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लखनऊ & 226011
Government of India - Ministry of Railways
Research, Designs & Standards Organization,
Lucknow – 226011

No. EL/3.2.182

Dated 27.08.2015

Modification Sheet No.RDSO/2015/ EL/MS/0438 (Rev.'0')

1.0: Title:

Modification in resistance ring to Increase the radial gap between resistance ring and end ring in scheme-II design of rotors for traction motor type 6FRA6068.

2.0: Object:

To increase the radial clearance between resistance ring and rotor end ring from 1.5mm to 2.5mm at devotail joints to reduce the failures of Scheme-II design of rotors for traction motor type 6FRA6068.

3.0: Existing arrangement:

- 3.1 Three phase traction motors type 6FRA6068 are used on WAG9/WAP7 class of locomotives. The performance of these traction motors with OEM design rotor had not been satisfactory primarily due to failure of rotors .
- 3.2 Investigation had been carried out by RDSO and failures had been attributed to torsional vibrations of the short circuit ring. After careful study it was decided to reduce the torsional vibrations as much as possible while allowing the axial thermal expansion of rotor bars thus reducing the stresses in rotor bars. Based on this study and validation through Finite Element Analysis of different designs it was observed that stresses on

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rotor bars reduces considerably by mechanically interlocking the resistance ring radially on the end plate at three locations while allowing it to move axially during thermal expansion. Use of zirconium copper, a stronger material for rotor bars was adopted to increase the life of rotors.

3.3 On the basis of the study, RDSO issued two design of rotors vide letter number EL/3.2.182 DATED 06.06.2008 after approval from Railway Board vide letter no 2005/Elect(TRS)/440/18/5(3Ph) Pt dated 27.05.08.

- i) Scheme-I-Stamping type resistance ring design rotors
- ii) Scheme-II- Resistance ring Mechanically interlocked to end ring design rotors.

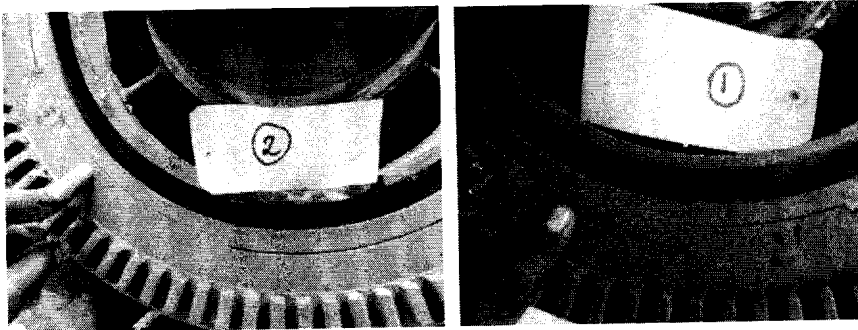
3.4 After the introduction of scheme I & scheme-II design of rotors, the performance of the traction motor type 6FRA6068 has been satisfactory. At present approx. 1498 rotors of scheme II design & 506 rotors of scheme-I design are in service.

3.5 In existing arrangement in scheme-II design the radial clearance between Resistance Ring and Rotor End Ring is 3 mm at three dovetail joints (radius of resistance ring is 186.5mm and radius of end ring is 183.5mm) and 1.5 mm at other three dovetail joints (radius of resistance ring is 179.5mm and radius of end ring is 178mm).

3.6 CLW vide letter number.CLW/TM/8021 dated 01.04.2015 reported that 09 failures have been reported in scheme-II rotors on account of rotor bar cracks. Design review of the scheme-II rotors has been carried out after careful study of the failed rotors and it was observed that in failed rotors the radial gap of 1.5mm was not existing.

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- 3.7 The scheme II design of rotors is based on the philosophy to restrict the torsional movement/vibration of resistance ring while allowing axial movement. While investigating the failed rotors it is observed that in failed rotors the axial movement of resistance ring was blocked due to infringement of resistance ring with rotor end ring at several locations causing excessive compressive loads on rotor bars during thermal expansion which results in rotor bar crack. Photographs of the some of the failed rotors are given below:

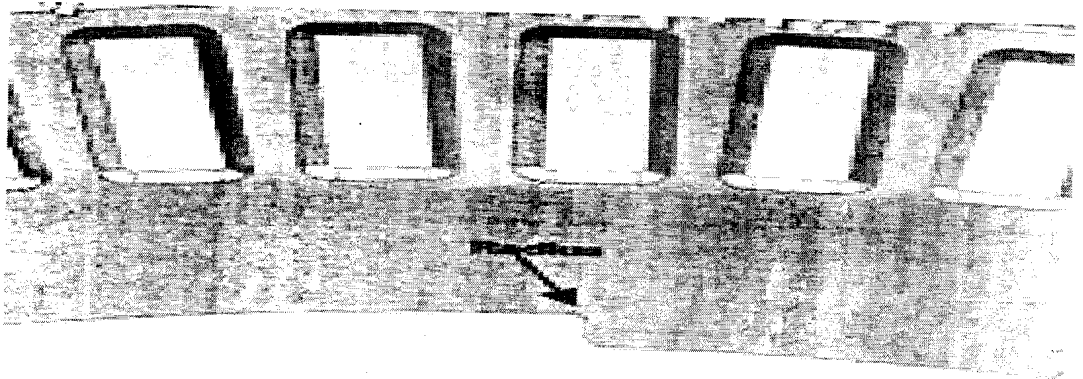


4.0: Modified arrangement:

- 4.1 During Mechanized Induction brazing of resistance ring and rotor bars, uncontrolled expansion of resistance ring is taking place at brazing temperature causing unequal radial gaps between resistance ring and rotor end ring. In some cases no radial gap is left out. The radial clearance between resistance ring and rotor end ring has been revised considering the actual expansion of resistance rings at brazing temperature.
- 4.2 The radial clearance between Resistance Ring and Rotor End Ring has been modified from 1.5mm to 2.5 mm at three dovetail joints by changing the radius from 179.5mm to 180.5mm at these dovetail joints as indicated in the drawing number SKEL 4742, Alt-1. With this, the overlap surface of Resistance Ring & End Ring will reduce from existing 4 mm to 3 mm. Radial clearance of 3mm will remain unchanged at remaining 3 devotail joints.

SKEL 4742-1

- 4.3 Further, a root radius of 1.0mm has been introduced at the corner of the dovetail step, in drg No SKEL 4742 Alt-1 to avoid stress concentration at sharp corners of dovetail steps. sketch for understanding is given below.



Resistance Ring

5.0: Application of Class of locomotives:

WAP7 & WAG9 class of locomotives

6.0: Material Required:

No additional material is required , however resistance ring to be procured as per drawing number SKEL-4742,Alt-1.

7.0: Material rendered surplus: Nil

8.0: Reference: Nil

9.0: Modified drawing:

SKEL 4742 Alt-1 Punched type resistance rings, mechanically interlocked to endplate design of rotors for traction motor type 6 FRA 6068 for WAG9/WAP7 locomotives.

SKEL-4742-1

10.0: Agency of Implementation:

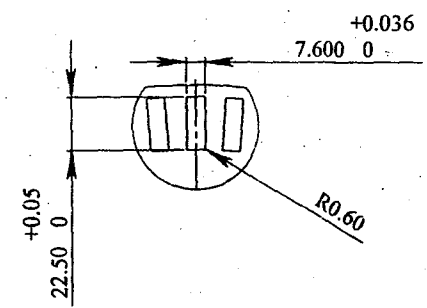
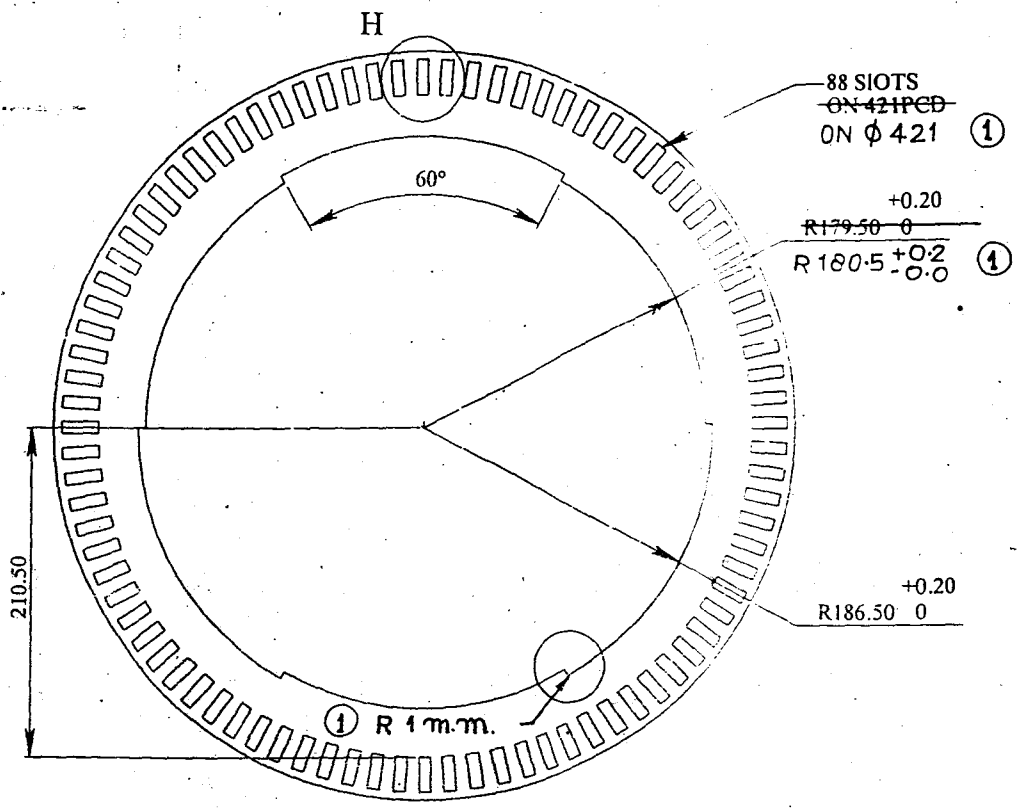
All Traction motor manufacturers, CLW and repair agencies doing new manufacturing/ repair of scheme -II rotors for traction motor type 6FRA6068

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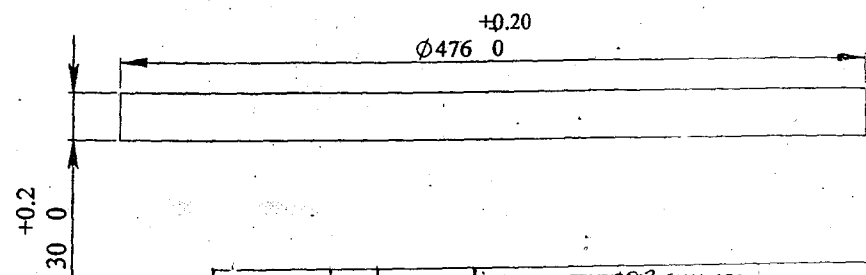
(P.K.Saraswat)

For Director General (Elect)

Encl: Drg.No.SKEL-4742,Alt-1



DETAIL H
SCALE 1 : 2



REF. NO	PART NO	DESCRIPTION	DETAIL DRG. NO	NO/LOCO	MATL	SPEC.
REF						
			APPD. BY	(FOR DG)		
		Punched Type Resistance Rings Mechanically Interlocked to Endplate Design of Rotor for Traction Motor type 6 FRA6068 for WAG9/WAP7 locos				FIRST ISSUED June. 2008
						SUPERSEDES
						SUPERSEDED BY
			R.D.S.O.ELECT. DTE	SKEL-4742		
				ALT. '0'		

STATUS	ALT. REF. NO	DESCRIPTION	APPD. BY	DATE
	1	DIM R179.5 $\begin{matrix} +0.2 \\ 0 \end{matrix}$ CHANGED TO R180.5 $\begin{matrix} +0.2 \\ 0 \end{matrix}$. ROOT RADIUS R1mm INCORPORATE AT CORNER OF DOVETAIL STEP. 421PCD CORRECTED AS ϕ 421		27-8-15

DWG NO. 4742
D.L.C. MUMBAI
01-0-08