

## **REVISION OF SPECIFICATION**

**Item Name: Technical Specification of the Cleaning Solvent for Electrical Rotating Machines of Diesel Electric Locomotives.**

**Specification No. : MP.0.8000.01 (Rev.- 03) April'2021.**

1. RDSO is reviewing the specification to cater to the latest technological developments in the field, modify clauses not relevant in the present context and making them more enabling with focus on functional requirements.
2. It is requested that your comments / suggestions with regard to improvements /modifications in specification of the above mentioned item may be submitted in the following format along with the justification for the changes required.

### **Part A: Basic Information**

<b>SN</b>	<b>Particulars</b>	<b>Information</b>
1	Name	
2	Designation	
3	Professional Qualification	
4	Organization / Firm's Name	
5	Address for Correspondence	
6	Contact No.	
7	Email ID	
8	Whether firm is registered with RDSO for the subject item. If yes, details like date of registration, current status etc. If no, firm's experience in manufacturing of subject item or similar item	
9	Whether any technical document/Report/Study to support suggested changes is available / enclosed for better appreciation	

### **Part B: Comments / Suggestions on the specification**

<b>SN</b>	<b>Clause No. of RDSO STR/ Spec</b>	<b>Clause, as it exists in RDSO STR/ Spec</b>	<b>Clause , as it should read after incorporation of comments /suggestions in the RDSO Spec / STR</b>	<b>Justification for changes</b>

**Comments may be sent to following address within 15 days from the date of publication on [rdso.indianrailways.gov.in](http://rdso.indianrailways.gov.in)**

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<b>Document No.:</b>	MP.0.8000.01	Revision No: 03	Issued : <a href="#">April' 2021</a>
<b>Document Title:</b>	Specification of the Cleaning Solvent for Electrical Rotating Machines of Diesel Electric Locomotives.		

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अनुसंधान  
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मानक संगठन  
लखनऊ  
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Government of India  
Ministry of Railways  
Research Design &  
Standards  
Organization  
LUCKNOW  
ESTT: 1957

# डीजल इलेक्ट्रिक इंजन का विद्युत घूर्णन मशीनों के लिए सफाई विलायक की विशिष्टि

## Specification of the Cleaning Solvent for Electrical Rotating Machines of Diesel Electric Locomotives

Specification Number	MP.0.8000.01		
Version Number	Rev. 03	Date of Issue	<a href="#">April' 2021</a>

### Brief Description

This document describes the Specification of the Cleaning Solvent for Electrical Rotating Machines of Diesel Electric Locomotives. The complete specification details the functional requirement of the cleaning solvent, scope of supply and testing of the material ensuring reliability and fail safe operation.

<b>Document No.:</b>	MP.0.8000.01	Revision No: 03	Issued : April' 2021
<b>Document Title:</b>	Specification of the Cleaning Solvent for Electrical Rotating Machines of Diesel Electric Locomotives.		

## FOREWORD

### **RDSO had revised the Specification of the Cleaning Solvent for Electrical Rotating Machines of Diesel Electric Locomotives.**

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<b>Document No.:</b>	MP.0.8000.01	Revision No: 03	Issued : <a href="#">April' 2021</a>
<b>Document Title:</b>	Specification of the Cleaning Solvent for Electrical Rotating Machines of Diesel Electric Locomotives.		

## LIST OF AMENDMENTS

Sl. No.	Amendment date	Revision	Details
1.	April'21	03	Revision of cover page (Title change), Page no. 1
			Addition of 'Foreword', 'Disclaimer', 'copy right' & 'Address for communication' Page no. 02
			Addition of list of Amendments, Page no. 03
			Addition of Index , Page no.04
			Revision of clause 1.1, (added 'over IR'),
			Addition of clause 1.2 Page no. 06
			Addition of clause 2.0 (Definitions), Page no. 06
			Addition of word 'Technical' in clause 2.0 and revised the clause as 3.0, (Technical Requirements), Page no. 06
			Revision of clause 2.1,
			Revision of clause 2.3,
			Revision of clause 2.7,
			Revision of clause 4.0, 'Tests" and added 'Categories of Tests' Page no. 09
			Addition of clause 5.0 (Categories of Tests), Page no. 09
			Addition of clause 7.0 (Field Trial), Page no. 11
			Addition of clause 9.0 (Proven technology & Technical Collaboration), Page no. 13
			Addition of clause 12.0 (Test Certificates and Markings), Page no. 13
			Addition of clause no. 13 (Warranty), Page no. 13
			Addition of clause no.14 (Submission of QAP), Page no. 13
			Addition of clause no. 15 (Vendor changes In approved status), Page no. 14
			Addition of clause no. 16 ( Preference to Make In India), Page no. 14
			Addition of clause no. 17 (References) , Page no. 14
			Revision of Appendix
			Due to addition of 'New clauses', all the existing clauses revised.

<b>Document No.:</b>	MP.0.8000.01	Revision No: 03	Issued : <a href="#">April' 2021</a>
<b>Document Title:</b>	Specification of the Cleaning Solvent for Electrical Rotating Machines of Diesel Electric Locomotives.		

## **INDEX**

<b>S No.</b>	<b>DESCRIPTION</b>	<b>PAGE No.</b>
1.	COVER PAGE	1
2.	LIST OF AMENDMENTS	3
3.	INDEX	5
4.	SCOPE	6
5.	DEFINITIONS	6
6.	TECHNICAL REQUIREMENTS	7
7.	SAMPLING	9
8.	CATEGORIES OF TESTS	9
9.	PROCEDURE OF APPROVAL FOR CLEANING SOLVENT	11
10.	FIELD TRIALS	11
11.	PRECAUTIONS AND CLEANING METHODS	11
12.	STORAGE	12
13.	PACKING	13
14.	PROVEN TECHNOLOGY & TECHNICAL COLLABORATION	13
15.	TEST CERTIFICATES AND MARKINGS	13
16.	WARRANTY	13
17.	SUBMISSION OF QAP	13
18.	VENDOR CHANGES IN APPROVED STATUS	14
19.	PREFERENCE TO MAKE IN INDIA	14
20.	REFERENCES	14
21.	APPENDIX	16

<b>Document No.:</b>	MP.0.8000.01	Revision No: 03	Issued : <a href="#">April' 2021</a>
<b>Document Title:</b>	Specification of the Cleaning Solvent for Electrical Rotating Machines of Diesel Electric Locomotives.		

## 1.0 SCOPE

- 1.1 This specification prescribes technical requirements and tests for cleaning solvents suitable for electrical rotating machines of ALCo Diesel Electrical locomotives over IR.
- 1.2 This Specification covers basic features of the cleaning solvent. It is the responsibility of the manufacturer/ supplier to develop "Product Data Sheet" including "material safety data" and the same should meet the requirements of this specification.

## 2.0 DEFINITIONS

- 2.1 'PURCHASER' means the Ministry of Railways, or an administration under the Ministry of Railways, on behalf of the President of the Republic of India.
- 2.2 'IR' means Indian Railways.
- 2.3 'IRS' means Indian Railway Standard.
- 2.4 'RDSO' means Research Designs and Standards Organisation Manak Nagar, Lucknow, - 226 011.
- 2.4 'INSPECTING AUTHORITY' means the representative to inspect the supply on behalf of the PURCHASER.
- 2.5 'TENDERER' means the firm/company that submits offer for supply of Cleaning solvent, in full or part, as per this schedule, is placed.
- 2.6 'CONTRACTOR' means the firm/company on whom order, for supply of Cleaning solvent, in full or part, as per this schedule, is placed.
- 2.7 'MANUFACTURER' means the firm/company on whom order, for supply of Cleaning solvent, in full or part, as per this schedule, is placed.
- 2.8 'SPECIFICATION', unless otherwise mentioned, refers to specifications of IR/RDSO.
- 2.9 'NABL' means National Accreditation Board for Testing and Calibration Laboratories (NABL) is a Constituent Board of Quality Council of India.
- 2.10 'PTFE' means Polytetrafluoroethylene, a strong, tough, waxy, non-flammable synthetic resin.
- 2.11 'MOU' means a Memorandum of Understanding (MOU or MoU) is an agreement between two or more parties outlined in a formal document.
- 2.12 'IS' means Indian Standard refers to any standard published by the Bureau of Indian Standards.
- 2.13 'ISO' means International Organisation for Standardisation. Here it refers RDSO's apex documents.

<b>Document No.:</b>	MP.0.8000.01	Revision No: 03	Issued : <a href="#">April' 2021</a>
<b>Document Title:</b>	Specification of the Cleaning Solvent for Electrical Rotating Machines of Diesel Electric Locomotives.		

- 2.14 ASTM means American Society for Testing and Materials.
- 2.15 OECD means Organisation for Economic Co-operation and Development is an international organisation that works to build better policies for better lives.

### 3. TECHNICAL REQUIREMENTS

#### 3.1 Appearance

The material shall be clear, homogeneous, mobile, non-oily and free from visible impurities. The material shall be tested as per para 1 and 2 of **Appendix**.

#### 3.2 Description

The cleaning solvent should be a non-oily, neutral, self-drying and non-toxic material. The solvent should be non-flammable and volatile at ambient temperature. The solvent shall have freedom from 'free chlorine' and 'moisture'. It should be suitable for spray, immersion or brush application.

#### 3.3 Effectiveness of cleaning solvent

The cleaning solvent should be an efficient cleaning agent for electrical machines of diesel electric locomotives, which accumulate dust, dirt, muck, oil, grease, gum, carbon or any other organic matter over prolonged usage. The solvent shall completely and rapidly flush away these matters when applied by a jet spray, wiping or immersion. No rinsing, flushing or special removal method shall be necessary except the use of an air blast to facilitate drying. The cleaning efficiency of the solvent shall be comparable with Carbon Tetra Chloride when tested as per test details given in para 5 of **Appendix**.

#### 3.4 Chemical Composition

Although the exact chemical composition may be proprietary information, the manufacturer shall indicate the major basic constituents of the solvent along with other details in their **Product Data Sheet** including **material safety data** and the same should satisfy the requirements of the specification.

#### 3.5 Specific Gravity

The manufacturer shall declare the specific gravity of the solvent and this shall not vary by + 1% as declared in their Product Data Sheet.

#### 3.6 Flash Point

The flash point shall not be lower than 65°C to IS: 1448 (P-20) when determined by Abel's flash point apparatus. The solvent shall offer no fire hazard during the period while the solvent is being applied to the equipment being cleaned and fire danger shall be negligible during the evaporation of the solvent when normal safety precautions are observed.

#### 3.7 Non - Volatile Matter

The solvent should be completely volatile and shall not deposit any non- drying oily or sticky residues in order to avoid accumulation of atmospheric dust or dirt in the electrical machines under ambient temperature. When used to clean an electrical machine as per the procedure given at clause 8.1 and 8.2, the machine should be completely dry after the cleaning process. When tested as prescribed in para 3 of Appendix, the material shall not have a residue more than 0.025%.

#### 3.8 Moisture

<b>Document No.:</b>	MP.0.8000.01	Revision No: 03	Issued : April' 2021
<b>Document Title:</b>	Specification of the Cleaning Solvent for Electrical Rotating Machines of Diesel Electric Locomotives.		

The solvent should have negligible moisture content. When determined by the test given in clause 5.1(h), the moisture content shall not exceed 0.1%.

### 3.9 Neutrality

The prepared aqueous extract of the solvent should be free from acid and alkali radicals. The solvent should be free from inorganic acids and alkalis. The solvent shall be tested for suitability by both the tests given at clause 5.1(f).

### 3.10 Percentage of Aromatic Hydrocarbons

The percentage of aromatic hydrocarbons should generally not exceed 4% when tested as per IS: 12026 (Part-1). Refined aromatic solvent shall be used.

However, in case the percentage of aromatic hydrocarbons exceeds this limit, the manufacturer shall submit a deviation statement with satisfactory technical details and references indicating that the solvent has no harmful effect on the insulation of electrical machines.

### 3.11 Effect of solvent on Insulating Materials

The varnish coated conductors and coils, mica, commutator segments, risers, resin glass bands, PTFE, sealing compounds, silicone, shellac and other insulating materials should not show any sign of degradation, deformation or irreversible damage etc. on visual examination after application of the solvent on the electrical machines. This test shall be conducted as prescribed in para 3 of **Appendix**.

### 3.12 Effect of solvent on Metallic Constituents of Electrical Machines

The solvent shall not corrode, pit or damage copper, steel, iron, bronze, solder, silver solder, zinc and silver after 72 hours immersion at normal room temperature.

### 3.13 Evaporation Rate

The solvent shall have a controlled evaporation rate in order to eliminate any condensation during the period of application or at the time of drying out in order to avoid moisture ingress in the insulating materials and prevent corrosion on the metallic constituents of Electrical machines. The solvent shall have a relative evaporation rate within + 30% of white spirit to IS – 1745 containing 5% trichloroethylene.

### 3.14 Determination of Dielectric Constant

The cleaning solvent shall have dielectric constant less than 3 to ensure very low field interaction for electric field. The dielectric constant of the cleaning solvent shall be measured as per IS: 6262.

## 4.0 SAMPLING

Minimum 2.5 litres of sample of cleaning solvent shall be arranged for acceptance test. Scale of sampling should be done as per table given below:

Sl. Nos.	Sampling (Lot size)	No. of containers to be selected
1.	Up to 100	5
2.	101-200	6
3.	201-300	7
3.	301-400	8

<b>Document No.:</b>	MP.0.8000.01	Revision No: 03	Issued : April' 2021
<b>Document Title:</b>	Specification of the Cleaning Solvent for Electrical Rotating Machines of Diesel Electric Locomotives.		

4.	401-500	9
5.	500 and above	10

The containers should be selected at random as per IS: 4905: 68.

## 5.0 CATEGORIES OF TESTS

### 5.1 TYPE TESTS:

Type tests shall normally be carried out by the 'Inspecting Authority' on the sample offered by the firm. For type test, firm shall supply 6-litres cleaning solvent in three sealed containers each of 2-litres capacity as per their approved **Product Data Sheet** including **material safety data**. If there is any change in data sheet or source of supply of any chemical compound /sub-compound, cleaning solvent made to the changed composition or from new source shall be treated as a separate sample / batch for the purpose of conducting type tests. Following tests shall be as under:

Sl. No	TESTS	METHOD OF TEST & Their Requirement
a.	Visual examination of the solvent	Para 1 of Appendix & Clause 3.1
b.	Test for impurities & foreign materials	Para 2 of Appendix & Clause 3.1
c.	Test for non - volatile matter	Para 3 of Appendix & Clause 3.7
d.	Effect of the solvent on insulating material	Para 4 of Appendix & Clause 3.11
e.	Effectiveness of cleaning solvent	Para 5 of Appendix
f.	Determination of freedom from acidity & alkalinity	IS : 430 : 1972, IS : 1448 (Pt.-1) & Clause 3.9
g.	Test for contents of atomic hydrocarbon	IS : 12026 (part – 1) & Clause 3.10
h.	Test for moisture content	IS : 101 (Part 2/Sec1) & Clause 3.8
i.	Determination of flash point	IS: 1448 (P-20) & Clause 3.6
J.	Test for evaporation rate	Compare evaporation time procedure as in para 3 of Appendix & Clause 3.13
k.	Determination of Specific Gravity	IS : 1448 (Pt - 16) : 1990 & Clause 3.5
l.	Determination of free chlorine.	Para 6 of Appendix.
m.	Determination of Dielectric constant	IS: 6262 & Clause 3.14
n.	Toxicity testing	Test parameter shall be as per clause 5.1.1

**5.1.1 Toxicity Tests:** Toxicity Tests are to conduct on cleaning solvent. These test method provides information on health hazard likely to arise from short-term exposure. The test methods as indicated below:

Sl. no	Parameters	Test method
1.	Acute dermal Irritation on Rabbits	OECD-404
2.	Acute Inhalation Toxicity on Rats	OECD-403
3.	Acute Eye Irritation in Rabbits	OECD-405

#### NOTE:

The manufacturer shall submit the certificate at the time of type test. The certificate from a Government laboratory OR accredited agency (NABL), that the solvent when used by industrial workers with precautions as stipulated at Clause 8.0, 8.1 and 8.2 is not harmful / toxic to the said workers.

<b>Document No.:</b>	MP.0.8000.01	Revision No: 03	Issued : <a href="#">April' 2021</a>
<b>Document Title:</b>	Specification of the Cleaning Solvent for Electrical Rotating Machines of Diesel Electric Locomotives.		

## 5.2 ACCEPTANCE TEST

Minimum 2.5 litres of sample of cleaning solvent shall be arranged for conducting the Acceptance test. Acceptance Tests are to be carried out on samples selected randomly from a lot ready for dispatch, for the purpose of acceptance of the lot by the purchaser or any other inspecting agency nominated by the purchaser. Following tests shall constitute Acceptance Test:

Sl. No.	TESTS	METHOD OF TEST & their Requirement
a.	Visual examination of the solvent	Para 1 of Appendix & <a href="#">Clause 3.1</a>
b.	Test for impurities & foreign materials	Para 2 of Appendix & <a href="#">Clause 3.1</a>
c.	Determination of freedom from acidity & alkalinity	IS : 430 : 1972 & IS : 1448 (Pt.-1)
d.	Determination of flash point	IS: 1448 (P-20) & <a href="#">Clause 3.6</a>
e.	Determination of Specific Gravity	IS : 1448 (Pt - 16) : 1990 & <a href="#">Clause 3.5</a>

## 6.0 PROCEDURE OF APPROVAL FOR CLEANING SOLVENT

Procedure for approval for cleaning solvent shall be applicable as per vendor guideline of vendor controlling authority.

6.1 Literature and Product data Sheet including material safety data of cleaning solvent and internal test results should be sent to vendor controlling authority by the firm [for evaluation](#).

6.2 If Internal test results are found as per the requirement of this specification:

- a. Firm shall be called for a demonstration of their cleaning solvent at any workshop / diesel shed by cleaning some traction machines.
- b. If the cleaning solvent is found successful in the demonstration, it is called for type test.
- c. For type test, firm shall supply 6-litre cleaning solvent in three sealed containers each of 2-litre capacity. Each container shall be marked as per **clause 10.0**.

6.3 The type test for all the requirements as laid down in this specification is mandatory for product approval or approval of manufacturers. However, approving authority reserves the right to repeat the tests at their discretion at a certain time interval or as and when required.

6.4 The CONTRACTOR shall be responsible for execution of the contract in accordance with this schedule and for satisfactory operational performance of the Cleaning solvent supplied, irrespective of any approval which the PURCHASER / Vendor Controlling Authority may have given.

## 7.0 FIELD TRIALS

After successful completion of type test, field trial of cleaning solvent shall be carried out at any two diesel sheds, nominated by Vendor Controlling Authority. Approximately 18 traction machines (9 at each diesel shed) shall be cleaned using the solvent. The cleaning efficiency and immediate effect on the machines as well as field performance of the machine shall be monitored.

<b>Document No.:</b>	MP.0.8000.01	Revision No: 03	Issued : April' 2021
<b>Document Title:</b>	Specification of the Cleaning Solvent for Electrical Rotating Machines of Diesel Electric Locomotives.		

Performance feedback shall be furnished by User Railways as per prescribed format as follows:

1. Magnet Frame No.-----

Windings	IR (Before cleaning)	IR (After cleaning)	IR (After baking)
A			
AA			
F			
FF			

IR (After baking at 120°C for 6 hours) taken on date:-----

2. Armature Sl. No. -----

Armature No.	IR (Before cleaning)	IR (After cleaning)	IR (After baking)

IR (After baking at 120°C for 6 hours) taken on date:-----

Note:- Acceptance limit as per clause no. 5.2 of Appendix

## 8.0 PRECAUTIONS AND CLEANING METHODS

Cleaning solvents are designed to meet cleaning and maintenance needs of electrical rotating machines. While handling cleaning solvent, bare hands should not be allowed to use due to defatting properties. Cleaning solvents are meant to remove oil and grease and therefore, shall react on prolonged contact with skin.

### 8.1 PRECAUTIONS

Following recommendations are to be followed during cleaning of traction machines:

- 8.1.1 It is recommended that workmen should use industrial gloves and eye shields when applying the solvent.
- 8.1.2 Barrier cream is recommended to use to reduce reaction and replace fat loss in case of contact.
- 8.1.3 Continuous contact may affect the skin. Contaminated skin should be washed with soap & plenty of water.
- 8.1.4 It is recommended that the area where cleaning solvent is used shall be well ventilated. An industrial fan with high volume of air displacement should be located behind the workmen and in line with the job so that the positive pressure will not draw the solvent towards the workmen.
- 8.1.5 During spraying of solvent, a long necked adjustable nozzle type lancer is recommended.
- 8.1.6 Smoking should be prohibited in areas where the solvents are used.
- 8.1.7 For further details, suppliers may be contacted before use of any cleaning solvent.

<b>Document No.:</b>	MP.0.8000.01	Revision No: 03	Issued : April' 2021
<b>Document Title:</b>	Specification of the Cleaning Solvent for Electrical Rotating Machines of Diesel Electric Locomotives.		

## 8.2 CLEANING METHODS

- 8.2.1 Cloth used for cleaning of equipment should be non-fluffy, clean and dry unless it is moistened with a recommended solvent.
- 8.2.2 Cotton waste or fluffy cloth, which is often used for general cleaning in workshop, should not be used for cleaning brush gear, commutators, electrical contacts etc., since leftover fluffs or fibres may cause electrical or mechanical failures.
- 8.2.3 Care should be taken to ensure that the cleaning fluid does not enter in machine bearings. Carbon brushes should be removed before the application of solvent.
- 8.2.4 Compressed air should be used to blow out dust, dirt etc. from electrical machines. Special water trap equipment must be fitted in the airline, since without this equipment it is virtually impossible to obtain dry air.
- 8.2.5 The spray of solvent must be kept moving over the surface and not allowed to dwell more than momentarily on a surface because solvent has a softening effect on the insulating materials and varnishes. The spray may however, be repeated in short bursts until the part shows a fair degree of cleanliness.
- 8.2.6 The solvents used during spraying may be drained into a collecting trough fitted with a sludge pump with filter and used again. Details of such recovery equipment and methods of spraying can be obtained from the solvent manufacturers.

## 9.0 STORAGE

When stored in original sealed containers under normal temperature conditions, the material shall satisfy the requirements prescribed in this specification for a period of not less than 2 years from the date of manufacture.

## 10.0 PACKING

- 10.1 The material shall be suitably packed in well closed containers. The packing shall be as agreed between purchaser and supplier and subject to the provisions of law in force in the country for the time being.
- 10.2 All containers in which the material is stored shall be clean, dry and leak- proof. The containers shall be protected from light and stored preferably in dry place. If the containers are closed with corks, those shall be protected with metal foils.

## 11.0 PROVEN TECHNOLOGY & TECHNICAL COLLABORATION

Cleaning solvents offered shall be of proven technology to meet cleaning and maintenance needs of electrical rotating machines. The Indian supplier shall furnish documentary evidence of technical collaboration, if any, with a manufacture abroad whose system of proven technology has been used by other Rail Roads. In case of offers from foreign bidders, they must indicate the plan for indigenisation in a phased manner and must enclose a copy of MOU with an Indian firm and Reserve Bank of India's clearances.

## 12.0 TEST CERTIFICATES AND MARKINGS

### 12.1 TEST CERTIFICATES

<b>Document No.:</b>	MP.0.8000.01	Revision No: 03	Issued : <a href="#">April' 2021</a>
<b>Document Title:</b>	Specification of the Cleaning Solvent for Electrical Rotating Machines of Diesel Electric Locomotives.		

The manufacturer shall provide test certificate of the solvents /material procured from outside and supplied to the purchaser.

## 12.2 MARKING

Each containers shall be marked with the following :

- (a) Name of the material.
- (b) Name of the manufacturer and / or trade mark, if any.
- (c) Net weight and gross weight of the material.
- (d) Month and year of the manufacture.
- (e) Major constituents of the material.

## 13. WARRANTY

The warranty shall be as per the IRS standard conditions.

## 14. SUBMISSION OF QAP

QAP shall prepare in line with the RDSO Document No: QM-RF-8.1-3 ("**Guidelines for preparing QAP during registration**") Version No: 1.0 dated 20.08.2018 or latest. QAP covering all the information as asked in the document under section '0' to 'I' must be given in the form of single document indicating name and works address of the firm and page no. 'x' of 'y' on each page. Each page should be signed by Quality Control in-charge. The approved QAP must be a controlled document and a quality record of ISO Quality Control System of the vendor. A certificate to this effect shall be provided along with the QAP by the vendor. One copy of the QAP, after final approval will be given back to the vendor for implementation.

## 15. VENDOR CHANGES IN APPROVED STATUS

All the provisions contained in RDSO's ISO proceeding laid down in document no. QO-D-8.1-11 Ver. 1.2 dated 22.06.2020 or latest (titled: "**Vendor changes in approved status**") and subsequent version/amendment thereof, shall be binding and applicable on the successful vendor/ vendors in the contract floated by Railway to maintain quality of products supplied to Railways.

## 16. PREFERENCE TO MAKE IN INDIA

The Government of India policy on 'Make in India' programme shall apply.

## 17. REFERENCES

Assistance has been received from the following Indian Standard Specifications and RDSO documents in the formation of this specification:-

- 17.1 IS: 6262-1971 or latest  
Method of Test for Power Factor and Dielectric Constant of Electrical Insulating Liquids.
- 17.2 IS: 12026 (Part-1) – 1986 or latest  
Guide for the determination of the aromatic hydrocarbon content of new insulating oils, Part 1: Adsorption chromatographic method.
- 17.3 IS:3202 - 1965 or latest

<b>Document No.:</b>	MP.0.8000.01	Revision No: 03	Issued : April' 2021
<b>Document Title:</b>	Specification of the Cleaning Solvent for Electrical Rotating Machines of Diesel Electric Locomotives.		

Code of practice for climate proofing for electrical equipment.

- 17.4 IS: 1448 (P-20) – 1998 or latest  
Methods of test for petroleum and its products. Determination of flash point.
- 17.5 IS: 4905-1968 or latest  
Random sampling and randomization procedures.
- 17.6 IS : 430 : 1972 or latest  
Specification for Paint remover, Solvent type, Non-flammable.
- 17.7 IS : 1448 (Pt.-I) -1998 or latest  
Methods of test for Petroleum and its products, Distillation of Petroleum products.
- 17.8 IS: 101 (Part 2/Sec1) - 1988 or latest  
Methods of sampling and test for paints, varnishes and related products, Part 2: Test on liquid paints (chemical examination), Section 1: Water content.
- 17.9 IS: 1448 (Pt - 16) : 1990 or latest & Clause 2.5  
Methods of Test for Petroleum and its products P:L6 J Density, Relative Density.
- 17.10 IS: 1745- 1978 or latest.  
Petroleum hydrocarbon solvents.
- 17.11 OECD-403 dated 7, September 2009 or latest.  
OECD Guideline for the Testing of Chemicals- Acute Inhalation Toxicity
- 17.12 OECD-404 dated 24th April 2002 or latest.  
OECD Guideline for the Testing of Chemicals- Acute Dermal Irritation/Corrosion
- 17.13 OECD-405 dated 2 October 2012 or latest.  
OECD Guideline for the Testing of Chemicals-Acute Eye Irritation/Corrosion.
- 17.14 RDSO Document No: QM-RF-8.1-3, dated 20.08.2018 or latest.  
Guidelines for preparing QAP during registration.
- 17.15 RDSO's ISO Document no. QO-D-8.1-11 Ver. 1.2 dated 22.06.2020 or latest.  
Vendor changes in approved status.
- 17.16 ASTM – D – 2109 –78  
Standard test methods for non-volatile matter in halogenated organic solvents and their admixtures.

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<b>Document No.:</b>	MP.0.8000.01	Revision No: 03	Issued : April' 2021
<b>Document Title:</b>	Specification of the Cleaning Solvent for Electrical Rotating Machines of Diesel Electric Locomotives.		

## **APPENDIX**

### **1. VISUAL EXAMINATION OF THE SOLVENT**

The solvent should be checked visually that there are no impurities and it is also clear, homogeneous and mobile.

### **2. TEST FOR IMPURITIES AND FOREIGN MATERIALS**

Place 5 drops of the cleaning solvent by means of small pipette at the center of clean white filter paper supported on the porcelain basin and allow the liquid to evaporate at room temperature away from direct sun light. Examine after 30 minutes whether there is any oil or greasy spot on the filter paper.

### **3. TEST FOR NON-VOLATILE MATTER**

A known quantity of the material is evaporated on a water bath and residue is weighed.

#### **3.1 Apparatus**

Basin of suitable capacity shall be made of platinum, silica or borosilicate glass. The surface area of the basin should be sufficiently large for quick evaporation.

#### **3.2 Procedure**

Evaporate 100 ml of the material to dry in the weighed basin on a water bath. Dry the residue for 30 minutes in an oven maintained at a temperature of 150°C ( $\pm 2^\circ\text{C}$ ). Cool in a desiccator and weigh.

#### **3.3 Calculation**

Non-volatile matter percent by,

Mass =  $M/D$ .

Where,

M = Mass in g of the residue obtained.

D = relative density of the material.

**Note:** The procedure as per ASTM-D-2109-78 (method B) may be adopted.

### **4. EFFECT OF THE SOLVENT ON INSULATING MATERIALS**

4.1 Different types of tapes (glass mica, Kapton mica, Nomex, PTFE strip and ceramic) currently in use and coated with varnish / resin also currently in use on electrical machines of Diesel Electric Locomotives, should be used in the test. The exact materials to be used for this test will be advised by Vendor Controlling Authority before internal test.

4.2 The tapes will be weighed initially and then soaked in the solvent for a period of 120 minutes. After removal from the solvent, the tapes are air dried for 5 hours and then weighed. The gain in weight shall not be more than 5%.

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4.3 Another set of weighed tapes will be soaked in the solvent for 30 minutes and then stored at  $100 \pm 2^{\circ}\text{C}$  for 60 minutes. The tapes on attaining room temperature will again be weighed. The loss in weight shall not be more than 3%.

4.4 The tapes in both cases will be examined and shall be free from any deformation or damage.

## 5. EFFECTIVENESS OF CLEANING SOLVENT

5.1 The effectiveness of the cleaning solvent shall be determined by actually cleaning old coils/sample coils in dirty state. Comparison only will be made by cleaning two exactly similar coils by CCL<sub>4</sub> & solvent. The solvent should be as effective as CCL<sub>4</sub>. After cleaning, the coils shall also be subjected to IR test.

5.2 Cleaning solvent, which gives the IR value of at least 10 Mega ohms, shall be considered to be effective. Exact test procedure shall be decided between the Vendor Controlling Authority/user and manufacturer mutually.

## 6. Determination of free Chlorine Procedure:

6.1 Take 50 ml solvent and 50 ml redistill water in a 500 ml separating funnel. Shake the content vigorously 4-5 times. Keep the mixture undisturbed till it completely separates out in two liquid phases. Extract the water phase for the test.

6.2 Take about 10 ml of the water extract in a test tube and add a small portion of AgNO<sub>3</sub> solution.

6.3 There shall not be any turbidity due to addition of AgNO<sub>3</sub> solution that will indicate the absence of free chlorine in the solvent.

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