Specification No. RDSO/2008/EL/SPEC/0065(Rev'0')

सत्यमेव जयते

Government of India
Ministry of Railways

Technical Specification for Swaging of Rotor Bars for Rotors for Traction Motor type 6 FRA6068 for WAG9/WAP7 locos.

Specification No. RDSO/2008/EL/SPEC/0065(Rev'0')

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1. Foreword

1.1. Three phase traction motors type 6FRA 6068 are used on WAG9/WAP7 class of locomotives. The performance of these traction motors has not been satisfactory primarily due to failure of rotor bar. Loose rotor bar is the number one cause of Cu Bar rotor failures. At starting, the rotor bars oscillate at rotor bar vibration freq. = 2 X % Slip X Line Freq. The rotor bars vibrate as a consequence of high current forces. If the bars are not firmly seated, they will break over time. There are many different methods to achieve tight rotor bars, the most preferred method is swaging.

1.2. Swaging is a method for reducing the relative movement of a rotor cage with respect to the core. This movement is reduced by forming a depression in a portion of a rotor bar. The formation of depression displaces rotor bar material adjacent to the depression which in turn deforms an adjacent portion of the rotor core. The reduction of relative movement between rotor cage and rotor core is dependent on various depression geometries, quantities and positions.

2. Scope

2.1. Through this specification, it is intended to design and develop a process of swaging of rotor bars in a squirrel cage traction motor to prevent the development of crack by making them fully secured in rotor core.

2.2. This specification is applicable to two schemes of rotor for three phase traction motor type 6FRA 6068.

2.3. The specification describes the process of swaging, the geometry of swaging with respect to rotor bars used in three phase traction motor type 6FRA 6068.

3. Governing Specifications

This specification is valid for following two schemes of rotors:

3.1. Scheme I : Shaft Mounted Zirconium Copper Stamping Resistance Ring Design as per RDSO/2007/EL/SPEC/0060(Rev'0')

3.2. Scheme 2: Resistance Ring Mechanically Interlocked to Endplate Design as per Specification No. RDSO/2007/EL/SPEC/0061(Rev'0')

3.3. CLW specifications and drawings for materials and dimensions: Same CLW existing specifications and drawings for TM 6FRA6068 except in case of items where specific mention is given in the subsequent para of this specification.

4. Qualification Criteria for Tenderers

Swaging has to be carried out by the tenderers by mechanized process and they must have in house design and development capability, manufacturing and testing facility for Three phase AC Traction motors. Tenderer, not having adequate competence in this field will not be considered.

5. Technical Conditions :

Swaging has to be carried out on all the rotor bars with pneumatic tool with a force of 10 ton. Hammering with chisel is prevented.

5.1. **Geometry of Swaging** : Depth of depression is preferably in the range of about 6% to 8%.Width of depression is preferably in the range of about 30% to 35%.The radius of curvature of depression is also an important geometrical quantity. The radius of curvature of depression is preferably in the range of about 0.127 cm to 0.191cm. Within this range depression will have a minimum of sharp notches.

5.2. **Swaging Tool :** Normally any standard pneumatic/hydraulic tool can ne used for sawing with proper swaging Swage tool , used shall have a minimum functional length of 2.54 cm and width of 0.305 cm. Total length of the tool should be min 8mm . Guide keys on the press shall fit firmly in the rotor slot openings. No hammering should be necessary. The tool shall a locating arm attached to one side with a location stop. The arm is adjusted to locate the depressions on either side of the axial canter line of the rotor assembly. The arm is adjusted by loosening a set screw and sliding the locating arm so that when the locating stop is against the end ring, the depression is just to the right of the axial centreline. Similarly, when the tool locating arm is properly adjusted and the stop rests on the inboard side of the end ring, the depression is just to the left of the axial canter line.

5.3. **Process of Swaging :** Swaging has to be carried in two steps – first immediately after inserting the rotor bars in the core and again after brazing the rotor bars with resistance rings. In both these steps swaging has to be carried out on the full length and on all the bars. The swage tool is positioned to form a depression on the first chalk-marked rotor bar extending lengthwise from 25 mm from the core end. The process of swaging shall be so uniform it shall not damage the rotor bars.

6. Quality Assurance Plan (QAP)

6.1. The successful tenderer shall formulate and furnish a quality assurance plan (QAP) covering the details swaging of rotor bars in the QAP of the complete rotor. The QAP shall be furnished to RDSO at design approval stage and got approved as part of design approval.

6.2. The QAP shall essentially contain the each step involved in swaging , its geometry , tool proposed to be used and final test .

7. Design clearance

7.1. The tenderer shall submit the following documents to RDSO for getting the design approval :

7.1.1. Details of design along with calculations.

7.1.2. Detailed dimensional drawings of rotor and its components.

7.1.3. QAP

8. Routine Inspections

8.1. The routine inspections shall be carried out as per test plan approved by RDSO as part of QAP by an authorized representative of Indian Railways.

9. Documents to be furnished by Tenderer

The tenderer shall submit clause by clause compliance of this technical specification along with the tender documents. Statements like "noted" etc shall not be treated as compliance. The tenderer should explicitly write "complied" or otherwise with comments wherever applicable.

10. Drawings and Specifications

Component	RDSO drawing no Drawing No.	RDSO's Specification
Shaft Mounted Zirconium Copper Stamping Resistance Ring Design as per RDSO/2007/EL/SPEC/0060(Rev'0')		
Rotor Steel stampings with increased cooling hole dia	SKEL 4693 Rev '0' Alt 'I'	Relevant CLW Spec
Rotor Bars	SKEL 4740	RDSO/2008/EL/Spec/0063 (Rev'0')
Copper Stamping for Resistance Rings	SKEL 4738	RDSO/2008/EL/Spec/0062 (Rev'0')
End Ring	SKEL 4739	Relevant CLW Spec
Resistance Ring Mechanically Interlocked to Endplate Design as per Specification No. RDSO/2007/EL/SPEC/0061(Rev'0')		
Rotor Steel stampings with increased cooling hole dia	SKEL 4693 Rev '0' Alt 'I'	Relevant CLW Spec
Rotor Bars	SKEL 4741	RDSO/2008/EL/Spec/0063 (Rev'0')
Punched type Resistance Rings	SKEL 4742	RDSO/2008/EL/Spec/0064 (Rev'0')
End Rings	SKEL 4732	Relevant CLW Spec