

**SPECIFICATION  
FOR SILICONE BASED RESIN COMBINATION FOR VACCUM  
PRESSURE IMPREGNATION (VPI) {(SILICON IMPREGNATING  
RESIN AND ITS FILLER/AUXILIARY MATERIAL (IF ANY))} OF 3-  
PHASE TRACTION MOTOR TYPE 6FRA- 6068 & 6FXA-7059 OF  
ELECTRIC LOCOMOTIVES**

<b>Approved by</b>
<div style="display: flex; justify-content: space-between; align-items: center;"> <div style="text-align: center;"> <p><b>RAJIV KUMAR BARNWAL</b></p> </div> <div style="font-size: 8px; line-height: 1;"> <p>Digitally signed by RAJIV KUMAR BARNWAL DN: c=IN, st=West Bengal, 2.5.4.20-c8b287a96cd7ef65069b4c115d125fb200f09010 670176136433c61d5b3dc6c6, postalCode=713331, street=OFFICE OF CEE / TM WORKS OFFICE CLW CHITTARANJAN, pseudonym=91033d17157100cf9ef88d715139bec7, serialNumber=c4c6235df288d9fa480fb614e443504b6ffc 34164f1219198474a97078559c9, ou=ELECTRICAL, o=CHITTARANJAN LOCOMOTIVE WORKS, cn=RAJIV KUMAR BARNWAL Date: 2022.08.22 12:39:07 +05'30'</p> </div> </div> <p style="text-align: center; margin-top: 10px;"><b>CEE/TM</b></p>

<b>SPECIFICATION FOR SILICONE BASED RESIN COMBINATION FOR VACCUM PRESSURE IMPREGNATION (VPI) {(SILICON IMPREGNATING RESIN AND ITS FILLER/AUXILIARY MATERIAL (IF ANY))} OF 3-PHASE TRACTION MOTOR TYPE 6FRA-6068 &amp; 6FXA-7059.</b>		CHITTARANJAN LOCOMOTIVE WORKS, WEST BENGAL, INDIA NO.: 4TMS.096.093 Alt. 1 First Date of Issue :31/05/2021		Page 1 of 5
Prepared & Checked by	<p><b>PRADIP KUMAR MANDAL</b></p> <p style="font-size: 8px;">Digitally signed by PRADIP KUMAR MANDAL Date: 2022.08.18 17:04:39 +05'30'</p>	Reviewed by	<p><b>RANJAN KUMAR PRAMANIK</b></p> <p style="font-size: 8px;">Digitally signed by RANJAN KUMAR PRAMANIK Date: 2022.08.19 12:15:26 +05'30'</p>	
Signature Not Verified CEE/TMDO		DY.CEE/TMD		

Digitally signed by PRADIP KUMAR MANDAL  
Date: 2022.09.06 12:45:04 IST  
Reason: IREPS-CRIS  
Location: New Delhi

156731/2024/HEP-TXM20500

ALT NO.	AUTHORITY	DESCRIPTION	INITIAL	DATE
1.	CEE/TM	Digitization of Specification & Para 2.3 modified		18.08.2022

<b>SPECIFICATION FOR SILICONE BASED RESIN COMBINATION FOR VACCUM PRESSURE IMPREGNATION (VPI) {(SILICON IMPREGNATING RESIN AND ITS FILLER/AUXILIARY MATERIAL (IF ANY)} OF 3-PHASE TRACTION MOTOR TYPE 6FRA-6068 &amp; 6FXA-7059.</b>		<b>CHITTARANJAN LOCOMOTIVE WORKS, WEST BENGAL, INDIA NO.: 4TMS.096.093 Alt. 1 First Date of Issue :31/05/2021</b>		Page 2 of 5
Prepared & Checked by	<b>PRADIP KUMAR MANDAL</b> Digitally signed by PRADIP KUMAR MANDAL Date: 2022.08.18 17:05:25 +05'30'	Reviewed by	<b>RANJAN KUMAR PRAMANIK</b> Digitally signed by RANJAN KUMAR PRAMANIK Date: 2022.08.19 12:17:16 +05'30'	
SSE/TMDO		DY.CEE/TMD		

1.0 SCOPE

This specification covers the technical requirement of Silicone based resin combination for vacuum pressure impregnation (VPI) {(Silicon Impregnating Resin and its Filler/Auxiliary material (if any))} to be used for Vacuum pressure impregnation for H- and C- class insulation of 3-phase traction motor type 6FRA6068/ 6FXA7059. The material shall comply with this specification instruction in chemical composition, mechanical properties and all other listed requirements.

2.0 GENERAL

2.1 SILICON IMPREGNATING RESIN FOR VPI OR EQUIVALENT TO SILRES H62C is a methyl phenyl vinyl hydrogen polysiloxane not modified with organic components, very low volatility (Suitable for vacuum Pressure impregnation), cured by heat through catalysed addition cross linking without the formation of cleavage products, it also cures in thick layers, even in contact with air, tack free and without formation of bubbles. It is remarkably insensitive during curing to influence of various kinds of insulating materials. It contains no decomposable and physiologically problematic components. The vulcanise of SILICON IMPREGNATING RESIN FOR VPI OR EQUIVALENT TO SILRES H62C conforms to the fire safety requirements defined in UL 94 V0.

2.2 Filler /Auxiliary material is a liquid component of Silicone Impregnating Resin for VPI or Equivalent, which cured by heat through catalyzed addition cross linking without the formation of cleavage products, it also cures in thick layers, even in contact with air, tack free and without formation of bubbles. It is remarkably insensitive during curing to influence of various kinds of insulating materials. The Mixture contains no decomposable and physiologically problematic components. This instruction lays down all the requirements which are made for substance filler material.

Auxiliary material is a liquid component of Silicone Impregnating mixture.

2.3 Ratio to be used in VPI

- (a) Silicon Impregnating Resin or Equivalent - 110 parts by weight
- (b) Filler/ Auxiliary material (if any) - 02 parts by weight\*

\* Manufacturers may suggest ratio as per their product/ formulation.

Alt-1

3.0 REQUIREMENTS

3.1 Gel times for SILICON IMPREGNATING RESIN FOR VPI OR EQUIVALENT TO SILRES H62C

Temperature	Gelling Time
140° C	300 min
160° C	100 min
180° C	45 min
200° C	26 min
220° C	15 min

<b>SPECIFICATION FOR SILICONE BASED RESIN COMBINATION FOR VACCUM PRESSURE IMPREGNATION (VPI) {(SILICON IMPREGNATING RESIN AND ITS FILLER/AUXILIARY MATERIAL (IF ANY)) OF 3-PHASE TRACTION MOTOR TYPE 6FRA-6068 &amp; 6FXA-7059.</b>		CHITTARANJAN LOCOMOTIVE WORKS, WEST BENGAL, INDIA NO.: 4TMS.096.093 Alt. 1 First Date of Issue :31/05/2021		Page 3 of 5
Prepared & Checked by	PRADIP KUMAR MANDAL Digitally signed by PRADIP KUMAR MANDAL Date: 2022.08.18 17:05:56 +05'30'	Reviewed by	RANJAN KUMAR PRAMANIK Digitally signed by RANJAN KUMAR PRAMANIK Date: 2022.08.19 12:18:19 +05'30'	
SSE/TMDO		DY.CEE/TMD		

156731/2024/HEP-TXM20500

**3.2 Filler/ Auxiliary Material (If any)**

General Characteristics	Unit	Values	Test Method
Refractive index at 20°C	----	1.467±0.003	DIN 53491
Storage life from delivery date, in original airtight container at room temperature ( $\leq 25^{\circ}\text{C}$ )	Months	12	IEC 455-2 Section 14

**4. Product data (Cured for 16 Hrs at 150°C)**

Typical General Characteristics	Inspection Method	Value
Appearance	Visual	Clear, Transparent
Density at 25°C		1.16 g/cm <sup>3</sup>
Hardness Shore D	DIN 53505	60-80
Flexural strength at 25°C	DIN EN ISO 178	24--40N/mm <sup>2</sup>
Thermal conductivity at 50°C	DIN 52612	0.2 W/km
Specific heat at 0-100°C		1.45 j/(g.K)
Volume resistivity $\rho_v$ , at 23°C	IEC 60093, (=DIN 53482)	1.5x10 <sup>15</sup> $\Omega$ cm
Dielectric strength(50Hz) at 23°C a) Surrounding medium: electrical insulating mineral oil	IEC 60243-1	27 kV/mm
Dielectric strength(50Hz) at 23°C b) Surrounding medium: silicone rubber(SIR)	IEC 60243-1	82 kV/mm

**4.1 Special Tests**

Sealed Tube Test set up (for testing reactions with other insulating items)	IEC 60038-18-22
VPI of Test sample with Vacuum and Temp Control	For BDV after VPI

All the test specified in the specification shall be carried out preferably at manufacturer's works. The manufacturer shall arrange all the necessary machinery, apparatus, labour and assistance required for conducting the tests without Extra cost. If any testing facility is not available at firm's premises, the test has to be done from any Govt. approved NABL lab at own (Firm's) cost.

<b>SPECIFICATION FOR SILICONE BASED RESIN COMBINATION FOR VACCUM PRESSURE IMPREGNATION (VPI) {(SILICON IMPREGNATING RESIN AND ITS FILLER/AUXILIARY MATERIAL (IF ANY)} OF 3-PHASE TRACTION MOTOR TYPE 6FRA-6068 &amp; 6FXA-7059.</b>		CHITTARANJAN LOCOMOTIVE WORKS, WEST BENGAL, INDIA NO.: 4TMS.096.093 Alt. 1 First Date of Issue :31/05/2021		Page 4 of 5
Prepared & Checked by	PRADIP KUMAR MANDAL Digitally signed by PRADIP KUMAR MANDAL Date: 2022.08.18 17:06:37 +05'30'	Reviewed by	RANJAN KUMAR PRAMANIK Digitally signed by RANJAN KUMAR PRAMANIK Date: 2022.08.19 12:19:43 +05'30'	
SSE/TMDO		DY.CEE/TMD		

**5.0 APPLICATION**

Silicone based resin combination for vacuum pressure impregnation (VPI) {Silicon Impregnating Resin and its Filler/ Auxiliary material (if any)} to be used for Vacuum pressure impregnation for C- class insulation of 3-phase traction motor type 6 FRA6068 / 6FXA7059.

**6.0 REFERENCE TO ABB STANDARDS**

This specification is equivalent to ABB specification HZN: 02582 & HZN:02583 for the item Silicon Impregnating Resin or Equivalent and HZLK:605002 for Filler/Auxiliary material (if any)

**7.0 SHELF LIFE**

Shelf life of the material in the original sealed drum at a room temperature 25°C should be  $\geq 09$  months for Silicon Impregnating Resin or Equivalent and  $\geq 12$  months for Filler/ Auxiliary material (if any) .

**8.0 PACKING**

The material shall be supplied in Drum of 20/25/180/200kg. The material shall be suitably packed so as to ensure safe transportation of material without any damage.

**9.0 MARKING**

The material shall be labelled securely and indelibly (e.g. with an adhesive label on an appendage) with the following information –

- Name of the manufacturer, purchase order reference and date.
- Name, quantity, batch no., date of manufacture & expiry date of the material.
- Special precaution for storage, if applicable for the material.

**10.0 SPECIAL INSTRUCTION**

If any deviation in properties of product data, firm may seek approval of the same submitting detail justification regarding gelling time, viscosity, colour, ratio etc.

Firm should submit detail VPI procedure of their product along with offer.

Firm should submit Compatibility Test report of their product vs Existing Silicone based resin combination for vacuum pressure impregnation (VPI) before prototype inspection indicating that there will be no adverse effect on existing insulation scheme.

<b>SPECIFICATION FOR SILICONE BASED RESIN COMBINATION FOR VACCUM PRESSURE IMPREGNATION (VPI) {(SILICON IMPREGNATING RESIN AND ITS FILLER/AUXILIARY MATERIAL (IF ANY)) OF 3-PHASE TRACTION MOTOR TYPE 6FRA-6068 &amp; 6FXA-7059.</b>		<b>CHITTARANJAN LOCOMOTIVE WORKS, WEST BENGAL, INDIA NO.: 4TMS.096.093 Alt. 1 First Date of Issue :31/05/2021</b>		Page 5 of 5
Prepared & Checked by	<b>PRADIP KUMAR MANDAL</b> Digitally signed by PRADIP KUMAR MANDAL Date: 2022.08.18 17:07:11 +05'30'	Reviewed by	<b>RANJAN KUMAR PRAMANIK</b> Digitally signed by RANJAN KUMAR PRAMANIK Date: 2022.08.19 12:21:30 +05'30'	
SSE/TMDO		DY.CEE/TMD		