



A division of Transnet limited

INFRASTRUCTURE

SPECIFICATION

REQUIREMENTS FOR INFRARED THERMO GRAPHIC SCANNING OF OVERHEAD TRACK EQUIPMENT.

Statement of authorisation:

There is no SANS specification available for similar material / equipment and as far as can be ascertained no other specification / standard suitably covers Transnet Freight Rail requirements. The specification has been compiled in a manner which shall favour / encourage local manufacture of material / equipment to a maximum degree.

This specification covers the requirements for infrared thermal scanning of 3kV, 25kV and 50kV of railway electrification equipment, the processing of the data and presentation of results for the purpose of preventative maintenance.

Author:	Junior Manager – Infrastructure Engineering	D.G. Naidoo
Authorised:	pp Principal Engineer – Infrastructure Engineering	C.F. Du Toit

Two handwritten signatures in black ink, one above the other, corresponding to the names D.G. Naidoo and C.F. Du Toit.

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Circulation restricted to: Infrastructure Maintenance
 Infrastructure Engineering
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1.0 SCOPE.

This specification covers the technical requirements for infrared thermo graphic scanning of railway electrification equipment, processing of data and the presentation of results for the purpose of preventive maintenance on 3kV DC, 25kV AC and 50kV AC overhead track equipment of Transnet Freight Rail.

2.0 GENERAL

Transnet Freight Rail requires condition assessment information over its 13 000km of overhead electrification equipment to eliminate the risk to service reliability. The data must be in compatible format for Transnet Freight Rail's Infrastructure Maintenance Management system, and be usable to maintenance repair teams.

3.0 SERVICE CONDITIONS.

The infrared scanning shall be done under the following conditions:

- 3.1 Altitude : 0 - 1800m above sea level.
- 3.2 Ambient temperature : -5 °C to +45 °C.
- 3.3 Relative humidity : 10% to 90%.
- 3.4 Lightning conditions : 11 flashes per square km per annum.

4.0 TECHNICAL REQUIREMENTS.

- 4.1 The contractor shall use infrared imaging to detect temperature deviations, relative to a reference temperature, of electrification infrastructure equipment.
- 4.2 The reference temperature against which overheating components are compared shall be that of the running conductor or component to which the overheating component is electrically connected.
- 4.3 A "hotspot" shall be reported whenever the temperature of the component is $\geq 5^{\circ}\text{C}$ above that of the associated reference component. This threshold may be changed at the discretion of the project manager.
- 4.4 For the purpose of scanning the overhead track equipment, the thermal imaging equipment may be mounted on the trailing locomotive of a locomotive consist which will generally be hauling a heavy haul train load, but may be a specified locomotive consist. Alternatively for scanning the track bonding, the equipment may be mounted on the leading locomotive in which case the contractor must allow for such cabling that might be required. Suitable means for mounting such equipment without causing damage to said locomotive shall be provided by the successful contractor.
- 4.5 The thermal recording equipment shall be capable of reliable operation under the electrically noisy environment and mechanical vibration normally associated with railway traction locomotives.
- 4.6 The recording equipment shall have its own power source. Petrol driven generators will not be allowed. A battery bank is recommended.

- 4.7 Scanning will be generally undertaken at night during cooler months of the year and the program shall be arranged by the Project Manager.
- 4.8 The contractor shall use image analysis software to record the following during the scanning process:
 - 4.8.1 Capture a six second image file sequence and save it to disc with file reference as specified in section 5.3 hereof.
 - 4.8.2 Capture an image bitmap depicting the defect centred on the bitmap.
 - 4.8.3 Save a database record to disc as specified in section 5.3 hereof.

5.0 REPORTS.

5.1 GENERAL

This section describes the format in which defects detected through infrared thermo graphic scanning are to be reported; the system whereby the location of defects are to be identified and the format of reports.

5.2 TRANSNET FREIGHT RAIL INFORMATION REQUIREMENTS

- 5.2.1 Transnet Freight Rail references its railway infrastructure in relation to kilometric beacons that are installed in the railway servitude. Due to past railway deviations there are "long-" and "short kilometres". For this reason a defect location can be presented as e.g. 23km, 1060 meter. It will not be possible to provide a mechanical measuring wheel with odometric read-out to the locomotive consist to derive this figure.
- 5.2.2 In addition to km-references, masts are numbered sequentially with reference to the kilometric beacon positions, e.g. "23/14" will be the mast number for the 14th mast between km-23 and km-24 beacons.

5.3 FORMAT OF REPORTS

- 5.3.1 The information is required in two media formats namely hard copy and compact disc.
- 5.3.2 An electronic report on compact disc shall on completion of each depot's scanning, be handed to the Contracts Supervisor. The Contractor shall acquire acknowledgement of receipt in the site diary to that effect. The report shall include:
 - (a) the electronic image files.
 - (b) a post-processed database report on completion of a depot's area that provides a purified version on compact disc and hard copy printout on in which the probable component that is the source of the "hot-spot" is identified .
- 5.3.3. The standard component descriptions in Annexure 4 must be used in the "component" field. The contractor's Thermographer must indicate the probable overheating component. The contractor is not expected to guess at the likely root cause of the overheating component.

- 5.3.4. Hard copy printouts shall be provided on A4-size, with the information as specified in Annexure 2 hereto.
- 5.3.5. Electronic data:
- 5.3.5.1 For each defect detected a database record is required in the prescribed Microsoft excel file format, as specified in the Annexure 1 hereto.
- 5.3.5.2 For each defect detected a bitmap image on compact disc is required.
- 5.3.5.3 For each defect detected a 6 second image sequence file on CD shall be provided, starting 4 seconds before- and ending 2 seconds after the defect.
- 5.3.5.4 Images must be readable with Microsoft product software.
- 5.3.5.5 Image files, coded into the file name, must be saved with :
- depot Name, and
 - record number unique to the campaign

5.4 MEASUREMENT REQUIREMENTS

- 5.4.1 The system must identify at the location where the following phenomena occurs, the information required in Annexures 1 and 2:
- 5.4.1.1 overheating components as a result of electrical continuity defects.
- 5.4.1.2 visible arcing emitted by the copper of the wire during the electrical arcing caused by the current collector parting from the contact wire, but excluding those at section insulators.

5.5 DATA VERIFICATION

- 5.5.1 Transnet will require a verification of the data before acceptance, the details of which will be described in the project specification.

6.0 Tender Procedure.

- 6.1 Tenders shall be submitted in accordance with Transnet's tendering method stated in the Project Specification.

7.0 Annexures.

The following appendices form an integral part of this specification.

- 7.1 Annexure 1: INFORMATION REQUIRED IN DATABASE FORMAT.
- 7.2 Annexure 2: FORMAT FOR HARD COPY REPORT-1.
- 7.3 Annexure 3: FORMAT FOR HARD COPY REPORTS-2.
- 7.6 Annexure 4: STANDARD DESCRIPTIONS OF COMPONENTS.

END

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ANNEXURE 1 - INFORMATION REQUIRED IN DATABASE FORMAT

Microsoft Excel file format for viewing with Microsoft Office software, and for importing into IAMM viewer:

<i>Parameter</i>	<i>Format, e.g.</i>
Date	2004-03-12
Record no.	0001
GPS Latitude	29.84803401
GPS Longitude	-27.33911629
GPS Altitude	1707.22
Section ID	E1H13VC
Line code	C02 – L028
Section description Node 1	Newcastle
Section description Node 2	Ladysmith
Mast location (before fault)	45/2
Mast location (after fault)	45/3
Magnetic tape timer	01:24:34
Kilometer	45
Meter	00102
Line (up/down/yard)	Up
Linked bitmap	LDS_0034 .JPEG
Linked video clip	LDS_0034 .MPEG
Defective component	Catenarysplice
Relative temperature	16°C

ANNEXURE 2 - FORMAT OF HARD COPY REPORT-1

**Infra-red Scan
Overhead Track Equipment**

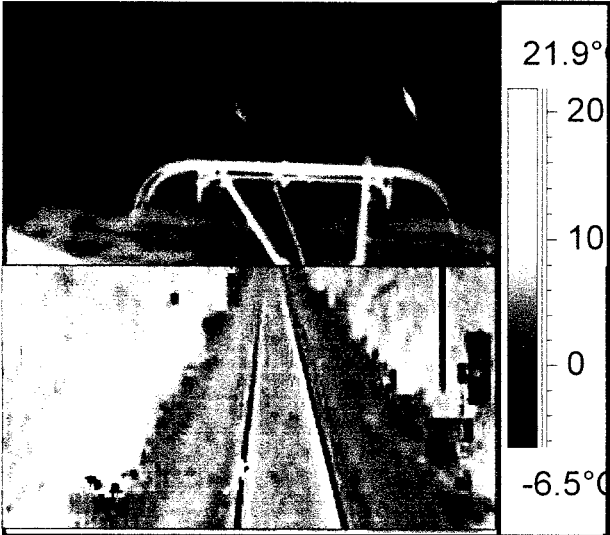
Date	Record Number	GPS Co-ordinates			Section description				Line (up/down/yard)	Mast loc before	Mast loc after
		Latitude	Longitude	Altitude	Section ID	Line code	Node 1	Node 2			

Relative Temperature	Magnetic tape Time counter	Km	Meter.	Linked bitmap	Linked video clip	Component

END

ANNEXURE 3 - FORMAT OF HARD COPY REPORT-2

Images of the overhead wires and track bonding must be combined in a graphic picture, and the location text superimposed on the graphic. The file must be in the JPG format. An example of the graphic format is provided as guideline:

	Parameter	Format, e.g.
	Date	2005-08-13
	Record no.	0034
	GPS Latitude	29.84803401
	GPS Longitude	-27.33911629
	GPS Altitude	1707.22
	Section ID	E1H13VC
	Line code	C02 - L028
	Section description	Newcastle
	Node 1	
	Section description	Ladysmith
	Node 2	
	Mast location (before fault)	45/2
	Mast location (after fault)	45/3
	Magnetic tape timer	01:24:34
	Kilometer	45
	Meter	0.0102
	Line (up/down/yard)	Up
	Linked bitmap.	LDS_0034.JPEG
	Linked video clip.	LDS_0034_.MPEG
Defective component	Splice_Feeder	
Relative temperature	16°C	

END

ANNEXURE 4 - STANDARD DESCRIPTIONS OF COMPONENTS

The standard defect descriptions are to be used for compatibility with the IAMM system and have a standard word length with underscore characters for word breaks. No other description may be used. Pick-list compiling is recommended. The information is available to the successful tenderer in electronic format from Transnet Freight Rail.

- 1 Bond_Mast_Rail_Mast_side
- 2 Bond_Mast_Rail_Rail_side
- 3 Bond_Rail_continuity
- 4 Booster_wire_clamp
- 5 Clamp_FCC catenary_side
- 6 Clamp_Catenary_Suspension
- 7 Clamp_Contact
- 8 Clamp_Earth_wire
- 9 Clamp_FCC_contact_side
- 10 Clamp_FCC_feeder_side
- 11 Clamp_Feeder_Suspension
- 12 Distribution_switch_contacts
- 13 Distribution_line_clamp
- 14 Distribution_line_insulator
- 15 Dropper
- 16 Insulator_Cross_Span
- 17 Insulator_Feeder
- 18 Insulator_Strain
- 19 Insulator_Strutt
- 20 Insulator_Suspension
- 21 Insulator_Top
- 22 Jumper_FCC
- 23 Jumper_Contact_Contact
- 24 Jumper_Track_switch
- 25 Multiple_components
- 26 Phase_break
- 27 Pantograph bounce
- 28 Section_insulator
- 29 Splice_Contact
- 30 Splice_Feeder
- 31 Track_switch_contacts
- 32 Uncertain_Inconclusive

END