

**Government of India
Ministry of Railways
Research , Designs & Standards Organisation**

**Manak Nagar,
Lucknow—226011**

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Technical Circular No . 1

Address :
As per Distribution list

Sub : Repair Method Of Bogie Frame .

Kindly find enclosed herewith a copy of manual no . PA - 159 on repair method of bogie frame /{ Horn block} of WAG6 C locomotives which is very informative and educative for welding repair work of all type of bogies . This report may be used as a general guidance and training of staff. Following additional points may be incorporated in the above report :-

- i) Dye penetrate test should be carried out after gouging of the cracked portion to ensure that there is no old crack left behind.
- ii) An improved brand of class C2 and DI of IRS M-28 electrodes should be used after preheating them at 250⁰C for atleast one hour prior to use.



Encl : As above

(O.H. Pande }
for Director General / Elect.

Distribution

As per enclosed list

REPAIR METHOD OF BOGIE FRAME (HORN BLOCK) OF WAG6C LOCOMOTIVES

1. Scope of application

The following work procedure provides the sheet plate working and welding for repair of cracked parts of the horn block of the bogie frame.

2. Table 1 preparation for work

No.	Item	Name	Q'ty
1.	Measuring tools	5-mtape measure,,2-m convex scale	1 each
2.	Restraining members	Equal angle steel, 100 x 100 x 10, Length: 2500	2 pieces
3.	''	Bolt for horn block	2 pieces
4.	Gouging tools	Pneumatic grinder. See sketch *1.	2 pieces
		Offset grinding wheel. See sketch *2. (Type: A/W, 36 P, Ø100)	50 pieces
		Hand grinder. See sketch *3.	2 pieces
		Rotary bar. See sketch *4. (Type: (A), (B))	(A)7+(B)3
		Shank grinding wheel. See sketch *5.	30 pieces
		Air hose. Hose adapter: 1/4, Inside diameter of hose: 9.5 mm	2/15m
5.	Welder	Manual welder	1 pieces
6.	Dye penetrant fluids	Detergent, penetrant, and developer fluids	As required
7.	Annealing	Tempil stick for 600°c–800°c	3 pieces
8.	Hand tools	1–pound hammer, flat chisel, cape chisel	2 each



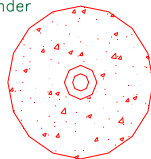
*1. Pneumatic grinder



*3. Hand grinder



*2. Offset grinding wheel



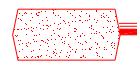
Skill touch grinding wheel



*4. Rotary bar (A)



*4. Rotary bar (B)



*5. Shank grinding wheel

3 Work procedure

1. Explanation of work procedure and method
2. Remove all the parts which may become obstacles to repair and which may be broken by repair work.
3. Put the removed parts in a pallet or a box and keep them in the specified storage place.
4. Take measures to prevent them from losing and to protect them from dust.

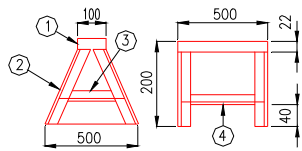
Appoint a person responsible for the storage of the removed parts.

4

1. So place the bogie frame that it can be repaired easily.
2. Take care that the bogie frame will not be twisted when it is placed on the stands.
 - o The allowable twist of the whole bogie frame is 0.3 mm.
3. Take care that the bogie frame will not slip down or incline during the repair work.

Measure the twist with a level or a transit.

Keep the safety strictly.



Reference drawing of stand

- Dimensions of members of stand
- 1 SS41-22T: 100 x 500 x 22
 - 2 Angle steel bar: 75 x 75 x 9 x 710
 - 3 Angle steel bar: 75 x 75 x 9 x 480
 - 4 Angle steel bar: 75 x 75 x 9 x 490

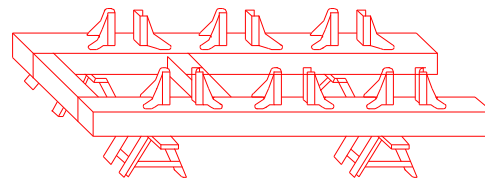
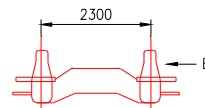
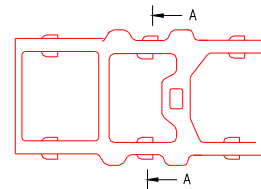


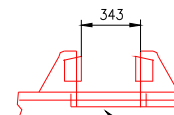
Fig.2 how to place bogie frame

5

1. Measure the dimension between horn blocks (343mm) and the width of each horn block (2300mm), and take a record of them.
2. Measure the above dimensions as shown in Fig.3.



Section A-A



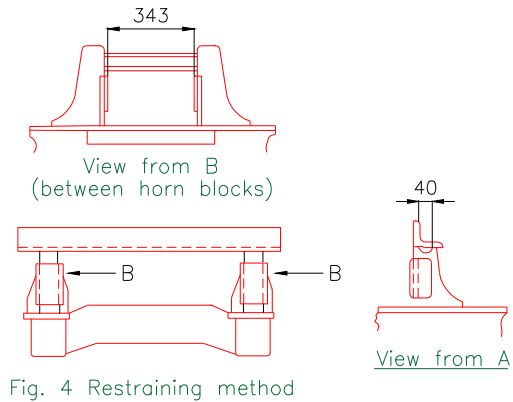
View from B

Fig.3 Measuring positions of dimensions

6

1. Install restraining members to prevent deformation caused by the welding heat (Angle steel bar of 100 x 100 x 10 x 2500).
2. Install the restraining members as shown in fig.4.

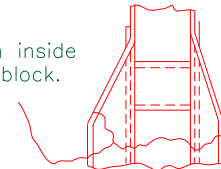
Use $\phi 50 - \phi 60$ steel bars or 2" (Outside diameter: 60.5) high-pressure steel pipes as restraining members between horn blocks



7

1. Gauge crack (a) on the inside of the horn block shown in Fig. 5 with a tungalloy cutter as shown in (b).
2. Gauge the cracked part as shown in (c).
3. Gauge 5 - 10 mm longer than each end of the crack.

(a) Crack on inside of horn block.



(b) Tungalloy cutter

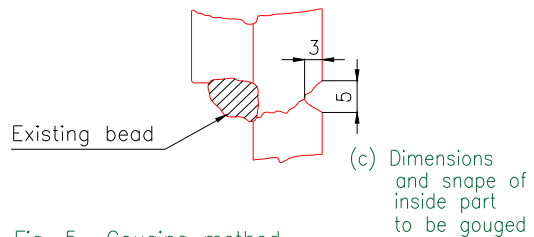
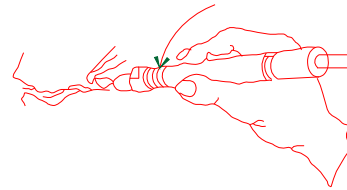


Fig. 5 Gouging method and dimensions of cracked portion

8

1. Weld the cracked part of the inside of the horn block under the condition shown in Table 2.
2. If welding has been stopped halfway, be sure to remove all slag and spatters with a chipping hammer, wire brush, etc. Before starting welding again.

Table 2 Welding condition

Welder	Welding rod		Current	Position	Drying of welding rod (if possible)	
	Brand	Rod diameter			Temperature	Time
DC	AWS E7016 or E7018	ø3.2	80 ^A - 140 ^A	Horizontal	300°C-350°C	1.0 hr

9

1. Lay the weld bead as shown in (a) or (b).
2. Judge how to lay the bead from the condition of the crack.
3. In case of (b), remove all the slag and spatters after the first pass.

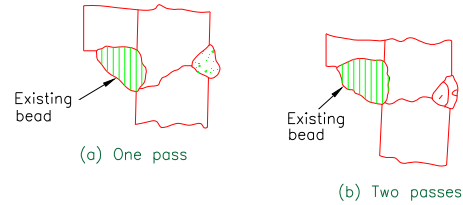


Fig. 6 how to lay weld beads

10

1. Confirm there is not a defect in the toe of weld and there is not one such as blow hole in the bead.
2. Gauge any defective part, then weld it again See Fig.7.

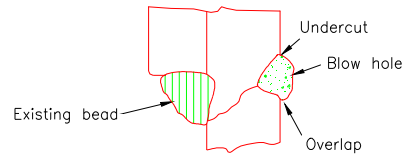
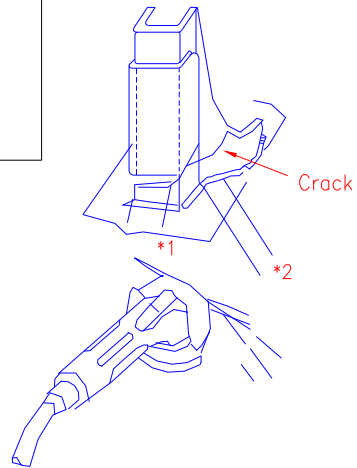


Fig. 7 Weld defects

11

Repair of defective part (on outside)

1. Gauge a crack with a pneumatic grinder and tungstolloy cutter. Cut off the weld beads in lengths marked *1 and *2 as shown in Fig. 8.
2. Gauge as shown in (a) (Cutting dimension: 8-9 x 13 mm).
3. When preparing the part on outside to be repaired, cut off the bottom of the weld bead on the inside (*3) by about 1.0-2.0 mm.



12

Dye penetrant check

1. Remove all metal chips and dust from the prepared part on outside for repair.
2. Wash the prepared part with detergent, then degrease it.
3. Let all the detergent evaporate.
4. Apply penetrant fluid, and wait for about 15 minutes.
5. Wash out the penetrant fluid with the detergent.
6. After the detergent has evaporated, apply developer fluid.
7. Check for defects (indication). If any defect is found, gouge it.

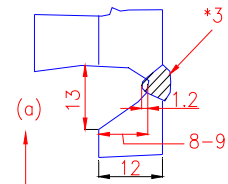
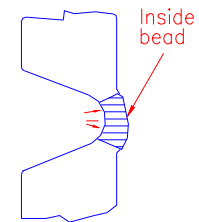


Fig. 8 Dimensions of gauged parts *1 and *2

Any defect must not be made along the border of inside bead on bottom of prepared part.



13 Welding

1. For the welding condition of the outside, see Table 2 in page 4.
2. The number of layers is shown in Fig.9.
3. Remove all the slag and each time one layer is deposited (with a chipping hammer, wire brush, jet chipper, etc).

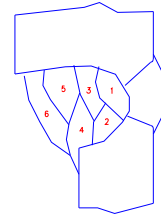


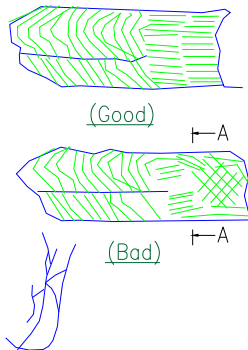
Fig. 9 Number of layers

14 Peening the layers

1. Peen the welded part to relief it from strain.
2. Peen the second, third and last layers as shown in Fig. 10,11, and 12.
3. Evenly and smoothly peen each bead.

Precaution

- a. If the peening chisel bounds irregularly, the bead surface is flaked. As the result, the remaining strain cannot be removed and the next bead cannot be deposited normally.



Section A-A Flaking of bead surface

If the bead is peened irregularly and constantly in vertical, horizontal or inclined position, the bead surface is flaked as shown in Section A-A.

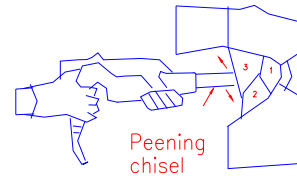


Fig. 10 Peening the second layer

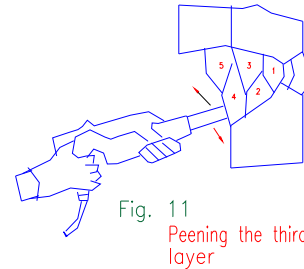


Fig. 11 Peening the third layer

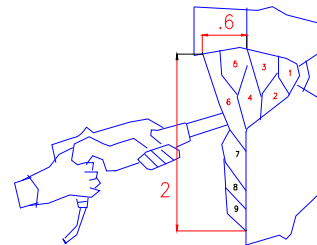
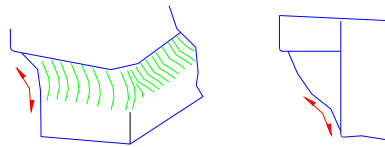


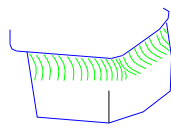
Fig.12 Peening the last layer

15 Finishing the welded part roundly

1. Finish the welded part roundly with a grinder to lower the concentration of stress as shown in Fig. 13.
2. Use a rotary bar to finish the welded part.
3. The grinding direction, surface roughness of the finished surface, and cutting depth must be as shown below in (a), (b), and (c).



(a) Surface must be ground in direction of stress concentration.

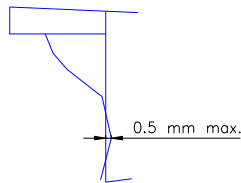


25^S

1. Surface roughness
1 S = 1/1000 MM
2. Surface roughness means



(b) Surface roughness of finished surface



(c) Cutting depth

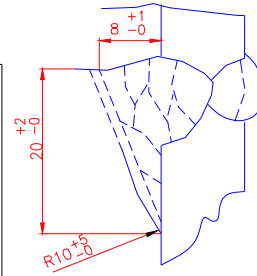


Fig. 13
Finishing
dimensions of
weld bead

16 Reinforcement welding

1. Gauge the existing weld bead as shown in Fig. 14.
2. When applying arc air gouging, do not cut part No. (17) horn block. Leave a part of the existing weld bead and finish with an air grinder as shown below in (a).

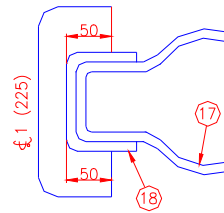
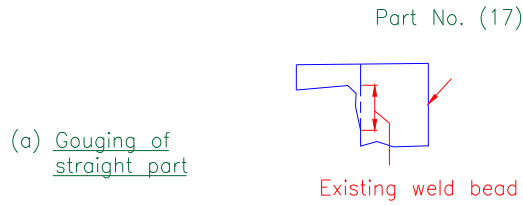
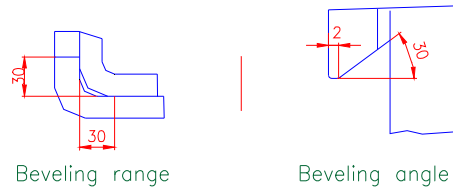


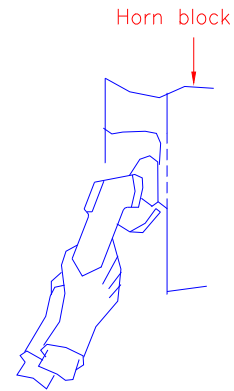
Fig. 14 Gauging dimensions



3. Gouging of round parts and beveling dimensions
Leave the existing weld bead on the round part and finish with a grinder, similarly to 2-(a).
Finish as shown below in (b).



(b) Dimensions and shape



* If all the weld bead is removed by an air arc gouging, the horn block is cut. Thus, be sure to leave it by about 1.0 mm, then finish with a grinder.

18 Welding

1. First, weld the inside of beveled round part of the horn block as shown in Fig. 17.
2. When depositing the first layer on the bottom of the beveled part, confirm it securely penetrates. Remove all the slag after each s deposited.
3. For the welding condition, see Table 2 in page 4.
4. After the inside of the beveled part has been welded, weld the specified part.
5. If welding has been stopped halfway, remove all the slag from the end of bead before starting welding again from there.

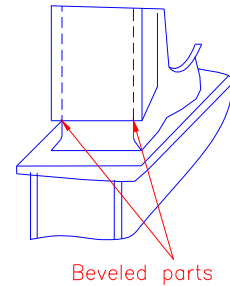


Fig. 17 (a) Beveling of round parts

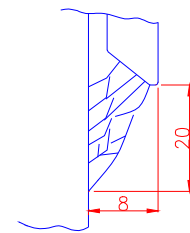


Fig. 17 (b) Number of layers

19 Finishing roundly

1. Finish the welded surface with a grinder to lower the concentration of stress as explained in page 7.

20 Inspection

1. Confirm the welded surface is grounded roundly in the direction of the stress concentration.
2. Confirm the welded part is finished to $R10_{+0.5}^0$.
3. Confirm the leg size is 8 x 20, R10.
4. Confirm the welded part is free from weld defects (undercut, overlap, cold lap, blow hole, etc).
5. Confirm the cut depth of the base metal at weld toe is less than 0.5 mm.

