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सत्यमेव जयते

भारत सरकार – रेल मंत्रालय
अनुसंधान अभिकल्प और मानक संगठन
लखनऊ – 226 011
Government of India – Ministry of Railways
Research, Designs & Standards Organization,
LUCKNOW – 226 011

No.EL/3.1.35/2(3-phase) 17/11/2011

Chief Electrical Engineer,

- Central Railway, Mumbai CST- 400 001.
- Northern Railway, Baroda House, New Delhi-110 001
- South Central Railway, Rail Nilayam, Secunderabad –500 071
- South Eastern Railway,Garden Reach, Kolkata -700 043
- West Central Railway, Jabalpur-482001
- South East Central Railway, Bilaspur-495004
- East Central Railway, Hazipur-844101 (Bihar)
- Chittaranjan Locomotive Works, Chittaranjan- 713 331

MODIFICATION SHEET No. RDSO/2011/EL/MS/0396 (Rev. '0') Dated: 17.10.2011

1.0 Title:

Modification in Brake hanger mounting brackets (Holder and Support) of WAP-7/WAG-9 Electric locomotives to prevent crack/ breakage of bracket.

2.0 Object:

Railways have reported crack/breakage of Brake hanger mounting brackets (CLW drawing no.1209-01.212-034 Alt-1, 1209-01.212-037 Alt-1 and 1209-01.212-035) of WAP-7/WAG-9 Electric locomotives.

It is observed that crack initiates from the area where pivot tube is welded with the bogie bracket and travels to the outer surface and finally complete eye is broken. The failure of Brake hanger mounting bracket is of very serious nature as after the breakage, complete brake hanger assembly along with TBU/PBU may fall on the track.

3.0 Present Arrangement:

Brake hanger assembly is suspended from pivot tube, which is welded to the bogie bracket. A radial thickness of 15 mm is provided around the eye hole of 64 mm dia in the bogie bracket. The pivot tube is welded in this 64 mm dia hole and complete brake hanger with PBU/TBU is suspended from this pivot tube. It also takes the load of braking effort while brakes are applied.

4.0 Failure investigation:

Railway Board had constituted a committee comprising of DSE(CS)/RDSO, Dy.CEE/D-II/CLW and Sr.DEE/TRS/GMO/ECR to jointly study the problem and submit recommendations to address the above issue. The committee submitted its report no. RDSO/2010/EL/IR/0144(Rev 0) in December 2010.

The broken piece of locomotive No. 30213 was sent to Metallurgical & Chemical Directorate of RDSO for investigation and confirmation of micro-structure, chemical composition etc.

The failure of bogie bracket in fatigue manner adjacent to welding at eye hole from heat affected zone was due to following reasons:-

(i) The abrupt change of structure across the transition of heat affected zone having martensite & bainite structure and base plate having elongated as rolled grains of ferrite & pearlite.

(ii) Brittleness produced in the heat affected zone due to lack of preheating at the time of welding.

5.0 Modified Arrangement:-

(i) The brake hanger mounting brackets of WAP-7/WAG-9 locomotives should be monitored closely. Dry penetrate test (DPT) on mounting brackets should be done on all the WAP-7/WAG-9 locomotives during every MOH/IOH/POH.

(ii) In the modified design of brake hanger mounting bracket the radial thickness around eyehole is increased from 15 mm to 33 mm as per drawing no. SKEL-4862 and SKEL-4863 (copy enclosed) on all existing WAG-9 locomotives.

The replacement of brake hanger mounting bracket with modified design should be done during POH or any other opportunity. The detailed procedure is given in Annexure 'A'.

(iii) For this purpose CLW should modify the bracket drawing as proposed. CLW should adopt new design of bogie bracket as per drawing no. SKEL-4862 and SKEL-4863 on all newly manufactured WAG-9 locomotives. The following improvements in the modified design of bogie bracket should also be incorporated:-

a) The raw material of steel plate to be used for manufacturing the component should be in normalized heat treated condition with guaranteed impact strength of 50 J at room temperature and 25 J at -20° C.

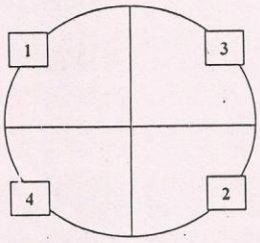
b) The cutting of the sections from the raw material to the required size of the component should be done in such a manner that the longer portion containing eyehole should have metal flow lines along the rolling direction.

(iv) While welding pivot tube in the bogie bracket following suggestions given by M&C Directorate should be followed:-

a) Preheating of the base metal (bogie bracket) and circular steel tube (pivot tube) after placing weld tacks should be done at 150°C-200°C followed by the welding with CO_2 copper coated wire (dia. 1.2mm) of Grade ER 90 S – D_2 as per AWS A5 – 28 – 96/Class III as per IRS: M – 46 - 03.

b) Inter pass temperature should be about 150°C.

c) Edge preparation shall be given to the plate to about 45° with root face about 1.0 – 2.0 mm. Welding sequence to be followed during fabrication is given below in four stages:



d) Stresses should be relieved by localized heating using oxy-acetylene flame for 8-10 minutes.

e) The welded area around the eye hole should be subjected to dye penetrated testing or Magnetic particle testing with the help of portable electromagnetic yoke to ensure that the weld deposit and the adjacent heat affected area is free from any cracks.

6.0 The conversion work of WAP-7 bogie for adoption of conventional type brake rigging is being done as per RDSO Modification sheet no. RDSO/2009/EL/MS/0381 Rev'0' dated 07/09/2009. Hence above modification of bogie bracket need not to be implemented on WAP-7 locomotives. However DPT should be done during MOH/IOH/POH or any other opportunity till complete conversion to conventional brake rigging is done.

7.0 One newly manufactured WAG-9 locomotive no. 31294 has been successfully provided with modified bogie brackets at CLW as a trial fitment.

8.0 **Application to Class of Locomotives:**

All WAG-9 Electric locomotives.

All WAP-7 Electric locomotives with original TBU/PBU type brake rigging as mentioned in para 6.0 above.

9.0 **Agency of Implementation:**

CLW/CRJ,
All Electric Loco sheds maintaining 3-phase locomotives,
POH workshops.

10.0 **Periodicity of Implementation:**

CLW- During manufacturing of new WAG-9 locomotives.

Electric Loco sheds-

(a) DPT during MOH/IOH schedule on unmodified bogie brackets.

(b) During replacement of bogie bracket.

POH Workshops-During POH

17/11

(S. K. Gupta)
for Director General/Electrical

Encl: (1) Welding procedure for replacement of Mounting Brackets
(2) Drawing No.SKEL-4862
(3) Drawing No. SKEL-4863

Annexure 'A'

Procedure for replacement of Mounting Bracket and holder to bogie frame:

a) Dismantle the bogie frame and clean it with caustic soda or any other recommended cleaning agent. The dust, dirt, oil/grease shall be removed with hot water jet.

b) Remove brake hanger mounting brackets and plate (Drg No. 1209-01.412-139) by oxy-cutting cleanly. Care should be taken during cutting operation to prevent formation of notches and excess removal of material. There should not be any mark or traces of foreign material on the bogie frame from where brackets are removed. Also the grinding should be done at all the cut locations smoothly for removal of stress raiser point.

c) Bogie shall be examined after this for smooth finish and inspected for any cracks/abnormality at all the locations by DPT.

d) The brackets for various locations shall be manufactured as per RDSO Drawing No. SKEL-4862 and SKEL-4863 observing improvements suggested in para 5.0 (iii) above.

e) Proper cleaning of area where brackets and plate are to be welded should be done by grinding. Edge of the brackets and plates should also be cleaned by kiss grinding before welding.

f) It is proposed/desired to carry out welding of Bracket and plate in flat position. For this purpose a suitable manipulator may be used. In absence of manipulator the bogie should be suitably tilted for easy accessibility of welding location.

g) The modified bracket and plate shall be welded at appropriate location by MIG/MAG welding. Use of proper jig to locate the bracket in position shall be used. The welding procedure and inspection/testing of weld quality shall be done as below:-

Welding Procedure

1. The weld area shall be preheated to about 150^0 C by using oxy-acetylene torch.
2. Metal Active Gas (MAG) welding process using CO2/(Argon+ 1-5% O_2) shielding gas shall be used. MIG/MAG welding filler wires approved under IRS class-III as per IRS M-46 of size 1.2 mm (preferably) should be used.
3. Welder employed for welding of bogie frame shall have a high standard of workmanship and shall be qualified to IS: 817/IS:7310.
4. A Weld joints shall have uniform beading and smooth change over from weld deposit to parent metal and thorough fusion between adjacent layers of weld metal and between weld metal and parent metal.

5. Adequate measures shall be taken in the process to avoid distortion during welding.
6. Weld joints shall be free from cracks, craters, undercuts, overlaps, porosity, inclusions, blow-holes etc.
7. In butt welded area, no extra runs are needed than required. Only stress raiser if any shall than be ground off by to and fro motion of grinder to eliminate stress raisers.
8. The fillet weld profile shall be flat to concave with concavity within the stipulated limits depending upon fillet size so that smooth transition occurs at the toe of weld maintaining correct size of the welds.
9. For welding of circular area, circumferential welding sequence shall be followed.
10. The quality of entire weld length shall be checked by Dye Penetrant test by the Quality cell and record to be kept.

h) Bogie frame shall be coated with one coat of anti-corrosive paint in order to prevent rusting.

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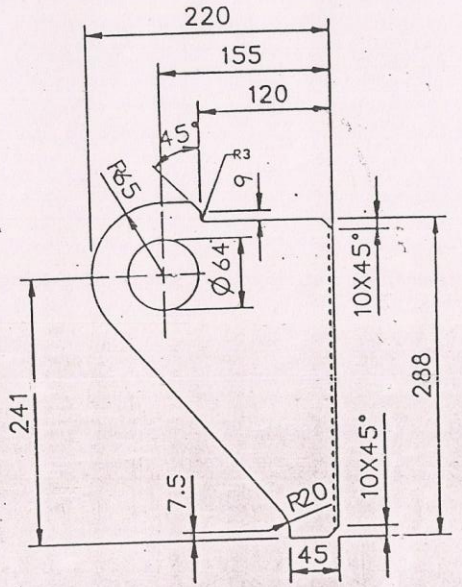
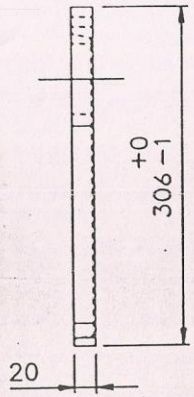
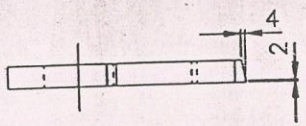






▽	50
▽▽	25
▽▽▽	6.3
▽▽▽	0.8
▽▽▽	0.1

SYMBOL (Roum (Max.)*)

*SURFACE ROUGHNESS TO IS:3073
WELDING SYMBOLS TO IS:813
TOLERANCES ON UNTOLERANCED DIMENSIONS TO IS:2102 (MED.)

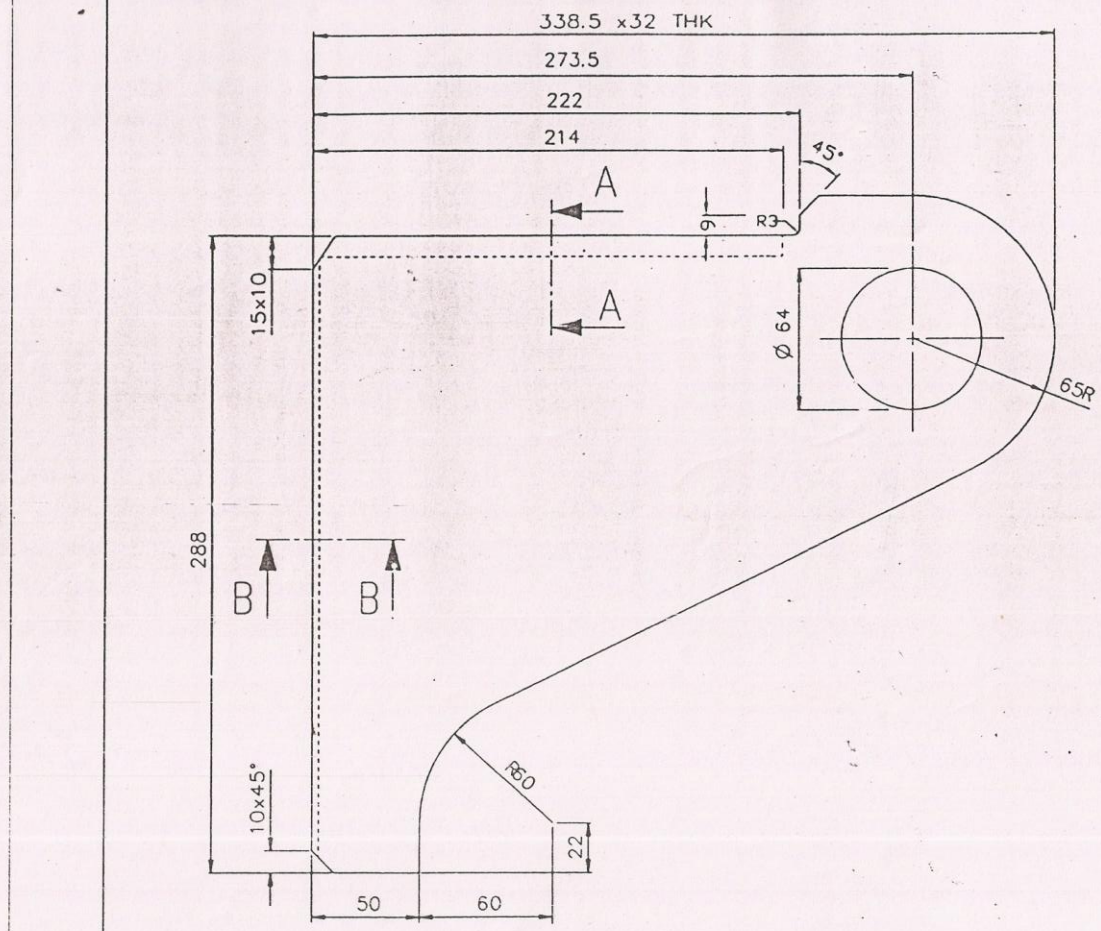
ALL DIMENSIONS ARE IN mm

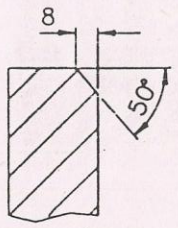
APPLICABLE FOR WAG9 LOCO

HOLDER

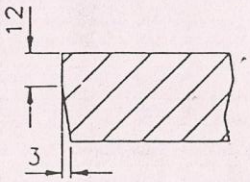
INDIAN RLYS RDSO

आरेखण संख्या DRG. NO. SKEL-4862





SECTION A–A



SECTION B–B

~	50
▽	25
▽▽	6.3
▽▽▽	0.8
▽▽▽+	0.1

SURFACE ROUGHNESS TO IS:3073
WELDING SYMBOLS TO IS:813
TOLERANCES ON UNTOLERANCED DIMENSIONS TO IS:2102 (MED.)

ALL DIMENSIONS ARE IN mm

APPLICABLE FOR WAG9 LOCO

SCALE– 1:2

SUPPORT

INDIAN RLYS RDSO

DRG. NO. SKEL–4863

FIRST ISSUE