Government of India

Ministry of Railways



# Scope & Schedule of Work for periodic Repair, Rehabilitation of Bogie Frames With Schedule of Technical Requirements for Electric Locomotives

Specification No. RDSO/2008/EL/SPEC/0057 (Rev-'0')

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## Scope & Schedule of Work for periodic Repair, Rehabilitation of Bogie Frames With Schedule of Technical Requirements for Electric Locomotives

### 1.0 GENERAL:

This scope and Schedule of work deals with the repair and rehabilitation of bogies for electric locomotives for the following type of bogies used in electric locomotives.

i) Trimount cast steel co-co bogies for WAM4, WAG5 locos as per RDSO's specn. No. MP.0.4900.04 Rev '01' of Oct'04.
ii) Cast steel flexi coil bogies with bolster for WAP1, WAP4 locos as per RDSO's specn. No. MP.0.4900.04 Rev '01' of Oct'04.
iii) Fabricated co-co bogies for WAG5 HB locos for BHEL built locomotive.
iv) High adhesion fabricated co-co bogies for WAG7 locos as per RDSO's specn. No. VL. SPEC 6 (Rev. 01) of Jan,01

The attention to the bogies in electric loco sheds and workshops are given due to cracks at various locations, attention to the liners due to improper clearances and deformation in bogie frames which leads to frequent breakages of components, like liners, springs, brake rigging, abnormal wear of wheels, brake blocks etc. Therefore, to ensure safe and reliable working of bogies and its suspension arrangement in electric locos, the periodical attention and repairs of the bogie should be carried out. Moreover, after a considerable period in service and development of major defects, the major rehabilitation work is required which cannot be done in electric loco sheds and workshops to ensure safe and reliable working of the bogie, suspension and brake rigging.

### 2.0 SCOPE OF WORK:

2.1 The scope of work has taken care of the periodical as well as breakdown attention to be given to the bogies of electric locos during major schedules like IOH & POH. Considering the life of components, the need for replacement, the required attention has been incorporated for brake rigging, pins, bushes and brackets etc., alongwith the complete bogie frame with bolster.

2.2 The Schedule of Technical Requirements is given as on eligibility criteria of vendors regarding their infrastructure, competence & capability to undertake the repair works.

2.3 The relevant instructions, guidelines issued from RDSO and practices being adopted by Zonal Railways have been incorporated and the references are indicated.

2.4 The details of work to be carried out during various schedules, its procedure, testing ,inspection at various stages, the documentation and other related aspects are given in the following paras

### 3.0 Trimount cast steel co-co bogies for WAM4, WAG5 locos as per RDSO's specn. No. MP.0.4900.04 Rev '01' of Oct'04

3.1 <u>Work to be done during POH and /or after development of major defects</u>

1. Cleaning of bogie frame
2. Squareness checking of bogie frame and its correction, if required.
3. DPT of bogie frame at critical zones as given by RDSO and attention to the cracks.
4. Dimensional checking of horns, if widened to be repaired.
5. All face liner size 160x200x6.2 changing – 24 nos/loco.
6. All horn leg liner "35x140x6.2 changing – 24 nos/loco.

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7. Changing of liners of bogies transom bracket (sand witch liner 90x90x6.2 center hole 35 mm – 24 nos/loco)
8. Changing of guide liners of horizontal lever – 16 nos/loco and checking of its bracket and to be changed on condition basis.
9. Checking of outer hanger bracket (08 pairs) inner hanger bracket (08 nos) & middle hanger bracket (08 nos) should be changed if it is fabricated otherwise in case of casting, all bushes to be changed and brackets are to be repaired.
10. Changing of brake cylinders 08 nos per loco on condition basis.
11. All pins & bushes of bogie & brake rigging to be changed
12. All hangers to be changed
    i) Outer hanger 08 nos per loco.
    ii) Inner hanger 08 nos per locos.
    iii) Middle hanger (04 nos LH, 04 nos RH) per loco.

13) Brake shoe holder along with brake block and its fasteners to be changed – 24 nos.

- Modified tie bar to be changed – 04 nos per locos.
-Safety sling to be changed – 08 nos per loco.
-Changing of top slack adjuster modified – 08 nos/loco.
-Changing of linkage modified – 08 nos/loco.
-Changing of equalizer plate top & bottom – 16 nos/loco.
-Changing of brake equalizer level on condition basis – 08 nos/loco

14. Modified foot step to be changed – 04 nos/loco.
15. Thorough checking and repairing of side bearer pan along with oil filling cup and replacement of liners.
16. Spring seat along with guard of bogie frame should be changed.
17. Horizontal & vertical liners of center pivot cavity along with oil filling cup with pipe to be changed.

3.2 **Work to be done during IOH**

1. Bogie cleaning.
2. DPT of bogie frame at critical zones as given in drawings to be done and attention to the crack
3. Changing of all face liner size 160x200x6.2– 24 nos/loco.
4. Changing of all horn leg liner "35x140x6.2– 24 nos/loco.
5. Changing of liners of bogies transom bracket (sand witch liner 90x90x6.2 centre hole 35 mm – 24 nos/loco).
6. Checking of guide liners of horizontal lever – 16 nos/loco and checking of its bracket and to be changed on condition basis.
7. Checking of all brake hangers and its brackets.
8. Checking of brake shoe holder along with brake block and its fasteners to be changed , all brake blocks to be changed.
9. Checking of condition of modified tie bar – 04 nos per locos.
10. Safety sling to be changed – 08 nos per locos.
11. Checking and repairing of Top slack adjuster modified – 08 nos/loco.
12. Checking and repairing of linkage modified – 08 nos/loco
13. Changing of equalizer plate top & bottom – 16 nos/loco
14. Checking of brake equalizer lever & worn out bushes to be changed – 08 nos/loco.
15. Liners of center pivot cavity to be changed on condition basis and oil filling cup along with its pipe to be checked and changed on condition basis.

16. Thorough checking and repairing of side bearer pan along with oil filling cup and replacement of liners on condition basis.
17. Modified foot step to be changed on condition basis – 04 nos/loco.
18. All pins & bushes of bogie frame & brake rigging to be changed.

**3.3 Cast steel flexi coil bogies with bolster for WAP1, WAP4 locos as per RDSO's specn. No. MP.0.4900.04 Rev '01' of Oct'04.**

Work to be done during POH and /or after development of major defects

1. Cleaning of bogie frame & bolster.
2. Squareness checking of bogie frame and its correction, if required.
3. DPT of bogie frame & bolster at critical zones as given in specification and attention to the cracks.
4. Dimensional checking of horns, if found worn out to be rectified by metal deposition and then grinding.
5. Leg liner of horn adopter 35x140x6 mm changing – 24 nos/sets.
6. Changing of horn adopter along with fasteners – 24 nos/loco.
7. Changing of face liner of adopter 160x200x6.2 mm – 24 nos/loco.
8. Brake rigging complete along with brake head and brake block to be changed with modified one.
9. Changing of all spring seats (top & bottom) for happy pad provision as per RDSO Guidelines
10. All pins & bushes of bogie frame & brake rigging to be changed.
11. Overhauling of bolsters
    a) Face liners changing (200x200 6 mm) – 04 nos/loco.
    b) Liner in two halves changing – 04 sets/loco
    c) Friction piston assembly changing – 04 nos/loco.
    d) Dimensional checking of center pivot of bolster and horizontal & vertical Polyimide liners in center pivot to be changed – 02 set/loco vertical & 02 nos/loco horizontal.
    e) Face liner of friction end pocket of bogie frame to be changed.
    f) Smooth movement of friction piston locking bar to be ensured, the groove formation in the bolster at the location of friction piston device to be filled with manganese materials and then grinding to be done. The provision of polyamide sleeve on friction piston device to be done as per RDSO modification sheet no. RDSO/2008/EL/MS/0354, Rev('0') dt. 29.01.08.

3.4 Work to be done during IOH:

1. Cleaning of bogie frame & bolster
2. DPT of bogie frame & bolster at critical zones as given in specification to be done and attention to the cracks.
3. Checking of all horns pedestal, adopter and fasteners to be changed on condition basis.
4. All pins & bushes of bogie frame & brake rigging to be changed.
5. Checking of all brake hanger levers, bracket and to be changed on condition basis.
6. Happy pads to be provided at top & bottom of primer spring as well as on secondary springs, Therefore the checking of all spring guard and spring seats and to be changed on condition basis for provision of Happy pads as per RDSO Guidelines
7. Overhauling of bolster
    a) Face liners changing on condition basis (200x200x6 mm) – 04 nos/loco.

b) Liner in two halves changing – 04 sets/loco
c) Friction piston assembly changing on condition basis – 04 nos/loco
d) Checking of center pivot of bolster and horizontal & vertical polymide liners in center pivot to be changed – 02 set/loco vertical & 02 nos/loco horizontal.
e) Face liner of friction end pocket of bogie frame to be changed.
f) Smooth movement of friction piston locking bar to be ensured, the groove formation in the bolster at the location of friction piston device to be filled with manganese materials and then grinding to be done. The provision of polyamide sleeve on friction piston device to be done as per RDSO modification sheet no. RDSO/2008/EL/MS/0354, Rev('0') dt. 29.01.08.

3.5 **High Adhesion fabricated Co-Co bogie for WAG7 Locos as per RDSO Specification No. VL.Spec6(Rev01) of January 2001**

**Work to be done during POH and /or after development of major defects**

1. Cleaning of bogie frame.
2. Squareness checking of bogie frame and its correction, if required.
3. RDPT of bogie frame and X-ray(Radiography) of 12 Nos. critical joints.
4. Dimensional checking of horns, if widened & cracked, the same to be repaired and machined.
5. All face liner size 160x200x6.2 changing – 24 nos/loco
6. All horn jeg liner "35x140x6.2 changing – 32 nos/loco
7. Change of liners of bogies transom bracket (sandwich liner 90x90x6.2 center hole 35 mm – 24 nos/loco
8. Changing of guide liners of horizontal lever - 16 nos/loco and checking of its bracket and to be changed on condition basis.
9. Checking of outer hanger bracket (08 pairs) inner hanger bracket (08 nos) & middle hanger bracket (08 nos) & to be changed on condition basis.
10. Changing of brake cylinders 08 nos per locos on condition basis.
11. All pins & bushes of bogie & brake rigging to be changed
12. All hangers to be changed –
    a) Outer hanger 08 nos
    b) Inner hangers – 08 nos
    c) Middle hanger (04 nos LH, 04 nos RH)
13. Brake shoe holder along with brake block and its fasteners to be changed – 24 nos
    a) Modified tie bar to be changed – 02 nos per locos
    b) Modified stopper of inside outer hanger to be provided as per Drg. No. – 04 nos per loco.
    c) Safety sling to be changed – 04 nos per loco
    d) Changing of top slack adjuster modified – 08 nos/loco
    e) Changing of equalizer plate top & bottom – 16 nos/loco
    f) Changing of brake equalizer lever on condition basis – 08 nos/loco
    g) All horns pedestal hole tapping to be done (size 20 mm) – 48 nos hole/loco.
    h) Side buffer rubber to be replaced– 04 nos/loco
    i) Sander bracket base provision leading and trailing – 08 nos/loco
    j) Replacement of bogie lifting lug on condition basis – 08 nos/loco

k) Provision for fitment of modified side bearer to be made if not available. For this a suitable thickness of MS plate of proper size to be welded to make it 50 mm from the level of bogie frame – 08 nos per loco.
l) Spring seat of bogie frame to be changed.
m) Liners of center pivot cavity to be changed and support tie bar to be changed.
n) Bracket for dampers to be changed – 08 nos per loco
o) Replacement of sand box, on condition basis

3.6 Work to be done during IOH:

1. Bogie cleaning
2. RDPT of bogie frame and X-ray(Radiography) of 12 Nos. critical joints.
3. Changing of all face liner size 160x200x6.2– 24 nos/loco
4. Changing of all horn leg liner "35x140x6.2 – 32 nos/loco
5. Changing of liners of bogies transom bracket (sandwich liner 90x90x6.2 center hole 35 mm – 24 nos/loco).
6. Changing of guide liners of horizontal lever – 16 nos/loco and checking of its bracket.
7. Changing of all brake hangers and its brackets, all worn out bushes and pins to be changed.
8. Checking of all brake shoe holder along with brake block and its fasteners to be changed.
9. Checking of condition of modified tier bar – 02 nos per locos. Modified stopper of inside outer hanger to be provided as per Drg. No. – 04 nos per loco.
10. Safety sling to be changed – 04 nos per loco.
11. Checking and repairing of top slack adjuster modified – 08 nos/loco
12. Checking and repairing of linkage modified – 08 nos/loco
13. Changing of equalizer plate top & bottom – 16 nos/loco on condition basis and all bushes to be changed.
14. Checking of brake equalizer level & worn out bushes to be changed – 08 nos/loco
15. Changing of horns pedestal fasteners and checking of hole.
16. Side buffer rubber to be replaced – 04 nos/loco
17. Sander bracket base provision at leading and trailing – 08 nos/loco
18. Replacement of bogie lifting lug on condition basis – 08 nos/loco
19. Provision for fitment of modified side bearer to be made if not available. MS plate of proper size to be welded to make it 50 mm from the level of bogie frame – 08 nos per loco
20. Liners of Center pivot cavity to be changed and support tie bar to be changed.
21. Bracket for dampers to be changed– 08 nos per loco
22. Replacement of sand box on condition basis.

4.0 Process and Activities for Repair/ Rehabilitation of cast steel co-co bogie frame for WAM4 and cast steel flexi coil bogie frame & Bolster for WAP1/WAP4 electric locos:

4.1 Ascertaining Chemistry:

For ascertaining chemistry of nominated bogie a small test piece of required size shall be obtained by the contractor from Railways before lifting the bogie frames from Railways premises. The test piece shall be cut from the bogie frame by hacksaw only

from the locations like brake hanger lever supporting pad or on the horns. No gas cutting is permissible for this purpose. The chemistry of the same test piece shall be examined by the contractor by spectrometric analysis or at his workshop laboratory or any other standard laboratory. The chemical composition shall be examined to confirm to the following:

| | |
|---|---|
| i) Carbon: | 0.18 to 0.25% |
| ii) Manganese | 0.8 to 1.1% |
| iii) Silicon | 0.2 to 0.5% |
| iv) Sulphur | 0.025% (Max) |
| v) Phosphorous | 0.025% (Max) |
| vi) Molybdenum | 0.1% to 0.20% |
| vii) Aluminium | 0.06%(Max) |
| viii) Chromium | 0.25% (Max) |
| ix) Nickel | 0.40% (Max) |
| x) Vanadium | 0.15% (Max) |

The total contents of residuals (i.e. Cr, Ni, Cu, Mo & V) shall not exceed 0.5%. Elements not specified above shall not ordinarily be present in the steel.

4.1.1 The result of chemical analysis of the test piece shall be advised by the firm to the consignee within seven days from the date of obtaining test piece from the Railways. If the result of chemical analysis of the test piece of nominated bogie frames is found within the limits, the nominated bogie shall be undertaken for rehabilitation. In case, the chemical composition is not within the limits, the nominated bogie shall not be taken for rehabilitation. The testing charges for the bogie frames rejected on chemical composition account shall be borne by the contractor and no additional payment will be made on this account by the Railways.

4.1.2 Check the carbon equipment (CE) percentage of the bogie frame casting which is carbon % +Mn% / 6 + (Cr+Mo+V)/5 + (Ni+Cu)/15

4.2 **Cleaning & Washing of Bogie Frame:**

4.2.1 **Cleaning:**

a) **Cleaning in Bosch tank:** After removal of muck deposited on the bogie frame, it shall be cleaned by placing in a cleaning vat for at least 4 hours or more till clogged oil, dirt, grease etc is removed. The cleaning vat should be of adequate size capable of accommodating the bogie frame. It should be filled with solvents and detergents. Generally anionic detergents with sodium metasilicate base are used as cleansing agent. The cleaning should be undertaken at about (80-85°C) temperature. It should be followed by hot water jet cleaning.

b) **Hot water jet cleaning:** Hot water jet mixed with a detergent or alkaline material and at a pressure of approximately 7 kg/cm$^2$ and at temperature of 80-85°C may also be used for cleaning of bogie frame after muck . The jet should be directed towards the part to be cleaned. The hot solution dissolves oil and grease and washes away the dirt and deposits. This method is often employed to remove heavy deposits of grease and oil from bogie frame.

4.2.2 **Washing:**

Remove bogie frame and rinse it in hot water for sufficient time to ensure removal of all foreign materials and cleansing agent.

4.3 **Removal of old liners & bushes:**

All liners and bushes shall be removed from the bogie frames with the help of oxyacetylene flame and adequate care so that the parent metal and areas are not affected.

4.4 **Normalising**

**Normalising & Heat Treatment of Bogie Frame:**

Before taking up the bogie frame for repair it should be subjected to stress relieving treatment in a heat treatment furnace having temp. recording devices. The bogie should be heat treated/stress relieved in one go (part by part heat treatment/stress relieving not permitted) and as per carbon equivalent. Proper jigs and fixtures are to be used to avoid deformation in bogie frame during heat treatment.

Heat treatment process:

i) The bogie frames to be charged in the furnace at 300°C or below using suitable fixtures to prevent distortion.
ii) It should be heated upto suitable temperature below the tempering temperature but not less than 540°C at a temperature increment rate not exceeding 75°C/hour.(640 Deg.C to 700 Deg.C)
iii) The bogie frame should then be soaked at this temperature for at least 2½ hours depending upon the maximum section thickness of the casting at the rate of 1 hour soaking for every 25 mm section thickness.
iv) The bogie frame is then to be cooled inside the furnace to a temperature of at least 300°C.
v) Finally, the bogie frame is to be cooled to room temperature.

Record of stress relieving cycles shall be submitted to the inspecting agency at the time of stage inspection.

4.5 Shot Blasting:

After heat treatment and before repairing the formation of scaling is to be removed by shot blasting method.. Metallic shots of 2mm size at the pressure of 3 to 5 kg/cm$^2$ should be used. The shot blasting should be done for 4 to 6 hrs and in one go i.e. part by part shot blasting should not be done.

4.6 Crack/Defect Detection:

The complete bogie frame shall be checked by visual inspection with magnifying glass (X10)/dye penetrant test for evidence of cracks, shrinkage, minor pits and other surface defects. The weld repaired areas and critical areas of bogie frame shall be subjected to magnetic particle and radiography inspection for presence of defects/cracks. The critical areas of bogie frame are shown hatched and in thick lines in the RDSO specification No. MP.0..4900.04 Rev'01' of October 2004.. The magnetic particle testing should be done as per IS:5334.

4.6.1 The record of above checks shall be submitted to the Inspecting Agency for review/inspection before commencement of rectification of these defective/cracked areas.

4.7 **Rectification of Defective & Cracked Areas**:

4.7.1 The rectification process for repairing of cracks, preparation for welding, pre-heating, selection of electrodes, setting up of welding parameters like welding current, polarity, welding techniques and precaution should be done as per guidelines for repair of cracked bogie frame by welding (both cast & fabricated) issued by M&C Directorate/RDSO vide Procedure No. RDSO/2006/MC/44 (First Edition or latest)

4.7.2 All other weld repaired areas in which defects are observed shall be opened and rectification shall be carried out as per the procedure given above.

4.8 **Correction for worn out areas & distortion**:

4.8.1 **Correction of worn out areas**:

The bogie frame shall be checked thoroughly for worn spots in areas which are normally not subjected to wear. Some of these areas are:

a) Excessive wear on the spring seats may require reconditioning or replacement.
b) The pedestal bottoms which are found worn shall be repaired by down hand welding. Worn areas at the pedestal bottoms can then be built up and brought back to standard size.
c) Levers, pins may cause wear on mounting brackets on bogie frame.

4.8.2 **Correction of Bent Sections or Distortion**:

The bogie frame shall be checked for any bent sections. These shall be straightened either cold or after application of heat. Before straightening any bent section, its effect on the adjoining sections should be checked. Distortions are to be corrected using horizontal and vertical hydraulic presses.

4.9 **Correction of holes, bushes, liners & studs**:

4.9.1 Drilled holes elongated by wear due to loose bolts, pins, sleeves or bushings should be brought back to normal size. Reconditioning can be done either by ring or plug welding.

4.9.2 **Worn out bushes**: All worn out bushes shall be replaced with new bushes. Where bushes are paired to carry a single load, both of the bushes should be replaced even if only one bush is worn out. Before pressing-in new bush, inspect the hole in the frame for an out-of-roundness condition. Defective holes should be reconditioned by ring or plug welding followed by drilling before fitment of new bushes.

4.9.3 **Broken or bent studs**: All broken or bent studs shall be replaced with new studs. If the threaded holes are found damaged, they shall be corrected by re-taping.

4.9.4 **Liners**:All old liners shall be replaced with new liners of recommended design and quality.

4.10 **Stress Relieving & Heat Treatment of Bogie Frame**:

After repairing the bogie frame for repair it should be subjected to stress relieving treatment in a heat treatment furnace having temp. recording devices. The bogie should be heat treated/stress relieved in one go (part by part heat treatment/stress

relieving not permitted) and as per carbon equivalent. Proper jigs and fixtures are to be used to avoid deformation in bogie frame during heat treatment.

**Heat treatment process**:

i) The bogie frames to be charged in the furnace at 300°C using suitable fixtures to prevent distortion.

ii) It should be heated upto suitable temperature below the tempering temperature but not less than 540°C at a temperature increment rate not exceeding 75°C/hour.(640 °C to 700°C)

iii) The bogie frame should then be soaked at this temperature for at least 2½ hours depending upon the maximum section thickness of the casting at the rate of 1 hour soaking for every 25 mm section thickness.

iv) The bogie frame is then to be cooled inside the furnace to a temperature of at least 300°C.

v) Finally, the bogie frame is to be cooled to room temperature.

Record of stress relieving cycles shall be submitted to the inspecting agency at the time of stage inspection.

4.11 Shot Blasting:

After heat treatment the formation of scaling is to be removed by shot blasting method. Metallic shots of 2mm size at the pressure of 3 to 5 kg/cm² should be used. The shot blasting should be done for 4 to 6 hrs and in one go i.e. part by part shot blasting should not be done.

4.12 After correction for worn out areas and distortions, the bogie frame should be checked by dye penetrant/Magnetic particle and radiography at critical areas and spots where weld correction has been done. After removal of crack/defects, the bogie frame should be stress relieved as per the cycle given in clause 4.4 and Shot blasting as per Clause 4.5.

4.13 Machining:

Machining of the bogie should be done after major weld repairs on horn gaps as per the dimensional tolerance specified for the bogie frame. The machining should be done on planomillar in one go i.e. without re-adjustment of bogie position.

4.14 Alignment & Trammeling of Bogie Frame:

After cleaning of bogie frame by shot blasting, it shall be given a detailed check for general alignment. The squareness of the bogie frame shall then be checked by trammeling as per the detailed trammeling diagram given in the specification. The distortion, if any, may be corrected wherever necessary. After trammeling check the weld portion of the bogie frame shall be re-verified with RDPT.

4.15 Testing:

4.15.1 Weld should be checked with magnified glass and RDPT for any type of weld cracks as per IS-3658.

4.15.2 Radiographic Testing: Finally the welded/rehabilitated and heat treated bogie frame shall be radiographed on all critical locations. Newly welded/rehabilitated areas also to be Radiographed to determine its soundness and its acceptability. A copy of standard

method for controlling quality of Radiographic Testing as per ASTM E.446 and ASTM E-186. Radiographic film shall be submitted to the consignee along with testing documents.

4.15.3 **Hardness :** The heat affected zone due to welding etc. shall not have a brinell hardness by more than 30 points as compared to the adjoining areas.

4.15.4 **Micro structure – Post Heat treatment**: A small piece should be cut by hand Hacksaw only (gas cutting is not permissible) from the castings having black spot area (i.e. from brake hanger lever supporting pad) for checking the microstructure with view to confirm whether proper heat treatment before and after welding given or not. The grain structure will be checked according to ASTMD-5. the microstructure shall be a homogenized ferrite and pearlite with equi-axed grains of size ASTM No. 6 or finer.

4.15.5 Dimensions & Tolerances:

a. All the machined surfaces shall have dimensions and tolerances as indicated in the relevant drawings.
a. Non-machined surfaces but critical to "form, fit and function", shall also be maintained as specified in the relevant drawings.
a. The tolerance on un-toleranced casting dimensions on all other non-critical areas shall be as per IS:4897.
a. Gauges, fixtures, templates and accurate measuring instruments shall be used to ensure the correctness of the dimensions. Such gauges, fixtures and templates shall be calibrated/checked periodically for correctness and accuracy.

4.15.6 Proof Load Test:

To ensure the quality, 02 bogies out of a lot of 10 bogies or 02 bogie per order if the order is for less than 10 bogies shall be subjected to proof load test as per the arrangement shown in the drawings of respective bogies(given in specification).

The following procedure shall be adopted for proof load test of bogies:

a) The bogie frame/bolster shall be kept on tables as per the arrangement shown in the relevant figure.
b) Dial gauges shall be mounted at the locations on the transoms and side frames as shown in the specified figure and should be set at zero before proof load test.
c) The bogie frame/bolster shall be loaded as per the loads given in the specified figure and the loads shall be sustained for a minimum period of 10 minutes.
d) Deflections in dial gauges shall be recorded under loaded condition.
e) Loads shall be removed gradually and readings of dial gauges shall be recorded.

There should not be any sign of deformation/permanent set or any cracks. The detection of cracks shall be checked by Radiography and magnetic particle/dye penetrant test on critical areas as shown in relevant figures.

If the bogie fails in proof load test, a detailed investigation should be done including 100% radiographic inspection for defects, wall thickness checks etc of the failed bogie to identify the cause of failure. The failure details including the cause detected and the corrective action taken should be properly documented to avoid such occurrence in other bogies during repair/rehabilitation.

**a.1 High adhesion fabricated co-co bogie for WAG7 locos as per RDSO's specn. No. VL. SPEC 6 (Rev. 01) of Jan,01**

**Process and Activities for Repair/Rehabilitation of High adhesion fabricated Bogie of WAG7 Locomotives**

The following aspects must be considered.

a.1 The bogie frame of WAG7 should not be repaired if there are cracks in the plates of
- a) Longitudinal (Long) beams
- b) Pivot beam
- c) Cross Transom

(The crack repairing in plates/box sections are not advisable)

However, the rectification of cracks can be done in horn, brackets, mounting lugs, traction motor mounting arrangement.

5.2 The RDPT/MPT should be done all along the welded joints of the bogie frame. The 12 Nos. of joints, known as X-ray joints (top & bottom joint between long beams & cross transoms) should be 100% checked by Radiography for any cracks and abnormality.

5.3 All the process & activities for WAG7 bogie will be similar as given in Para 4.0 to 4.15.6, except the stress relieving process which is given below:

1. To monitor the temperature effectively, four thermocouples shall be at the four corners of bogie frame/bolster assembly and two thermocouples at the centre of the long beams shall be provided on the furnace. The thermocouples shall be connected with associated recording equipment.
2. To avoid distortion during stress relieving operation, suitable tie-bars shall be provided.
3. The bogie assembly shall be kept in the furnace, bottom side up (inverted position).
4. The assembly shall be suitably supported while loading in furnace to avoid any permanent deformation.
5. The temperature of the furnace shall not exceed 315°C at the initial stage when the bogie frame /bolster assembly is kept in furnace.
6. Above 315°C, the rate of heating shall not exceed 160°C/hour. During the heating period, variation in temperature throughout the portion of the part being heated shall not be greater than 50°C.
7. Soaking temperature shall be between 600°C and 650°C. On reaching soaking temperature, the assembly shall be held within specified limits for a time not less than one hour per 25mm thickness of plates.

   For determining soaking time, the thickness of thickest part of assembly shall also be considered. During the soaking period, difference between highest and lowest temperature at different periods of the assembly shall not be greater than 50°C.
8. The job shall then be allowed to cool down to 315 °C in closed furnace at a rate not exceeding 100°C/hour. Below 315°C, the assembly may be cooled in still air.

6.0 Inspection:

6.1 Initial Inspection:

Before lifting bogie frame from Railway premises, chemistry of the nominated bogie frame as specified by the Railways shall be ascertained by the contractor by cutting a small piece of required size from nominated bogie frame at his laboratory. If the result of chemical analysis found within the limits then only the same nominated bogie frame

can be lifted by the contractor for rehabilitation from Railways. The same procedure is to be followed for all the bogie frames to be lifted from Railways. In case of the chemical composition not suitable for rehabilitation such bogie frame will not be taken for rehabilitation.

6.1.2 Before commencement of the work, the bogie frames shall be cleaned in the firm's premises. A joint inspection shall be carried out by the contractor along with Railway's representative to assess the actual work involved. Initial joint inspection shall be done within fifteen (15) days from the date of collection of bogie frame from Railways.

6.1.3 The initial joint inspection report duly signed by both the representative of Railways and contractor shall be submitted to the consignee immediately after inspection. After receipt of the bogie frame at contractor's premises or while under taking initial joint inspection, if any bogie frame is found unfit for rehabilitation, the contractor shall return the same to the Railways and can collect one more bogie in lieu of the unserviceable one from the Railways at his risk and cost.

6.2 **Stage inspection:**

6.2.1 The contractor should advise the consignee for stage inspection. Preferably, the heat treatment process shall be done in the presence of Railways authorized representative and the relevant chart has to be submitted to the consignee immediately after heat treatment. The Railway representative shall have free access to inspect the progress of work at any time at any stage with or without prior intimation at the contractor's premises to check the quality of work.

6.2.2 At the time of joint inspection the inspecting agency must see the records of cracks repaired, MPT, RDPT and Radiography.

6.3 <u>References/records of checks</u>:

6.3.1 Records of all checks carried out on the bogie frame such as DPT, MPT, Radiography Inspection, defects observed , repair work carried out, stress relieving cycle, dimensional checks, trammeling and proof load test shall be submitted to the inspecting agency for review. All these records shall be supplied along with the bogie frame and the same shall be the property of the Railway unit which has placed order on the firm.

6.3.2 **Final inspection:**

All checks/tests specified shall be carried out by the contractors and Railways Representative after completion of rehabilitation work at contractor's premises with his testing equipments. Some of the important dimensions to be measured, checked and to be carried out as indicated in the specification. The measured dimensions/checks conducted shall be recorded in the joint inspection. However, all dimensions given in the drawings are to be checked during the final joint inspection. The final acceptance shall be given after fitment and commissioning on locomotives to the entire satisfaction of Railways.

7.0 <u>Painting</u>:

After shot blasting and crack detection, the bogie frame shall be given one coat of Red Oxide Zinc Chromate to IS:2074 (Primer). The bogie frame shall be given two finish coats of 25-micron DFT black synthetic enamel to IS:2932. The paint shall be of RDSO

/ ICF approved brands procured from RDSO/ICF approved firms. Rust preventive coatings shall be applied on all machined surfaces before packing.

8.0 **Packing & Transportation**:

The packing and transportation of the bogies from Railways and delivery to the Railways would be done by the contractor at their own cost and risk. While packing, due care shall be taken by the firm to protect all machined surfaces against any possible damage during transit/handling. Also, it has to be ensured by the firm that the bogie frame does not incur any type of damages during transit/nandling that may result in its unsafe operation in service. Suitable wooden planks and fasteners may be used to avoid such damages.

9.0 **Warranty**:

9.1 Tenderers should give the warranty for 24/30 months from the date of commissioning of bogie or from date of supply of bogie frame to the consignee whichever be earlier.

9.2 Warranty shall be towards the defect free service with respect to imperfection, shrinkages, bad workmanship and failure of any associated components covered under the contract.

9.3 Tenderers shall give prompt and adequate service support while attending the warranty. The attention to the warranty should be given by the tenderers within 15 days after receipt of the complaints from the purchasers/Railways. The penalty @ 0.2% of the total work per week maximum upto 10% of the total cost should be imposed on the tenderers by the Railways for delays in compliance of the warranty obligation. The records of penalty clause operated should be maintained for evaluation of performance of the sources.

9.4 After rectification of defects bogies will be offered/accepted after inspection as per the conditions of the contract.

9.5 The warranty period will be considered again from the date of commissioning of defective bogie by the Railways i.e. intervening period from the failure upto the rectification of defects by the tenderers will not be considered and as such will be treated as waiting period.

10.0 SCHEDULE OF TECHNICAL REQUIREMENTS:

The contractor shall have following minimum inhouse infrastructure and testing facilities with them –

10.1 **Heat treatment furnace**: Cera wool lined heat treatment furnace having connected with 14 point thermo couples (6 on faces + 8 corners) and 14 point temp. recorder for recording the rate of heating, soaking, cooling time in a graph. The heat treatment furnace must have the capacity for raising the temp. upto 900°C. The size of the heat treatment furnace should also be of length 6 mtrs x W 3 mtrs x H 3 mtrs which can accommodate the co-co bogie for carrying out the heat treatment cycles in one go.

10.2 **Floor type horizontal boring machine**: Floor type horizontal boring machine having a spindle dia of 150 mm min and having length of bed of 10 mtrs width of 2.5 mtr and veticle height of 7.75 mtrs for carrying out the machining of horn check liners faces at six locations and machining the portion of the side bearer & centre pivot with a plano milling attachment.

10.3 **Plano milling cum planning machine:** This is required for machining for horn check & bracket mounting areas besides some intricate boring of levers and brackets used for brake rigging arrangement.

10.4 **Shot blasting facilities:** Adequate shot blasting arrangement suitable for operation as given in clause 4.5.

10.5 **Proof Load Testing:** Specially designed test rig for proof load testing of rehabilitated co-co bogie suitable for all the types of locomotives.

10.6 Vacuum spectrometer for ascertaining the chemistry & especially the carbon equivalent with determines the weldability of the co-co bogie to be rehabilitated and also for ascertaining the chemistry of Ms steel liners. Besides this, a in-house chemical lab must be with the contractor.

10.7 EOT crane facility of min 10 t capacity for handling co-co bogies during the following operation

a. Welding
b. Heat treatment
c. Machining
d. Tramelling

10.8 MPT & Dye penetrant test equipments must be available in-house.

10.9 **Radiographic faciiities:** For detection of cracks before rehabilitation & checking of soundness of weld cracks after the work.

10.10 For squaring of bogies suitable jig and fixtures should be available with the contractor.

10.11 **Additional: Specific facilities required for repair/rehabilitation of high adhesion fabricated bogie for WAG7 electric locos and fabricated bogies being used in WAG5HA & WAG5HB electric locos:**

i) Tenderers shall have facilities for low Metal Inert Gas (MIG) welding using $CO_2$/Argon gas as shielding media. This is in addition to the infrastructure requirement for cast steel bogies as mentioned above.

ii) Tenderers shall submit documentary evidence for procurement of steel plates for replacement in bogie frame as per IS:2062 grade as specified in Specn. No. VL.Spec-6. Procurement shall be made only from approved and/or RDSO approved sources. The testing facilities for plates must be available.

iii) The welders should be capable for carrying out MIG welding to the highest standard.

11.0 <u>Documents to be submitted alongwith the offer</u>

11.1 Detailed Quality Assurance Programme (QAP) for the work required to be done.

QAP shall contain the following –

i) The casting, manufacturing processes and control procedures at each stage of manufacturing indicating acceptable criteria. It should include checks for properties of mould & core, chemical composition and mechanical properties of metal, heat treatment details etc.

ii) The dimensional check sheets including bogie trammeling and machining indicating tolerances.

iii) Checks for surface quality for various casting defects in critical and non-critical areas.

iv) Checks to be carried out for internal defects in critical and non-critical areas.

v) Method for maintaining record of defects in casting, rectification and inspection.

vi) Proof load test arrangement and details.

vii) Any other miscellaneous stipulations necessary for maintaining the quality of castings.

11.2 The list of RDSO/CLW approved sources for procurement of various components, sub-assemblies and equipment which are required during the course of repair/rehabilitation work of bogies.

11.3 Tenderers shall submit a detailed statement showing the type, make of various machinery and plants area of commissioning and their present working status as given above in the STR para 10.0.

11.4 Tenderers shall submit details of qualified technical personnel and laboratory personnel for giving their names and educational qualifications.

11.5 Tenderers shall submit details of qualified welders as per norms stipulated in IS:817/ & IS:7310 (Approval test of welders work to approved welding procedure).

11.6 Clause wise comments on this specification and test programmes and deviations if any in terms of the cause

11.7 Tenders not accompanied by the above mentioned information and non-compliance of STR is likely to be rejected without assigning any reason whatsoever by the Railways.

11.8 In case of any confusion and lack of clear cut understanding with respect to dimensions, clearances and other technical details, the tenderer should consult the consignee for clarifications. The decision of the consignee shall be final.

12.0 *List of RDSO Specifications, Guidelines and drawings referred to in the* specification

| S.No. | Name of Specification/Norms/Guidelines/Drawings | RDSO Specification No. |
|---|---|---|
| 1 | Specification for Three Axle Cast Steel Trimount and Flexi-coil Bogie Frames and Bolsters for Broad Gauge Locomotives 9 WAM4/WAG5 & WAP1/WAP4) | MP.0.4900.04 Rev'01' of Oct.2004 or latest |
| 2 | Technical Specification for Fabricated Bogie frame & Bolster Assembly for Locomotives(WAG4) | Specification No. VL Spec-6 (Revision-01) , January 2001 or latest |
| 3 | Norms for Repair, Rehabilitation and Replacement of Cracked Trimount cast steel Bogie frames of Diesel and Electric Locomotives. | Report No. MP.Misc-164 (Revision-00) of March 2005 or latest |
| 4 | Guidelines for Repair of cracked Bogie Frame by welding( Both Cast & Fabricated) | Procedure No. RDSO/2006/MC/44 (First Revision) 10/2006 or latest |
| 5 | Guidelines for Welding of Liners | Procedure No. RDSO/2006/MC/29 or latest |

13.0 **List of Drawings**

| | | |
|---|---|---|
| 1 | Crack detection by Dye penetration test | SKDL-3814 Alt-3 or latest |
| 2 | Crack detection by MPI test | IS: 5334 or IS: 3658 or latest |
| 3 | High Adhesion bogie for WAG7 Locomotives for WAG7 | SKDL-4181 or latest |
| 4 | Radiographic testing ASTM E- | SKDL-3814, Alt. 3 or latest |

| | | |
|---|---|---|
| | | and SKVL-297, Alt. NIL or latest |
| 5 | Proof Load test of High Adhesion bogie for WAG7 Locomotives | SKDL-4305 or latest |

Note:

a) The Schedule of work may be changed /altered with respect to supply and fitment of items which are part of brake rigging and bogie suspension arrangement by the Zonal Railways. It will depend upon the arisings, specific requirements, modifications to be carried out etc. Only the Bolsters can also be repaired.

b) The Repairing/re-conditioning of other sub-assemblies e.g. axle box housing, spring seats, pneumatic pipelines , sanding arrangements/sanders can also be considered depending upon the requirement of Zonal Railways as a part of bogie repair works.

c) Railways should give a detailed list of such items (as mentioned above), for inclusion in the scope of work in the tenders.

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