Failure to comply with clause 3.1, 3.2 and 3.3 could preclude a tender from consideration.

4.0 SERVICE CONDITIONS

4.1 Environmental conditions

Altitude:	0 - 1 800 m above sea level
Relative humidity:	0% 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 emission.

Any equipment to be installed on electrification structures adjacent to the rail and shall be exposed to direct sunlight and vibrations.

4.2 Mechanical Conditions

Contact wire tension (new wire):	5,5kN (min) to 22,5kN (max.)
Required safety factor (overall):	2, 5
Contact wire size:	161 mm ² Cu

4.3 Electrical Conditions

Highest voltage of system:	3, 9 kV DC
Lowest voltage of system:	2, 2 kV DC
Maximum commutated current:	2, 7 kA
Maximum short circuit current:	35 kA
Lightning impulse withstand voltage:	65 kV

The 3 kV DC high speed circuit breakers opening time on the occurrence of a fault is 20 - 100 milliseconds for 3 kV DC systems.

5.0 DRAWINGS AND INSTRUCTIONS

5.1 All electrical drawings must use standard symbols as per drawing CEE-TA-0062.

5.1.1 A detailed drawing showing insulation inserts, runners, arcing horns and suspension arrangements with all relevant dimensions and in particular deviation, if any, from a plane surface after installation. (See clause 6 for design requirements.)

5.1.2 Details of insulating materials used and the resistance thereof to ultra-violet radiation shall be stated.

5.1.3 Detail and composition of metallic components used.

5.1.4 Minimum distance to be allowed between section insulator and catenary.

- 5.1.7 Details of adjustment of arcing horns.
- 5.1.8 Comprehensive instructions for installation and details of any special tools or equipment required.
- 5.1.9 List of railway organizations and service conditions where the section insulator offered is in successful use.
- 5.1.10 The expected life cycle for section insulator for low, medium and high traffic volumes.
- 5.1.11 Test certificates for tests called for in clause 7.2.
- 5.2 Non-electrical drawings must conform to SANS and industry standards that are applicable.
- 5.3 Tenderers shall provide the following information at time of tendering to enable a proper adjudication to be made. Failure to do so shall be indicated in the "Statement of Compliance" and may lead to rejection of the tender. Where feasible the information may be provided on the drawing.
- 5.4 Copies of original documentation shall be clearly legible.

6.0 DESIGN REQUIREMENTS

- 6.1 The section insulators shall be of durable design and shall be capable of carrying out their functions reliably under the service conditions stated. They shall be suitable for bi-directional traffic at speeds of up to 120 km/h.
- 6.2 The overall suspended mass of the section insulator shall not exceed 13 kg. (The mass of support droppers and fittings excluded).
- 6.3 The overall width of that part of the section insulator in contact with the pantograph shall not exceed 330 mm.
- 6.4 The section insulator shall be provided with suitable runners of either metal or insulating material such that a smooth continuous running surface is created for the passage of a pantograph.
- 6.5 They shall be so designed that electrical contact between pantograph and the overhead system will under no circumstances be completely broken whilst being traversed by the pantograph. Designs incorporating a gap longitudinally across the section insulator (i.e. with in-line runners) the gap width shall not exceed 150 mm such that the gap can be bridged out by the pantograph. Appendix 1: shows the detail of the pantograph.
- 6.6 Allowance shall be made in the design to ensure that no obstruction shall be formed to the passing pantograph should the section insulator fail to be set perfectly level in all planes with respect to the track.
- 6.7 The section insulator shall preferably present a perfectly plane running surface to the pantograph, when installed at the normal tension of 14,5kN. If not perfectly plane, or if variations in tension can

result in deviations from a perfect plane, the maximum allowable deviation shall be 6 mm at any point on the running surface within the range of operating tensions quoted in clause 4.2.

- 6.8 All runners or parts in contact with the pantograph shall be of rigid design such that no part shall deflect by more than that specified in clause 6.7 whilst being subjected to the upward thrust of the pantograph of 90N.
- 6.9 Arcing horns shall be provided and designed such to assist in extinguishing any arc. They shall also be placed such that the insulation used will not be damaged by the arcs drawn during operation and shall be of rigid design. The air-gap between arcing horns at different potential shall not be less than 75 mm. Each horn shall have a straight length above this air gap between 120 mm to 350 mm.
- 6.10 The main insulating material forming the insulation between the two circuits shall have a creepage length of not less than 450 mm. It shall also be able to withstand abrasion resulting from the passage of pantographs (if applicable) as well as electric arcing and ultra-violet radiation.
- P.T.F.E. (Teflon) shall not be used if in direct contact with the pantograph.
- 6.11 Where composite insulators are used as main insulation the protective coating on the outside shall be bonded to the core such that no cavities are formed between the coating and the core and shall be sealed at the ends to prevent the possibility of tracking along the insulator underneath the protective coating.
- 6.12 Each insulator of this type shall be subjected to the water immersion test described in clause 7.3.
- 6.13 Clause 6.11 also applies to any other protection material provided to protect the insulation against arcing/flashover.
- 6.14 Supporting droppers shall (if provided) be insulated to prevent any arcing between the catenary wire and the droppers. The supporting droppers shall be adjustable either by means of turnbuckles or some other means of providing fine adjustments to its length. Droppers shall be protected by thimbles or similar means to prevent wear taking place at sharp edges.
- 6.15 All supporting droppers of materials type stainless steel are to be used to prevent arcing between the catenary wire and the droppers.
- 6.16 Supporting droppers must be provided if the mass of the section insulator exceeds 5 kg or if its overall width is in excess of 75 mm.
- 6.17 Only non-corrosive materials shall be used in the construction of the section insulator.
- 6.18 Means of locking all bolts and screws shall be provided. All screw threads shall be of stainless steel.

7.0 TESTS

7.1 General

- 7.1.1 The first section insulator shall be subjected to type tests as specified in clauses 7.2.
- 7.1.2 All main insulators of the composite type shall be subjected to the routine test as specified in clause 7.3.
- 7.1.3 At least five samples of the main insulator material shall be subjected to the type test as specified in clause 7.2.1.
- 7.1.4 The responsibility for arranging these tests shall rest with the tenderer although Transnet Freight Rail reserves the right to perform such tests independently.
- 7.1.5 Transnet Freight Rail reserves the right to call for further type tests if considered necessary.
- 7.1.6 Transnet Freight Rail reserves the right to be present during the test.

7.2 Type tests

- 7.2.1 The insulating material (if of synthetic type) shall be tested for resistance to tracking in accordance with the test method described in ASTM D 2303. The average time to track 13 mm for five samples shall not be less than 24 hours at a constant test voltage of 2 kV with a constant contaminating flow rate as prescribed in ASTM D 2303. The cabinet in which the tracking test is performed shall be open at the top in order to create sufficient ventilation, thus limiting the relative humidity inside the chamber to a value that will not give false results. The flow rate of the contaminant should be accomplished by a gravity feed from a large reservoir mounted at a sufficient height to obtain the desired flow rate.
- 7.2.2 Impulse and power frequency tests shall be carried out on a complete section insulator in accordance with SANS 60383-2.
- 7.2.3 Mechanical load tests shall be carried out to establish whether the section insulator can withstand the maximum tension called for in clause 4.2 at a safety factor as specified.
- 7.3 Water immersion tests shall be carried out as follows: (Routine test).
 - 7.3.1 Immerse the sample in hot tap water (50 °C) and allow water to cool over 8 hours to approximately 20 °C.
 - 7.3.2 Repeat 7.3.1 nine times.
 - 7.3.3 After the 10th cycle, remove the sample from the water, wipe the surface dry with a paper towel and apply a DC test voltage of 25 kV/m length of insulator within 10 minutes. Measure the current after one minute on a DC ammeter with resolution of 1 nA.
 - 7.3.4 Insulators passing more than 100 nA have failed the test and must be rejected.

8.0 SPARES

8.1 Tenderers shall quote separately for the following spares:

8.1.1 Arcing horns.

8.1.2 Main insulators.

8.1.3 Metal runners (if not integrated with arcing horns).

8.2 The following information shall be made available for spares:

8.2.1 Complete ordering description.

8.2.2 Name of manufacturer.

8.2.3 Catalogue description number.

8.2.4 Type- and ordering number.

9.0 TOOLS

9.1 Special tools for installation of the section insulators shall be quoted for separately, but it must be clearly stated in tender that tool is required for installation.

10.0 PACKING

10.1 Each section insulator shall be packed individually complete with arcing horns, suspension fittings etc.

11.0 WARRANTEE/AFTER SALES SUPPORT

11.1 Tenders should give a warrantee on the workmanship of the manufactured items and provide a full disclosure of any warrantee conditions with a tender.

11.2 Tenders should state the extent of after sales support provided by them.

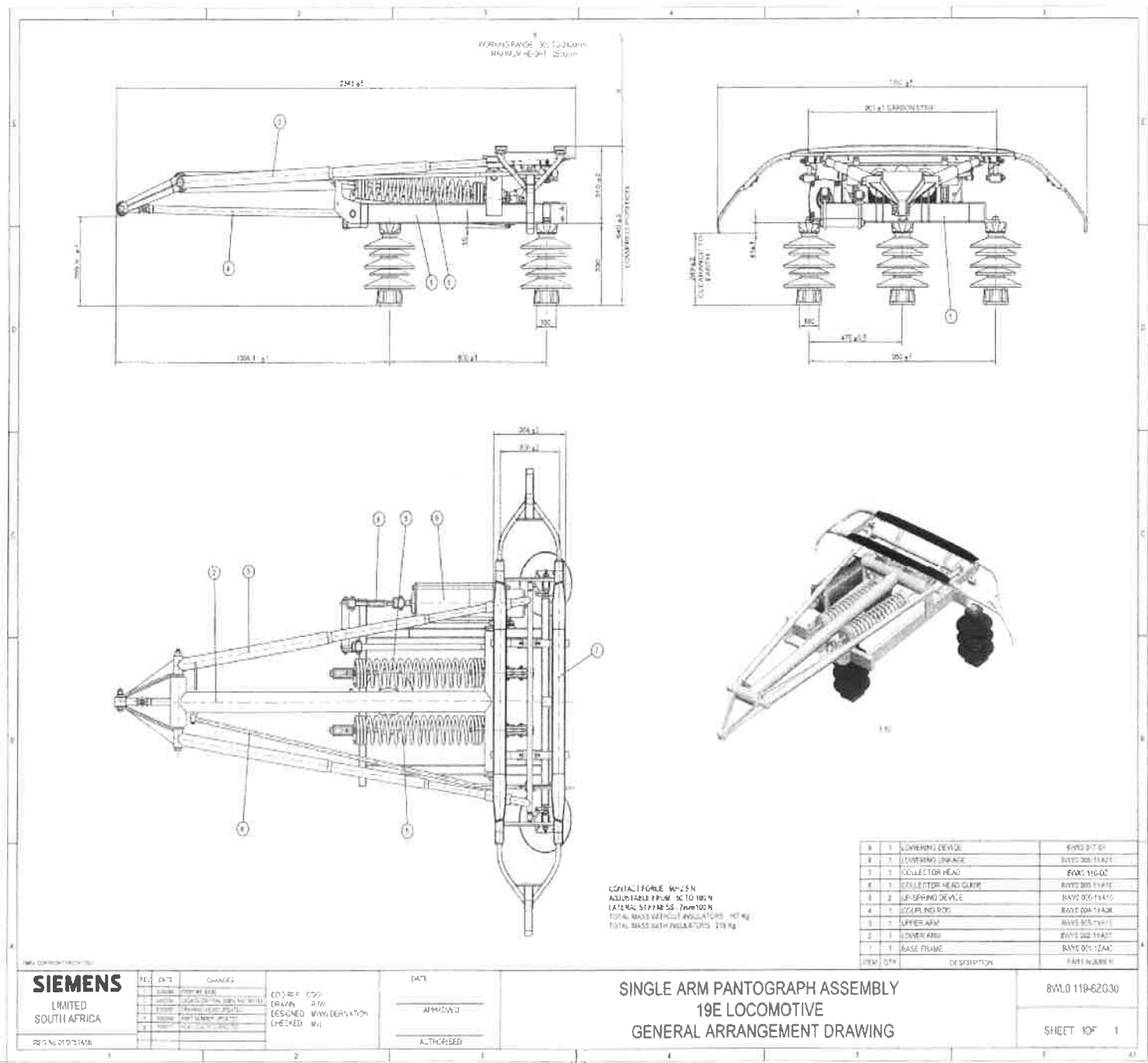
11.3 Tenders should provide a spare parts list with contact details with each item.

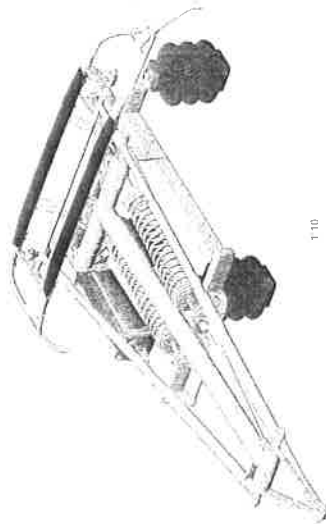
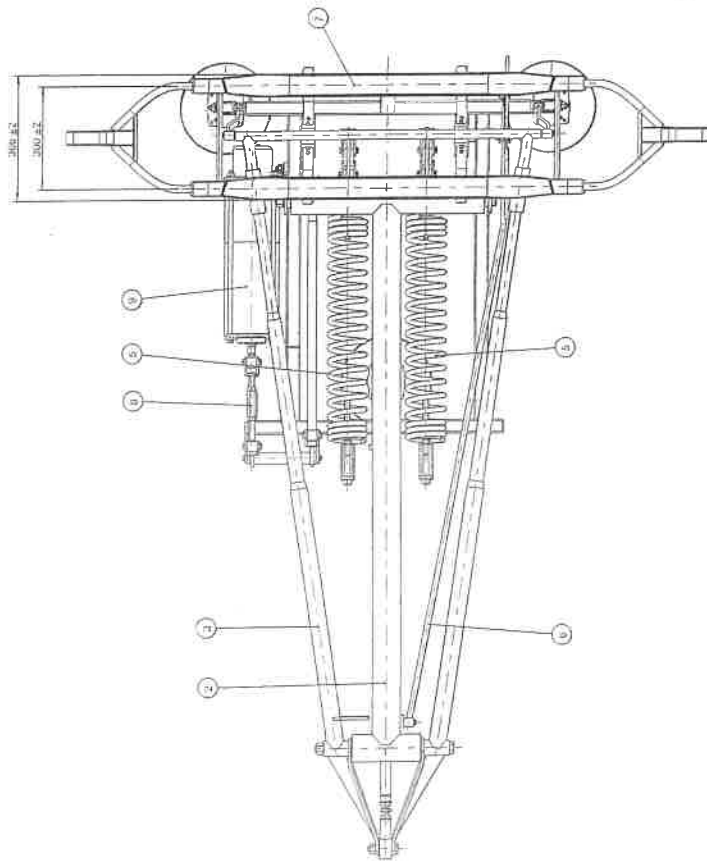
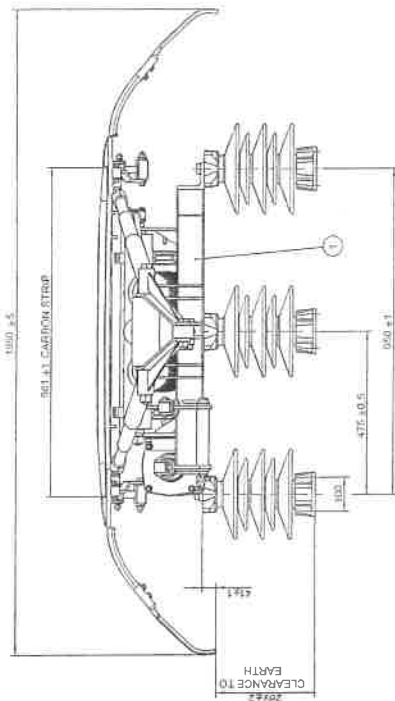
11.4 Lead times must be clearly indicated by tenders.

END

APPENDIX 1

Pantograph Drawing





6	1	COLLECTOR HEAD GUIDE
5	2	UP-SPRING DEVICE

ITEM	QTY	DESCRIPTION	PART NUMBER
0	1	LOWERING DEVICE	HWX01-017-02
7	1	LOWERING LINK	BWY01-001-1YA21
7	1	COLLECTOR W/ARM	BWY01-110-02
0	1	COLLECTOR HEAD GUIDE	BWY01-001-1YA16
5	2	UP-SPRING DEVICE	BWY01-005-1YA40
4	1	Coupling ROD	BWY01-001-1YA08
3	1	UPPER ARM	BWY01-003-1YA10
2	3	LOWER ARM	BWY01-002-1YA37
1	1	BASE FRAME	BWY01-001-12A40

SINGLE ARM PANTOGRAPH ASSEMBLY
19E LOCOMOTIVE
GENERAL ARRANGEMENT DRAWING

8WLO 119-6ZG30

SHEET 10 OF 1

[illegible]