



## TECHNOLOGY MANAGEMENT ROLLING STOCK TECHNOLOGY SPECIFICATION

### LOCOMOTIVE ADHESION MEDIA PERFORMANCE SPECIFICATION

Author:	Engineer Rolling Stock Technology	T J Mogashane
Approved:	Senior Engineer Rolling Stock Technology	K T Sivhabu (Pr.Eng)
Authorised:	Principal Engineer Rolling Stock Technology	Dr E Molobi (Pr.Eng, IWE)

Handwritten signature of T J Mogashane.

Handwritten signature of K T Sivhabu.

Handwritten signature of Dr E Molobi.

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**AMENDMENT HISTORY**

<b>Revision date</b>	<b>Version number</b>	<b>Details of amendments</b>
July 2013	00	Original document
June 2014	01	Note added 7.3.3: "The adhesion medium should not contain any particles or traces of cadmium and its oxides" added 10.0: Revision History and Table 4
May 2017	02	4.2 was amended to include the 25 and 50kg package size 7.3 was amended to indicate the acceptable tolerances for hazardous chemical substances, See Table 3 10.00 the revision history table was renumbered to <b>Error!</b> <b>Reference source not found.</b>
October 2022	03	6.0 Removed section 6.0 (Flow rate performance) and all related subsequent clauses. 8.3 Addition of certificate of conformance and test results report requirements 9.0 Addition of Qualification as a manufacturer section and its related subsequent clauses 10.0 Removed table 5 revision history and implemented amendment history table on page 3
February 2024	04	Addition of Clause 2.4 Amendment of Clause 4.2: ... in waterproof bags of 5, 10, 20, 25, and 50 Kg... to waterproof 10 and 20 kg bags. Amendment of hardness from 6 – 7 to 7 – 8 on Table 1 Amendment of pH from 8 to 7 ± 1 on Table 2 Addition of Clause 9.1.3

## 1.0 SCOPE

- 1.1 This specification covers the performance properties required of adhesion media used on locomotive sanding equipment for enhancing wheel adhesion to the rail.
- 1.2 The specification covers adhesion media as supplied to locomotive depots in bulk as well as adhesion media supplied in appropriate size waterproof bags.

## 2.0 REFERENCES

- 2.1 Rail and Safety Standards Board: *ERTMS adhesion management: An assessment of the available adhesion and slip risk for ERTMS.*
- 2.2 Rail Research UK: *New Rail Materials and Coatings, report RRUk/A2/1 by G. Vasic, F.J. Franklin and A. Kapoor*
- 2.3 White Rose Research Online: *Twin Disc Assessment of Wheel/Rail Adhesion by E.A. Gallardo-Hernandez, R. Lewis*
- 2.4 Occupational Safety and Health Administration (OSHA): *Health Effects of Hexavalent Chromium; Dangers of Hexavalent Chromium; Crystalline Silica Exposure Health Hazard Information*
- 2.5 Association for the American Railroads (AAR), Section M-916 Part 2 of 2017

## 3.0 DEFINITIONS AND TERMINOLOGY

- 3.1. The Supplier - the successful supplier and/or manufacturer of the adhesion media for use on Transnet locomotives
- 3.2. The Manufacturer- the organisation/entity that makes/manufactures the adhesion media.
- 3.3. QA Department - the section in which all quality inspection of incoming purchased material is evaluated.
- 3.4. Adhesion - it is a term that describes the condition of friction between the wheel and the rail when rolling and sliding occur. It is measure of the grip that occurs between the wheel and the rail.
- 3.5. Tractive Effort (TE) - it is the pull force that a locomotive is able to generate in order to move a train (locomotive and wagons).
- 3.6. Braking Effort - it is the retarding force in which a locomotive is able to generate in order to decelerate a train.
- 3.7. Material Safety Data Sheet (MSDS) – the product sheet containing information regarding safe handling, health and environmental effects and control measures.

#### 4.0 TYPE OF ADHESION MEDIA SUPPLIED

- 4.1. The adhesion media supplied may be sand, mineral slag or ceramic.
- 4.2. The adhesion media shall be supplied in waterproof 10 and 20 kg bags. For bulk orders, the manufacturer may package several waterproof bags of media in bulk bags as required by the depot.
- 4.3. The name of the supplier of adhesion media, the grade of the adhesion media and the mass of the bag shall be clearly visible on the packaging.
- 4.4. The adhesion media shall be supplied in a dry and ready to use condition (free of pebbles, leaves and foreign particles).

#### 5.0 ADHESION MEDIA PROPERTIES

- 5.1. When in operation the adhesion media shall be able to provide the minimum and/or improve the tractive and braking effort for all locomotives as specified by Transnet requirements (documents PD\_PEL\_NAT\_MAN\_001).
- 5.2. The adhesion media must be able to improve adhesion between the wheel and the rail during traction and braking when operating under the following conditions:
  - Adverse weather conditions (humidity, light rain, and snow) and
  - Contamination of the rail (light rust, grease and oil, salt and industrial fall-out, leaves)
- 5.3. The abrasion properties of the adhesion media when in operation shall not cause accelerated wear on the wheel and rail surfaces.
- 5.4. The adhesion media shall not affect the track circuit operation when in operation.

#### 6.0 CHEMICAL AND PHYSICAL PROPERTIES

- 6.1 The adhesion media shall have the physical and chemical properties as specified in Table 1 and Table 2, respectively.

**Table 1: Physical properties of adhesion media.**

Property	
Grain size (mm)	0.20 - 2.00
Profile range (micron)	70 - 110
Hardness (Moh Scale)	7 - 8
Specific weight (g/cm <sup>3</sup> )	3.5 maximum

**Table 2: Chemical properties of adhesion media.**

Property	
Moisture content	0 - 0.2%
pH value	7 ± 1

- 6.2 Table 3 below list the acceptable tolerances for the hazardous chemical substances that can be present in the adhesion media. All adhesion media shall conform to the requirements as specified in Table 3 below.

**Table 3: Hazardous chemical substances.**

Element /Compound	
Hexavalent Chromium (Cr <sup>6+</sup> )	<2% by volume and < 10mg/kg
Cadmium	No traces
Crystalline Silica / Free Silica	No traces

- 6.3 There should be no contamination (clay, grave, loam, and other foreign material) present in the adhesion media.
- 6.4 The adhesion media must be chemically stable, with zero to low levels of reactions when exposed to unsuitable environments.
- 6.5 The adhesion media as supplied shall be odourless.

## **7.0 HEALTH AND ENVIRONMENTAL PROPERTIES**

- 7.1 The adhesion media supplied should pose no health risk in terms of silicosis, lung cancer, allergic contact dermatitis, etc.
- 7.2 The adhesion media when mixed with the environment, no harmful biological effects should occur.
- 7.3 The supplier shall provide the MSDS of the adhesion media that complies with the requirements of the Occupational Health and Safety Act and the Regulations for Hazardous Chemical Agents. At a minimum, the MSDS shall clearly indicate the following:
- health and environmental dangers,
  - toxicology information,
  - handling and storage procedures,
  - accidents and spillage control measures,
  - stability and reactivity of the adhesion media.

## **8.0 CONFORMANCE TO SPECIFICATION**

- 8.1. All adhesion media supplied shall conform to the minimum requirements specified within this specification. Should the adhesion media delivered not conform to the requirements and/or is not equivalent to the tender sample, it shall be rejected.
- 8.2. All adhesion media supplied shall be tested for conformance to specification in terms of tractive effort and flow rate, chemical, physical, health and environmental properties by Transnet SOC Ltd.
- 8.3. The supplier shall provide a certificate of conformance for all the requirements in section 6.0 and its related subsequent clauses of this document. A report of all the test results

must accompany the conformance certificate. The report shall include the following test results:

- a. Grain size (mm)
- b. Profile range (micron)
- c. Hardness (Moh Scale)
- d. Specific weight ( $\text{g/cm}^3$ )
- e. Moisture content
- f. pH value
- g. Chemical analysis (content of Hexavalent chromium ( $\text{Cr}^{6+}$ ), Cadmium, and Crystalline Silica / Free Silica)

## 9.0 QUALIFICATION AS A MANUFACTURER

- 9.1. The qualification criteria as a manufacturer of adhesion media to be used on TRANSNET FREIGHT RAIL rolling stock shall be as follows: document submission, product evaluation, and process and facilities audit respectively. The qualification shall be performed by the TRANSNET FREIGHT RAIL Quality Evaluation Committee.
  - 9.1.1. The MSDS, certificate of conformance to this specification and test results as per clause 8.3 requirements of this document must be submitted. If the information from the documents submitted does not conform to the requirements of the specification, the manufacturer will be disqualified, and the evaluation will not proceed to the next phase of product evaluation.
  - 9.1.2. A sample for product evaluation according to the requirements of section 6.0 and its related subsequent clauses must be submitted. The submitted sample for product evaluation must be one (1) kilogram (kg) minimum. If the sample fails, only ONE (1) re-test will be allowed i.e., submission of another sample from the same batch for re-testing.
  - 9.1.3. If the sample was submitted in connection with a tender, retests will not be allowed if the submitted sample fails.
  - 9.1.4. If successful in the first two phases (i.e., 9.1.1 and 9.1.2) mentioned above, a site process and facilities audit will be performed to evaluate the manufacturing process and quality system of the organisation/entity.
  - 9.1.5. If all the qualification criteria is successfully met, the manufacturer and their product shall be approved.
- 9.2. Qualification as a manufacturer of adhesion media shall be approved by the TRANSNET FREIGHT RAIL Quality Evaluation Committee. Qualification is effective until revoked by TRANSNET FREIGHT RAIL. The cause of revocation is the failure of the manufacturer to maintain the requirements of this specification. The manufacturer is approved for a period of five (5) years, thereafter Transnet SOC Ltd reserves the right to re-audit the manufacture's facility or conduct tests on the adhesion media prior to commencement of the new contract.
- 9.3. Manufacturers that have been previously approved by TRANSNET FREIGHT RAIL but have not supplied for five (5) years or more must be re-qualified.

- 9.4. The TRANSNET FREIGHT RAIL Quality Evaluation Committee shall consist of:
- a. VIT (Wheelset) Member, Rolling Stock Technology, TRANSNET FREIGHT RAIL
  - b. Supply Chain Services (SCS) Member, TRANSNET FREIGHT RAIL
  - c. Corporate Quality, TRANSNET FREIGHT RAIL
- 9.5. Any changes in the properties (i.e., chemical, mechanical, health and environmental) of the adhesion media or a product name change after approval has been granted will result in the adhesion media having to undergo the qualification process as described in this document (Clause 9.0) again. Failure to disclose these changes to the evaluation committee will result in the disqualification and approval revocation of the adhesion media and its manufacturer until all the requirements are met.