

WOSS 501/7

British Railways Board

Director of Mechanical and Electrical Engineering

**Varnish Impregnation of
Electrical Machines**

WORKSHOP OVERHAUL STANDARD SPECIFICATION

REVISION RECORD

This Specification will be updated when necessary by the issue of amended pages accompanied by revision letters. The amended or additional part of re-issued pages will be marked with a vertical black line.

If you consider that an amendment is necessary, complete BR Form 14298 and pass it to the local BRB Resident Engineer or Area Quality Engineer. Submission of a form does not authorise the proposed amendments.

Revision No.	Re-issued Page Nos	Date	Inserted by
1	CONTENTS OF BOOK	AUG 86	

Revision No.	Re-issued Page Nos	Date	Inserted by

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 London Road
 Derby
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First published - NOV 1985

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This Specification applies to equipment fitted to the vehicles indicated 'X' below, but it is only to be implemented when authorised by an appropriate maintenance/overhaul document.

LOCOMOTIVES

03	X
08	X
09	X
20	X
25	X
26	X
27	X
31	X
33	X
37	X
43	X
45	X
47	X
50	X
56	X
58	X

73	X
81	X
85	X
86	X
87	X
88	X
89	X
91	X

DMU's

101	X
104	X
107	X
108	X
110	X
111	X
114	X
115	X
116	X
117	X
118	X
119	X
121	X
122	X
128	X
140	X
141	X
142	X
143	X
150	X
151	X

EMU's

302	X
303	X
304	X
305	X
307	X
308	X
309	X
310	X
311	X
312	X
313	X
314	X
315	X
317	X
318	X
319	X
504	X
507	X
508	X

411	X
412	X
413	X
414	X
415	X
416	X
419	X
421	X
422	X
427	X
432	X
455	X

485	X
486	X
487	X
488	X
489	X

DEMU's

201	X
202	X
203	X
204	X
205	X
207	X

COACHING STOCK

Mk 1	X
Mk 2, 2a-c	X
Mk 2d-e	X
Mk 2f	X
Mk 2 DBSO	X
Mk 3a	X
Mk 3b	X
Mk 3 (HST)	X
Mk 3 SLE and SLEP	X
Non Passenger	X

WOSS 501/7
WORKSHOP OVERHAUL STANDARD SPECIFICATION 501/7
VARNISH IMPREGNATION OF ELECTRICAL MACHINES

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Sections 2 to 4 not applicable

INTRODUCTION

This specification covers the requirements for Vacuum - Pressure Impregnation and Varnish Dipping of electrical equipment fitted to traction and rolling stock.

The type of varnish to be used will be found by reference to the WOSS or other specification for the component to be treated. Where no details are given it should be assumed that solvented stoving varnish (polyester class F) is to be used.

To assist in differentiating between the two basic types of varnish used, in this specification the solvented type is always referred to as "varnish" whereas the solventless type is referred to as "resin".

MATERIALS	BR Cat No	Approval Reference (see WOSS 501/6)
Polyester Film - Release Treated	55/12626	1.1.3
Masking Lacquer Sterling type 004-0168	28/38540	-----
Masking Grease Sterling type 004-1552	----	-----
Resin Impregnated Sealing Tape	55/121035	1.7.1
Solvented Stoving Varnish (Polyester Class F)		
Sterling MK 495	28/76501	3.1.4
Crosbie Armatherm 236	28/76065	3.1.4
Solventless Stoving Resin (Polyester Class H)		
Sterling 075-1480	7/57966	3.2.1

Other resins approved to WOSS 501/6 may also be called up.

REFERENCE SPECIFICATIONS

WOSS 501/6 Register of Approved Materials for Electrical Machines on Traction and Rolling Stock

SECTION 1. PROCEDURE

1. Varnish Maintenance

1.1 The varnish/resin to be used must be checked at least once every month and any necessary corrective action taken as follows :-

1.1.1 Solvented Varnish :-

Measure viscosity using a method approved by the manufacturers. Correct viscosity by addition of varnish or reducer as necessary.

1.1.2 Solventless Resin :-

Measure viscosity, gel time and cure time using a method approved by the manufacturers. If corrective action is necessary consult the manufacturer.

1.2 Storage Conditions

1.2.1 Solvented Varnish :-

Do not allow the varnish to become contaminated with dirt or water.

1.2.2 Solventless Resin :-

Store resin at a temperature between 15°C and 20°C. Do not allow the resin to become contaminated with dirt or water.

2. Preparation

2.1 Where areas of the work piece are required to be masked to prevent adhesion of the varnish/resin they must be covered with masking lacquer. On large flat areas apply a layer of cotton tape before masking to ease removal of the lacquer.

2.2 When using solventless resin on components which have bolted assemblies the bolts must be sealed to prevent ingress of resin or they must be removed, coated with masking grease and refitted.

Note:-If a torque value is specified the bolts must not be greased without first consulting the D of M & E E BRB at Derby for revised torque values.

2.3 Where flexible cables are fitted these must not be impregnated with varnish/resin. If it cannot be arranged that the exposed ends of cables are kept out of the varnish/resin they must be sealed using resin impregnated sealing tape .

3. Impregnation

- 3.1 Pre-heat, impregnate and stove in accordance with the appropriate table. Record the times and temperatures indicated in the table.
- 3.2 When using solventless resin on field coils which are not mounted on a pole brick they must be stoved in a vertical position with the terminal end uppermost. Coils must be suspended in a manner which prevents damage to the insulation. e.g. Use loops of glass tape which can be subsequently trimmed off after stoving.

4. Finishing

- 4.1 Remove varnish/resin from shafts, tapped holes, connection surfaces and other machined surfaces.
- 4.2 Remove all masking compounds and excess varnish/resin
- 4.3 Trim off all suspension tapes flush with the surface of the component.

TABLE 1 PROCESS FOR V P I OF ARMATURES IN SOLVENTLESS RESIN

PROCESS	SMALL(up to 300 mm Dia)	MEDIUM(up to 600 mm Dia)	LARGE(over 600 mm Dia)
1. Record Starting Time			
2. Stove at 160°C for at least	6hr	10hr	16hr
3. Record time			
4. Allow to cool to	40-50°C	40-50°C	40-50°C
5. Record temperature of work			
6. Transfer to vacuum pressure vessel			
7. Draw a vacuum of 2 to 5 Torr. Maintain this for at least	15 mins	30 mins	30 mins
8. Record the temperature of the resin			
9. Draw resin into the vessel to cover the windings and risers but not the commutator			
10. Record time			
11. Pressurise the vessel to 60 PSI (+ 5 P S I). Maintain this for at least	30 mins	30 mins	30 mins
12. Return the resin to the storage tank. Release the pressure and allow to drain for	30-60mins	30-60mins	30-60mins
13. Record time			
14. Transfer to oven. Stove to cure at 160°C for at least	6 hr	10 hr	16 hr
15. Record time			

TABLE 2 PROCESS FOR V P I OF ARMATURES IN SOLVENTED VARNISH

PROCESS	SMALL(up to 300 mm Dia)	MEDIUM(up to 600 mm Dia) 600 mm DIA)	LARGE(over 600 mm Dia)
1. Record Starting Time			
2. Stove at 160°C for at least	6hr	10hr	16hr
3. Allow to cool to	50-60°C	50-60°C	50-60°C
4. Transfer to vacuum pressure vessel			
5. Draw a vacuum of at least 28"Hg Maintain this for at least	15 mins	30 mins	30 mins
6. Draw varnish into the vessel to cover the windings and risers but not the commutator			
7. Pressurise the vessel to 40 PSI (\pm 5 P S I).Maintain this for at least	30 mins	30 mins	30 mins
8. Return the varnish to the storage tank. Release the pressure and allow to drain for	30-60mins	30-60mins	30-60mins
9. Record time			
10. Transfer to oven. Stove to cure at 160°C for at least	6 hr	10 hr	16 hr
11. Record time			

TABLE 3 PROCESS FOR V P I OF FRAMES/STATORS AND FIELD COILS IN SOLVENTLESS RESIN

PROCESS	SMALL(up to 300 mm rotor Dia) Also coils treated seperately	MEDIUM(up to 600 mm rotor Dia)	LARGE(over 600 mm rotor Dia)
1. Record Starting Time			
2. Stove at 160°C for at least	4hr	8hr	12hr
3. Record time			
4. Allow to cool to	40-50°C	40-50°C	40-50°C
5. Record temperature of work			
6. Transfer to vacuum pressure vessel			
7. Draw a vacuum of 2 to 5 Torr. Maintain this for at least	15 mins	30 mins	30 mins
8. Record the temperature of the resin			
9. Draw resin into the vessel to cover the windings but not the ends of any flexible cables			
10. Record time			
11. Pressurise the vessel to 60 PSI (\pm 5 P S I). Maintain this for at least	30 mins	30 mins	30 mins
12. Return the resin to the storage tank. Release the pressure and allow to drain for	30-60mins	30-60mins	30-60mins
13. Record time			
14. Transfer to oven. Stove to cure at 160°C for at least	4 hr	8 hr	12 hr
15. Record time			

TABLE 4 PROCESS FOR V P I OF FRAMES/STATORS AND FIELD COILS IN SOLVENTED VARNISH

PROCESS	SMALL(up to 300 mm rotor Dia) Also coils treated seperately	MEDIUM(up to 600 mm rotor Dia)	LARGE(over 600 mm rotor Dia)
1. Stove at 160°C for at least	4hr	8hr	12hr
2. Allow to cool to	50-60°C	50-60°C	50-60°C
3. Transfer to vacuum pressure vessel			
4. Draw a vacuum of at least 28"Hg Maintain this for at least	15 mins	30 mins	30 mins
5. Draw varnish into the vessel to cover the windings but not the ends of any flexible cables			
6. Pressurise the vessel to 40 PSI (\pm 5 P S I).Maintain this for at least	30 mins	30 mins	30 mins
7. Return the varnish to the storage tank. Release the pressure and allow to drain for	30-60mins	30-60mins	30-60mins
8. Record time			
9. Transfer to oven.Stove to cure at 160°C for at least	4 hr	8 hr	12 hr
10.Record time			

TABLE 5 PROCESS FOR VARNISH DIP OF ARMATURES IN SOLVENTLESS RESIN

PROCESS	SMALL(up to 300 mm Dia)	MEDIUM(up to 600 mm Dia)	LARGE(over 600 mm Dia)
1. Record Starting Time			
2. Stove at 160°C for at least	4hr	8hr	12hr
3. Record time			
4. Allow to cool to	40-50°C	40-50°C	40-50°C
5. Record temperature of work			
6. Immerse the component in solventless resin for 30 mins or until all bubbling stops. Remove from the resin and allow to drain for	30-60mins	30-60mins	30-60mins
7. As an alternative to operation 6 a V P I plant may be used with minimum vacuum and pressure to achieve the same result as follows			
7.1 Transfer to vacuum pressure vessel			
7.2 Draw a vacuum then draw resin into the vessel to cover the windings but not the ends of any flexible cables			
7.3 Pressurise the vessel and return the resin to the storage tank. Release the pressure and allow to drain for	30-60mins	30-60mins	30-60mins
8. Transfer to oven. Stove to cure at 160°C for at least	4 hr	8 hr	12 hr

TABLE 6 PROCESS FOR VARNISH DIP OF ARMATURES IN SOLVENTED VARNISH

PROCESS	SMALL(up to 300 mm Dia)	MEDIUM(up to 600 mm Dia)	LARGE(over 600 mm Dia)
1. Record Starting Time			
2. Stove at 160°C for at least	4hr	8hr	12hr
3. Record time			
4. Allow to cool to	50-60°C	50-60°C	50-60°C
5. Record temperature of work			
6. Immerse the component in solvanted varnish for 30 mins or until all bubbling stops. Remove from the varnish and allow to drain for	30-60mins	30-60mins	30-60mins
7. As an alternative to operation 6 a V P I plant may be used with minimum vacuum and pressure to achieve the same result as follows			
7.1 Transfer to vacuum pressure vessel			
7.2 Draw a vacuum then draw varnish into the vessel to cover the windings but not the ends of any flexible cables			
7.3 Pressurise the vessel and return the varnish to the storage tank. Release the pressure and allow to drain for	30-60mins	30-60mins	30-60mins
8. Transfer to oven. Stove to cure at 160°C for at least	4 hr	8 hr	12 hr

TABLE 7 PROCESS FOR VARNISH DIP OF FRAMES/STATORS AND FIELD COILS IN SOLVENTLESS RESIN

PROCESS	SMALL(up to 300 mm rotor Dia) Also coils treated seperately	MEDIUM(up to 600 mm rotor Dia)	LARGE(over 600 mm rotor Dia)
1. Record Starting Time			
2. Stove at 160°C for at least	4hr	8hr	12hr
3. Record time			
4. Allow to cool to	40-50°C	40-50°C	40-50°C
5. Record temperature of work			
6. Immerse the component in solventless resin for 30 mins or until all bubbling stops. Remove from the resin and allow to drain for	30-60mins	30-60mins	30-60mins
7. As an alternative to operation 6 a V P I plant may be used with minimum vacuum and pressure to achieve the same result as follows			
7.1 Transfer to vacuum pressure vessel			
7.2 Draw a vacuum then draw resin into the vessel to cover the windings but not the ends of any flexible cables			
7.3 Pressurise the vessel and return the resin to the storage tank. Release the pressure and allow to drain for	30-60mins	30-60mins	30-60mins
8. Transfer to oven.Stove to cure at 160°C for at least	4 hr	8 hr	12 hr

TABLE 8 PROCESS FOR VARNISH DIP OF FRAMES/STATORS AND FIELD COILS IN SOLVENTED VARNISH

PROCESS	SMALL(up to 300 mm rotor Dia) Also coils treated seperately	MEDIUM(up to 600 mm rotor Dia)	LARGE(over 600 mm rotor Dia)
1. Record Starting Time			
2. Stove at 160°C for at least	4hr	8hr	12hr
3. Record time			
4. Allow to cool to	50-60°C	50-60°C	50-60°C
5. Record temperature of work			
6. Immerse the component in solvented varnish for 30 mins or until all bubbling stops. Remove from the varnish and allow to drain for	30-60mins	30-60mins	30-60mins
7. As an alternative to operation 6 a V P I plant may be used with minimum vacuum and pressure to achieve the same result as follows .			
7.1 Transfer to vacuum pressure vessel			
7.2 Draw a vacuum then draw varnish into the vessel to cover the windings but not the ends of any flexible cables			
7.3 Pressurise the vessel and return the varnish to the storage tank. Release the pressure and allow to drain for	30-60mins	30-60mins	30-60mins
8. Transfer to oven.Stove to cure at 160°C for at least	4 hr	8 hr	12 hr