WOSS 501/9

British Railways Board

Director of Mechanical and Electrical Engineering

Building of Commutators

WORKSHOP OVERHAUL STANDARD SPECIFICATION

WOSS 501/9

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.

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BUILDING OF COMMUTATORS

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TOOLS

Building Ring With Segmental Pressure Pads or Taper Building Ring

Serrated Plate for Riser End Micanite Projection *

Press Plate for Taper Building Ring

Guide Pins

Torque Spanner

Vee Machining Gauge

Keyway Alignment Gauge

Micrometer Gauge

Feeler Gauge

* This is not necessary when batches of less than 10 commutators are being produced.

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MATERIALS

Commutator Segments to BS 1434, extra close tolerance, grade 2 (i.e. silver bearing)

Micanite Separators to BS 626 normal grade, stack gauged and supplied in packs corresponding to not more than a quarter of a commutator set plus spares

Micanite or GRP Vee Ring

Micanite Sleeve

Steel Components

MS4 Silicone Grease

Silicone Rubber Sealant or
Micanite & Insulators PVL 102 Sealing Putty

INTRODUCTION

This Specification covers the preparation and manufacturing process for the construction of wedgebound and archbound commutators. The variations in the procedure for each type of construction are indicated in the text.

The type of commutator fitted to a particular type of machine may be found by reference to the relevant WOSS or from the D of M & EE BRB on the Telephone Extension given in the front of this specification.

PROCEDURE

1. Preparation of Copper Segments

    1.1 Ensure that the segments are flat as defined in BS 1434 and are free from burrs.

    1.2 Machine slots in the segment riser to accept the armature windings. Where a BRB drawing exists the dimensions of the slot shall be as quoted on the drawing.

    1.3 Measure the segments for chordal thickness and arrange in four groups according to thickness. i.e. one group containing the thickest segments, one group containing the thinnest segments and two intermediate groups.

2. Preparation of Micanite Separators

    2.1 Inspect the micanite separators for flaking and soft patches. Discard defective separators. After inspection retain the separators in their original stacks.

3. Preparation of Building Jigs

    NOTE: Jigs with serrated baseplates must be used when batches of 10 or more commutators are being assembled.

    3.1 When using serrated baseplates check that the plate is free from burrs or other surface defects and that the micanite separator location slots are clean.

    3.2 Ensure that all component parts of the jig are free from surface defects and that the bolts run freely in the threaded holes.

    3.3 Lubricate all threads (and where necessary sliding surfaces) with a small quantity of silicone grease.

    3.4 Place the building jig on a solid surface.

4. Assembly of Copper Segments and Micanite Separators in Building Jig

4.1 Using Serrated Baseplate:

Arrange copper segments and micanite separators into the building jig with the riser end of the segments flat on the baseplate and the riser end of the separators located in the appropriate slot.

4.2 Without The use of the Serrated Baseplate:

Arrange copper segments and micanite separators into the building jig with the riser end uppermost. Ensure that the micanite separators project above the segment risers and that the working face of each commutator segment is in contact with the building jig.

4.3 Position the pressure pads so that they are equally spaced around the commutator circumference. Gradually tighten the building jig ensuring that the commutator remains circular.

4.4 Check the chordal spacing at 4 equally spaced points around the commutator.

Correct any inaccuracies by rearranging the segments and then re-tightening as described above.

4.5 Using a square, check that the segments are parallel to the axis. If necessary adjust and retighten as described above.

5. INITIAL CONSOLIDATION

5.1 Stove the complete assembly at a temperature of 180°C for a period of 3 hours (counted from the time the assembly achieves 180°C).

5.2 Remove the assembly from the oven and whilst still hot retighten the building jig.

5.3 Allow the assembly to cool to ambient temperature and again retighten the building jig.

6. MACHINING OF VEES

6.1 Transfer the assembly to a vertical borer or lathe.

6.2 Machine a reference diameter at the front end of the working face of the commutator and in the bore. Face the non riser end of the commutator.

6.3 As an alternative to clause 6.2 machine a reference diameter in the bore of the commutator at the riser end and face a band at that riser end to facilitate checking of the chordal spacing. The outside diameter of the band to be less than the outside diameter of the insulating vee rings which are to be fitted.

6.4 Using a jig fitted into the internal diameter machined in clause 6.2 or 6.3 to give a true centre check the chordal spacing at 4 positions 90° apart.

If it is necessary to release the building jig to rearrange commutator segments repeat clauses 4 and 5 and re-test.

6.5 Measure and record the diameter of the commutator at the reference band machined in clause 6.2. Alternatively mark four equally spaced positions around the commutator and measure the diameter over the risers at those points.

6.6 On commutators with a finished diameter of more than 500 mm rough machine the front and rear vees. Retighten the assembly in accordance with clause 5.3.

6.7 Machine the front and rear vees to the appropriate gauge.

7. PREPARATION OF STEEL VEES

7.1 Ensure that the front and rear steel vees are free from distortion, cracks, burrs and bruises. Check that all threads run freely over the full length of travel. Lubricate threads and boltheads with a small amount of silicone grease.

7.2 Place the insulating vee rings onto the steel vee rings and check these seat correctly.

8. ASSEMBLY OF COMMUTATOR

8.1 Clean all internal surfaces of the commutator using a fluffless cloth damped with methylated spirits. Check that no particles of copper or other foreign matter remain.

8.2 Lightly lubricate spigot faces and the internal surfaces of the commutator with silicone grease. Ensure that the silicone grease does not contaminate the outer end of the front insulating vee or problems may occur when subsequently fitting the vee ring extension protection in accordance with CEPS 25.

8.3 Apply a bead of silicone rubber or where specified PVL sealing putty to the sealing grooves on the steel vees. If silicone rubber is being used allow it to cure at room temperature for at least 12 hours before applying heat to the assembly.

8.4 Fit the insulating sleeve to the commutator.

8.5 Fit the front and rear steel vees to the commutator. Where the rear steel vee ring has a keyway ensure that the alignment of segments to keyway is correct by the use of an appropriate gauge. Check the alignment of the keyway at four positions on the commutator 90° apart. The maximum permitted tolerance is as follows:

± 0.2 m up to and including 500 mm diameter commutators

± 0.4 mm over 500 mm diameter

NOTE: On wedgebound commutators it will be necessary to slacken the building jig bolts slightly to allow the vee rings to enter the commutator assembly.

8.6 Fit the commutator bolts and tighten them a little at a time until a torque of approximately 25% of the final torque is achieved. Ensure that the front vee ring and commutator are both parallel and square to the rear vee ring within a maximum tolerance of ±0.4mm. A press or other suitable means may be used to assist with the tightening process.

9. STATIC SEASONING

9.1 Stove the complete assembly at a temperature of 180°C for a period of 3 hours (counted from the time the assembly achieves 180°C).

9.2 Remove the assembly from the oven and whilst hot tighten the commutator bolts a little at a time until 90% of the final torque is achieved. During this operation ensure that the steel vee rings and commutator remain parallel and square. If the temperature of the copper segments falls below 110°C at any time during the tightening process return the assembly to the oven and reheat to 180°C. A press or other suitable means may be used to assist with the tightening process.

9.3 Return the assembly to the oven and stove at 180°C for a period of at least 8 hours.

9.4 Repeat Clause 9.2 using the full torque values specified for that commutator.

9.5 Measure and record the diameter of the commutator at the reference band machined in clause 6.2. or measure the diameter over the risers at the points marked in clause 6.5.

9.6 Remove the building jig and repeat Clause 9.5. The difference between the initial and final readings should not be greater than 0.13 mm. If this figure is exceeded contact the D of M&EE BRB at Derby.

10. ROTATIONAL SEASONING

10.1 Season the commutator in accordance with WOSS 501/8.

11. TESTING AND EXAMINATION

11.1 Test the insulation between each of the commutator bars by applying a 500 V ac supply.

11.2 Carry out a high pressure insulation test between the commutator bars and the steelwork for a period of 1 minute using the voltage specified in the relevant specification or as agreed with the D of M & EE BRB at Derby.

11.3 Using a suitable jig compare the chordal spacing of the bars at 90° intervals around the commutator. The maximum permitted difference between measurements is 0.2 mm for commutators up to and including 500 mm diameter and 0.4 mm for commutators over 500 mm.

11.4 Using a square, check that the commutator bars are parallel to the axis the maximum permitted deviation from parallel is 0.2 mm for commutators up to and including 125 mm long and 0.4 mm for commutators over 125 mm long.

NOTE: The above tolerances must not be cumulative above the higher of the individual tolerances.