ESR 0540

OVERHAUL OF 48 CLASS LOCOMOTIVE BOGIES

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Issued June 2010
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1 Scope
This standard details the requirements for disassembly, overhaul and assembly of 48 class locomotive bogies.

2 Description of bogie
The 48 class bogie is of the rigid bolster swivel type, and fully equalised. In addition to the conventional swivel bearing about which the truck swings, and which bears a portion of the cab load, there are two pads, one on each side, carrying the balance of the cab load. The bogies are so positioned under the locomotive that the pads are located toward the centre of the locomotive. The swivel bearing and pads thus form a three point support to carry the loads on each bogie. The lateral spacing of the pads afford stability against tipping forces of the locomotive on a curve, and the frictional resistance on the pads prevents hunting at high speeds.

The No.1 end of the bogie is nearest the centre pin; the No.2 end is nearest the bearer pads. When the bogies are under a locomotive, the No.2 end of bogies face each other.

The suspension of each bogie is provided by eight pairs of helical double coil steel springs, two pairs of springs located above each pair of equalising beams. Four of the inner coils work in conjunction with friction snubbers. The equalising beams are mounted on the top of the axleboxes. The axleboxes, fitted with roller bearings, are mounted in horn-cheeks (pedestals) cast into the bogie frame. The total lateral float of the axles is obtained by the movement of the axleboxes within the horn-cheeks.

A traction motor is attached to each axle. The locomotive tractive power is supplied to the traction motors which are geared to the axles. The axles apply the tractive effort to the rails through the wheels. The driving force (wheels against the rails) is transmitted to the bogie frame by the axleboxes and from the bogie frame to the locomotive body to provide the locomotive tractive effort.

Air brake cylinders and brake rigging mounted on the bogie frame are used to apply the retarding force to the wheels to slow and stop the locomotive. A double brake block clasp type brake system is used so that two brake blocks act on each wheel.

3 Disassembly of bogie
The bogie must be disassembled so that all subassemblies can be inspected separately.

3.1 Removal of wheelset
Drain the oil from the traction motor suspension bearings, care should be taken to prevent any oil spilling into the traction motor.

The following components shall be removed:
- Hasler, wheelslip generators, low speed controllers and any other control equipment.
- Brake rigging.
- All traction motor nose suspension assemblies

3.2 Removal of brake equipment
The following items shall be removed from the bogie:
• Brake cylinders.
• Slack adjusters and piping. Label all piping with the bogie number so that undamaged pipework can be refitted to the bogie.
• Spring parking brake.
• Remaining brake rigging (after wheelsets have been removed).

3.3 Removal of ancillary equipment
Primary suspension, the helical double coil axlebox springs are to remain nested when they have been removed from bogie, springs and spring seats from the same axlebox shall be kept together. Scrap all resilient pads and all worn spring seat shims.

Load Pad units are to be removed.

Remove sanding hoses, U-bolts, brackets from each bogie.

Remove earth leads.

Remove ladders from each bogie.

3.4 Bolster
Remove any dampers and/or shock absorbers attached to the bolster and bogie frame. Scrap all bolster chafing plates.

3.5 Removal of equalising beams and other components
Remove snubbers and equalising beams.

3.6 Other considerations
The traction motor shall be kept away from any oil, grease, water or any other forms of liquid to prevent damage.

Ensure all disassembled components are not damaged once disassembled from the bogie.

4 Bogie frame

4.1 Cleaning
The frame should be suitably cleaned prior to inspection to necessitate an unrestricted view of the frame and its associated componentry.

Bogie frames shall be washed in accordance with AS 1627.1. The alkaline cleaning process shall be used. The cleaning media must not be harmful to frame components.

Bogie frames shall be cleaned so as to remove all traces of grease and dirt so that a thorough inspection of the frame may be carried out. The bogie frame shall be cleaned to a bare steel finish and all paint removed.

The effect of any cleaning media used is to be neutralised following washing.

All cleaned frames should be inhibited and protected from corrosion after washing and adequate precautions taken to ensure this.
4.2 Crack testing

4.2.1 Visual
Visually inspect the bogie frame members and welds for fractures and cracks paying particular attention to pedestals, spring seats, motor nose suspension mounts, brake equipment mounts and traction pad abutments.

4.2.2 Magnetic particle inspection (MPI)
All areas suspected of being cracked shall be subjected to a magnetic particle test (MPI) in accordance with ESR 0072.

All areas to undergo an MPI shall be cleaned with a wire brush prior to inspection.

A report on all fractures found shall be provided to the Principal. This report shall detail the bogie frame number, crack size and location on the bogie frame.

During the magnetic particle inspection particular attention shall be paid to the shaded areas in Figure 1.

Figure 1 – Bogie frame areas susceptible to cracking

4.3 Repair of cracks & fractured members
Fractures must be repaired by welding. All welds made on fractured sections and magnetic particle tested after the welds have cooled below 200°C.

Cracks greater than 50 mm in length shall be referred to the Principal for advice.
4.4 Missing parts
Make a thorough inspection to see that all the necessary parts are intact. Special attention should be given to wear plates, cotter keys, washers, bushes, studs, brake guides and brake pins.

4.5 Worn spots
The bogie frame must be thoroughly checked for worn spots. Worn spots must be repaired by welding in accordance with an accepted weld procedure. After welding, grind the area smooth to the original surface profile.

4.6 Elongated or oversize holes
Drilled holes must not be worn more than 2 mm on the diameter. Holes which are worn beyond this tolerance are to be reconditioned by ring welding, or, plug welding and then drilled to the correct size.

4.7 Worn bushes
Scrap any bush that has worn more than 2 mm on the diameter. After a bush has been pressed out, inspect the reamed hole in the frame for wear or out-of-roundness. Holes found unsuitable for a new bush are to be reconditioned by ring welding, or, plug welding, and then drilled and reamed to accept a standard new bush. For the location of bushes refer to the original engineering manufacturer's drawings.

4.8 Damaged threads
All threaded holes should be checked and re-tapped if required. If a threaded hole cannot be reconditioned by re-tapping, it must be plug welded, drilled and tapped.

4.9 Broken or bent studs
Replace any broken or bent studs.

4.10 Straightening/realigning bent sections
Bent sections must be straightened (hot or cold working is permissible). Before straightening any bent section, determine the effect that straightening will have on adjoining sections.

Depending on the severity of the misalignment, the repairer may be required to employ post repair heat treatment to normalise the frame.

Bent sections other than the obvious will be revealed during the bogie frame trammelling process.

4.10.1 Horn cheeks

4.10.1.1 Inspection
The end of all horn-cheeks must not deviate more than 3·0 mm from the horn-cheek base-line. Ensure that the horn-cheek jaws are perpendicular (within 0·5°) to the horn-cheek base-line (for horn cheek base-line see Figure 3).
4.10.1.2 Repair

Horn-cheeks that are not perpendicular to the horn-cheek base-line must be corrected by straightening the bogie frame (hot or cold working is permissible). The distance across horn-cheek jaws must be 257.2 ± 0.5 mm. Worn horn-cheeks must be repaired by welding. After welding, grind the area smooth to the original surface profile (see Drawing 102-132).

Weld new horn-cheek wear plates to bogie frame (Drawing 86756 for outside axles; Drawing 86755 for centre axle). Ensure that the distance between wear plates in each horn-cheek is 245.2 ±0.5/0.8 mm so that the required overall longitudinal clearance between the wear plates and axlebox is in accordance with section 10.5.

After welding, any exposed gap between the wear plates and the horn cheek shall be sealed with a suitable flexible sealant to prevent the ingress of water or foreign bodies between the wear plate and the horn cheek.

4.10.2 Trammelling

4.10.2.1 Inspection

The bogie horn cheeks (pedestals) are trammed to determine if they are in correct alignment with each other, that is, to determine if the distance between horn cheeks is equal to or within the specified allowable limits.

![Figure 2: Layout of trammelling points](image)

Ensure that the bogie is on a level table or surface before trammelling the horn-cheeks. Trammel the bogie frame using the horn-cheek tie bar hole centres as reference points.

A bogie frame that has all its horn-cheeks correctly aligned (refer to Figure 3) only needs to be trammelled diagonally. Each pair of measurements of the diagonal distance between horn-cheeks (across the bogie frame) must be within ±1.6 mm. For example, diagonals 1-6 and 2-5 shown in Figure 2 must be within ±1.6 mm.

However, if any pair of measurements are outside this tolerance, the transverse and longitudinal distances between horn-cheeks must be recorded to determine which horn-cheek is out of alignment. All transverse distances between opposite horn-cheeks must
be \( 2120.9 \pm 1.6 \) mm. The longitudinal distance between horn-cheeks of No.1 End axle and the centre axle must be \( 1676.4 \pm 1.6 \) mm and for the No.2 End axle, \( 1981.2 \pm 1.6 \) mm.

### 4.10.2.2 Repair

Horn-cheeks that are out of alignment must be corrected by straightening the bogie frame, hot or cold. Frames which have been repaired must qualify to all the abovementioned trammel requirements.

### 4.10.3 Spring caps

#### 4.10.3.1 Inspection

Check the location of the welded spring caps onto the bogie frame. The spring caps centres must be within \( \pm 1.0 \) mm of the centreline passing through the centres of the horn-cheek pedestal cap bolt holes. The longitudinal location of the spring caps must be \( 404.8 \pm 1.0 \) mm and \( 684.2 \pm 1.0 \) mm from the centre of the No.1 End horn-cheeks and \( 506.4 \pm 1.0 \) mm and \( 785.8 \pm 1.0 \) mm from the centre of the No.2 End horn-cheeks (see Figure 3).

Figure 3: Important frame dimensions

#### 4.10.3.2 Repair

If the misalignment of any spring cap is greater than \( 1.0 \) mm or the welds are cracked, the spring cap must be removed and rewelded to the bogie frame. The spring caps must be flat to prevent uneven spring loading.
4.10.4 Traction motor nose suspension mounting lugs

4.10.4.1 Inspection
Remove old wear plates and ensure each pair of traction motor nose suspension lugs are on the same plane within 0·8 mm. Inspect guide pin holes.

4.10.4.2 Repair
If the top and bottom pairs of mounting lugs are not on the same plane within 0·8 mm.
Weld new wear plates onto mounting lugs. The finish dimension across the wear plates must be $240·5 = 240·5 +/− 0·8$ mm and lug faces are on the same plane within 0·8 mm.

4.10.5 Centre pivot bearing

4.10.5.1 Inspection
Remove and scrap the centre pivot wear liners. Inspect the centre pivot bearing area for cracks, worn spots and damage.

4.10.5.2 Repair
Cracks, worn spots and damaged must be repaired. Install new centre pivot liners.

4.10.6 Loading pad (elephant’s foot oil pan assembly)

4.10.6.1 Inspection
Inspect oil pan assembly for cracks or damage, and ensure the pan is free of leaks. Check the oil filler is clear and functional and the protective cover is intact.

4.10.6.2 Repair
Any cracks or damage must be repaired. Replace oil pan filler if damaged or inoperative. Replace oil pan wear plate.

4.10.7 Welding
All welding to be in accordance with accepted procedures.

5 Suspension

5.1 Springs
Inspect springs in accordance with ESR 0043.
All springs must be qualified. Springs should be qualified individually and then as a nest.
Apply the working load as specified in Table 1.
### Table 1

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<th>Spring. No</th>
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<tr>
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<td>11.6</td>
<td>380±5</td>
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<tr>
<td>81247</td>
<td>23.4</td>
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<td>409-909</td>
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<td>380±5</td>
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(Nest of 81246 and 81247)

#### 5.2 Spring seats

Inspect the equaliser beam spring seats for evidence of distortion or damage. Replace 50.8 mm shaft if there is more than 0.5 mm wear on the shaft diameter. Ensure that the interference fit of the 50.8 mm shaft in the spring seat is 0.04 mm.

![Figure 1](image)

**NOTE:** Ø 50.8 mm shaft not shown.

Hole reamed for a 0.04 mm press fit with Ø 50.8 mm shaft.

#### 5.2.1 Repair

Scrap any spring seat that is distorted, damaged or does not conform to the wear limits shown in Figure 1.

#### 5.3 Equalising beams

Scrap any cracked or broken equalising beams. Check all equalising beams for worn spots especially where the beams have been hardened.

The beam thickness must be 28.6\(+0.7/0.3\) mm and be flat within 3 mm.

Drilled holes must not be worn more than 1 mm on the diameter except the axlebox locating hole which must be 38.50\(+0.08/-0.0\) mm.
5.3.1 Repair

Repair worn spots by welding. After welding, grind the area smooth to the original surface profile and heat treat the equalising beam if required.

Straighten all bent equalising beams.

Holes which are worn beyond tolerances are to be reconditioned by plug welding and then drilled and reamed to the correct size.

5.4 Snubbers

Snubbers shall be overhauled in accordance with ESR 0542.

6 Traction motor nose suspension

Inspect and repair in accordance with ESR 0543.

7 Brake gear

7.1 Brake cylinders

Brake cylinders shall be removed and overhauled to ESR 0514.

7.2 Brake rigging

7.2.1 Brake levers, connecting rods

7.2.1.1 Inspection

Brake levers, and connecting rods, shall be inspected for cracks, straightness, and twists.

If found to be cracked, twisted or broken they shall be scrapped.

Brake levers, and connecting rods shall be inspected for worn areas, if worn more than 25% of the original cross sectional area they shall be scrapped

Inspect slots for wear, the locating washer shall slide along the slot with minimal play.

All reamed and bushed holes shall be inspected for wear and elongation.

7.2.1.2 Repair

Any bent brake levers and connecting rods, shall be straightened to within 3 mm of the original surface when checked with a 300 mm straight edge centred as closely as possible over the indentation or bend, except by design.

Brake Levers and connecting rods shall be scrapped when bends are greater than 20 mm when compared to a 300 mm straight edge as closely as possible over the indentation or bend, except by design.

The maximum wear on the side of any connecting point shall be 3 mm. Brake levers and connecting rods shall be repaired by welding to fill any wear areas and grinding to the original surface profile.
Brake levers and connecting rods may be repaired by blending any gouges, wear areas etc (except connecting points), which are less than 6 mm deep. Total blend length should be 4 times the depth, no sharp corners or fillets are allowed.

Brake levers and connecting rods may be repaired by welding any gouges, wear areas (except connecting points), etc. which are 6 mm to 12 mm deep so that the surface is within a minimum of 1 mm of original.

If slots are worn they shall be built up by welding, then ground to the original surface profile. The locating washer shall slide along slot with minimal play.

7.2.2 Bushes and pins

7.2.2.1 Inspection
Bushes, pins and unbushed holes shall be inspected for wear.

Unbushed holes if worn more than 0.5 mm shall be fitted with a bush.

Bushes shall be renewed if worn more than 0.5 mm.

Pins shall be renewed if worn more than 0.5 mm

7.2.2.2 Repair
All loose bushes shall be replaced.

All bushes shall be pressed into position and those bushes less than 20 mm long shall be notched in three places on both external edges after case hardening and the bush secured by tack welding.

The positioning of holes shall be as per the original drawing.

7.2.3 Brake heads

7.2.3.1 Inspection
Brake shoe contact areas or material surrounding the lug pocket area shall be inspected for wear.

Brake head toe shall be inspected for wear, if wear extends more than 12 mm from the end, repair is required.

Pivot holes shall be checked for wear.

The lateral face of the pivot point shall be inspected for wear.

7.2.3.2 Repair
Brake heads where the thickness of any of the four shoe contact areas or material surrounding the lug pocket area is worn to 1.5 mm or less shall be scrapped.

Brake heads shall be repaired by welding to restore worn areas and ground to a 450 mm radius contour. The main point of contact shall be in the centre pads of the brakehead with no clearance allowed. There may be clearance up to 1 mm at the toe and head of the brakehead or a clearance up to 2 mm at the toe or head of the brakehead. The repairing workshop can design / manufacture a gauge to ensure the required accuracy is achieved upon repair.
Pivot holes, shall be repaired to section 7.2.2 Bushes & pins

If the lateral face of the head is worn greater than 0.5 mm it shall be repaired by welding and grinding to the original contour.

Any worn or out of tolerance brake head can be replaced by a new or second hand brake head meeting the requirements as described above.
7.2.4 Tie bars

7.2.4.1 Inspection
Tie bars shall be inspected for twists and cracks.

Tie bars shall be checked for worn areas, if worn more than 25% of the original cross sectional area they shall be scrapped.

All holes shall be checked for wear and elongation, and repaired to section 7.2.2 Bushes and Pins.

7.2.4.2 Repair
If cracked or twisted stabiliser bars shall be scrapped.

7.2.5 Welding
All weld repairs shall comply with standards and be to the original design.

8 Overhaul of wheelsets

8.1 Removal of traction motor
Remove the traction motor and gear case from the wheelset assembly.

Traction motors should be overhauled in accordance with ESR 0601.

8.2 Wheelset
Overhaul wheelsets in accordance with ESR 0331.

8.3 Gear
Inspect gear in accordance with ESR 0230.

If the gear hub wear face has been damaged and the gear has no other condemnable defects, it is permissible to repair the gear hub by fitting a wear ring as per drawing 306-095 and/or 306-290 depending on the extent of damage. The gear hub may be machined while the gear is on the axle.

The interference between the gear bore and the gear seat must be between 0.18 mm and 0.23 mm.

8.3.1 Thrust collar
A thrust collar may remain on an axle provided that:-

The thrust collar has no visible defects such as notches, grooves, or cracks.

The thrust face of the thrust collar is perpendicular to the axle and free from witness marks - machine thrust face if it is damaged or not perpendicular to the axle.

The overall length of the thrust collar is greater than 171.5 mm
otherwise the thrust collar is to be pressed off the axle and scrapped.
Note:- If a thrust face of a thrust collar has been machined, the collar may need to be pressed further onto the axle so that the correct distance between the gear and the thrust collar is maintained and spacer placed between the wheel and the thrust collar.

8.4 Axleboxes
Axleboxes shall be overhauled in accordance with ESR 0541.

All longitudinal axlebox wear liners shall be sealed on their perimeter after welding with RTV silicone to prevent the ingress of water and subsequent corrosion formation and liner expansion found on this type of axlebox.

<table>
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<th>Dimension</th>
<th>Tolerance</th>
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<tr>
<td>Bearing housing diameter</td>
<td>218.0 +0.5/-0.0</td>
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<tr>
<td>Distance from front to back of axlebox</td>
<td>273.1 +0.4/-0.4</td>
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<tr>
<td>Distance across axlebox (no wear plates)</td>
<td>232.5 +0.4/-0.5</td>
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<td>Distance across longitudinal wear plates</td>
<td>242.5 +0.4/-0.4</td>
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<td>Radius of equaliser beam pin seat</td>
<td>R20.6 +/-0.8</td>
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<tr>
<td>Width of equaliser beam pin seat</td>
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<td>Distance between equaliser beam pin slot centres</td>
<td>244.5 +/-1.5</td>
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Table 2

8.5 Inspection and repair of gear cases
Gear cases shall be overhauled in accordance with ESR 0501.

8.6 Hasler
The Hasler speedometer drive should be removed and overhauled in accordance with ESR 0500.

8.7 Low speed controller
If fitted the low speed controller should be removed and reinstalled when removing and fitting the bogie beneath the locomotive.

8.8 Traction motor
Install traction motors in accordance with ESR 242.

9 Desanding equipment
The sanding equipment consists of tubular steel pipes which are held to the bogie frame by U-bolts and a bracket at each of the four outboard pedestals. The desanding equipment makes use of polymeric hose which is held to the steel sanding pipe with cable ties.

9.1 Inspection
Inspect all hoses, U-bolts and brackets for signs of physical damage such as major cracks, bends, kinks, and gouges. Also check system for any leaks. If damage is
irreparable replace with new item, otherwise forward item to be repaired and kept for reassembly.

10 Assembly of bogie

10.1 Bolts and fasteners
Threads of bolts shall be coated with Loctite Anti Seize or equivalent.
Bolts and fasteners shall be of correct grade and torqued where required.

10.2 Traction motor nose assembly
Fit new or refurbished traction nose suspension assemblies between the lugs on the bogie frame. Compress suspension pack assembly and install the suspension guide pins and pin keepers.
Ensure minimum clearance exist on motor nose bolts following assembly and with traction motor assembled.

10.3 Primary suspension
Install new or refurbished spring seats and coil springs. Ensure that all primary springs have the same colour code.
Install equalising beams and spring seats. Install so that there is a zigzag progression of snubbers, one snubber per pair of equalising beams, as shown in Figure 4.

![Figure 4](image)

After the installation of the horn-cheek tie bars the longitudinal clearance between all horn-cheek liners and axleboxes must be 1-0 mm to 3-0 mm, and the lateral clearance must be $4.0 \pm 0.5 / -0.5$ mm for the outer axles and $17 \pm 0.5 / -0.5$ mm for the centre axle.

10.4 Brake levers
Install new or refurbished brake levers. All pins, bolts and bushes associated with the brake rigging must be hardened. Replace and fit all Split Cotter pins according to ESR 0312.

10.5 Wheelsets
Install wheelset and traction motor assemblies.

The wheel diameters are to be matched according to the Locomotive Wheel Data Table in ESR 0331.

Following installation ensure that the overall longitudinal axlebox clearances between the axlebox and bogie frame horncheek liners are in accordance with ESR 0240.
10.6 **Bolster**
Install secondary rubber springs that have the same colour code. Set the bolster in place between the bogie frame bolster horn-cheeks. Check that the bolster centre bearing plate is the correct height above rail. Install safety hooks.

10.7 **Shock absorbers**
Shock absorbers shall be primed before installation.

Ensure shock absorbers are installed with the correct orientation if required.

10.8 **Other equipment**
Install the horn-cheek tie bars, the remainder of brake rigging, sanding nozzles, air brake piping, brake cylinders, slack adjusters, new brakes shoes, steps, traction motor air ducts and Hasler speedometer drive. Ensure that the brake shoes are not overhanging the wheel edge paying particular attention to the centre axle.

Install elephants feet wear plates, and centre bearing wear plate and wear ring.

Install all other components so that the bogie when fitted in accordance with ESR 0241 is suitable for service.

10.9 **Temporary covers**
Install temporary covers on traction motor ducts and axleboxes where ancillary equipment has not yet been fitted to prevent the ingress of dirt and water.

11 **Performance test requirements**

11.1 **Air brake pressure test**
Pressure test the air brake pipework at a minimum pressure of 500 kPa. Use soapy water to ensure that all joints are air tight and that there are no leaks in the pipework.

Set brake cylinder piston travel to 50 mm.

12 **Stencilling**
The OH Date (MM/YY) and location (XXX) shall be stencilled in 40 mm high white letters on the right side pedestal on each side of the bogie. In addition a 100 x 100 mm 10 mm steel plate shall be affixed to a low stress area of the frame and stamped in 10 mm high letters, 5 mm from the top edge of the plate, with the OH date and location.

13 **Referenced standards**

13.1 **RailCorp standards**
ESR 0042  Overhaul of ride control bogie bolster
ESR 0043  Qualification of helical coil springs
ESR 0230  Inspection of gear & pinion
ESR 0240  Overall longitudinal axlebox clearances
ESR 0241 Installation & removal of bogie
ESR 0242 Installation of traction motors
ESR 0300 Application of non destructive testing
ESR 0312 Security of brake gear
ESR 0331 Disassembly/assembly of locomotive wheelsets
ESR 0500 Overhaul of Hasler axlebox remote drive
ESR 0501 Inspection & repair of locomotive gear cases
ESR 0514 Overhaul of locomotive brake cylinders
ESR 0541 Overhaul of locomotive axleboxes
ESR 0542 Overhaul of Symington type S snubber
ESR 0543 Requalification of traction motor nose suspension
ESR 0601 Traction motor overhaul

13.2 **Australian standards**
AS 1627 Metal finishing – Preparation and preheat treatment of surfaces

13.3 **RailCorp drawings**
86755 Locomotive bogie pedestal liner
86756 Locomotive bogie pedestal liner
102-132 48 Class bogie frame assembly
306-095 Reclamation of gear hub motor - Side
306-290 Reclamation of gear hub motor - Side