ESR 0320

INSPECTION OF DRAWGEAR

Version 1.0
Issued June 2010

Owner: Chief Engineer Rolling Stock
Approved by: Stephen White, Technical Specialist Rolling Stock Performance Standards,
Authorised by: Michael Uhlig, Manager, Rolling Stock Access Integrity

Disclaimer
This document was prepared for use on the RailCorp Network only.
RailCorp makes no warranties, express or implied, that compliance with the contents of this document shall be sufficient to ensure safe systems or work or operation. It is the document user’s sole responsibility to ensure that the copy of the document it is viewing is the current version of the document as in use by RailCorp.
RailCorp accepts no liability whatsoever in relation to the use of this document by any party, and RailCorp excludes any liability which arises in any manner by the use of this document.

Copyright
The information in this document is protected by Copyright and no part of this document may be reproduced, altered, stored or transmitted by any person without the prior consent of RailCorp.

UNCONTROLLED WHEN PRINTED
### Document control

<table>
<thead>
<tr>
<th>Revision</th>
<th>Date</th>
<th>Summary of change</th>
</tr>
</thead>
<tbody>
<tr>
<td>(RSS 0050) 1.0</td>
<td>August 2007</td>
<td>Based on TRSs 1086 &amp; 1088</td>
</tr>
<tr>
<td>(RSS 0320) 1.0</td>
<td>May 2008</td>
<td>Renumbered RSS 0320</td>
</tr>
<tr>
<td>(ESR 0320) 1.0</td>
<td>June 2010</td>
<td>Reformatted and renumbered ESR 0320</td>
</tr>
</tbody>
</table>

### Summary of changes from previous version

*NOTE – If the final document is small enough for the ‘Contents’ and ‘Document control’ to fit on one page remove the page break between the existing pages 2 and 3. HOWEVER if the ‘Document control’ page carries over to a second page separate pages must be used for ‘Contents’ and ‘Document control’*
Contents

1 Scope .............................................................................................................................................4

2 General information ...................................................................................................................4
   2.1 Sharon and Alliance couplers identification .................................................................4
   2.2 Length of heavy duty couplers .......................................................................................4
   2.3 Reclamation of couplers, knuckles and yokes ..............................................................6

3 Inspection .....................................................................................................................................6
   3.1 When to inspect ................................................................................................................6
   3.2 Fractures in coupler body ..............................................................................................7
   3.3 Coupler shank alignment wear; wear plate worn or missing ........................................9
   3.4 Yoke fractures ................................................................................................................9
   3.5 Amount of slack in drawgear .........................................................................................10
   3.6 Coupler contour ..............................................................................................................12
   3.7 Knuckle wear ................................................................................................................13
   3.8 Knuckle pin & pin hole wear limits .................................................................................13
   3.9 Coupler operation ..........................................................................................................14
   3.10 Anti-creep protection ....................................................................................................15
   3.11 Coupler height and droop ............................................................................................17
      3.11.1 Coupler centre-line height ....................................................................................17
      3.11.2 Coupler droop ......................................................................................................17
   3.12 Drawgear carriers ..........................................................................................................18
   3.13 Security of drawgear carriers .......................................................................................18
      3.13.1 Huckbolting .........................................................................................................18
      3.13.2 Bolting ................................................................................................................18
   3.14 Murray key inspection .....................................................................................................19
   3.15 Coupler release mechanism .........................................................................................19

4 References ....................................................................................................................................19
   4.1 RailCorp standards .........................................................................................................19
   4.2 RailCorp drawings ..........................................................................................................19
   4.3 Australian standards .......................................................................................................19
1 Scope
Drawgear failure is of major concern. It creates potential hazard and causes lengthy delays, sometimes derailment. Regular inspection and proper maintenance will reduce failures. This document is for guidance in drawgear inspection and maintenance on rolling stock to allow early detection and correction of faulty gear.

2 General information

2.1 Sharon and Alliance couplers identification
The majority of today’s couplers are of the Alliance type but the Sharon type is still to be found in common use.

To assist staff in recognising the difference between the two types of couplers, Figures 1 & 2 of both types are shown below.

Complete Sharon couplers are no longer available but spare parts (knuckles, lifters, etc) are still available from stores.

![Figure 1 'Alliance' heavy duty coupler](image1)

![Figure 2 'Sharon' heavy duty coupler](image2)

Error! Objects cannot be created from editing field codes.

2.2 Length of heavy duty couplers
Overall coupler length is determined by measuring the distance from the centre line of the yoke pin to the pulling face of the knuckle. Coupler shank length is determined by measuring the distance from the centre line of the yoke pin to the back of the coupler head. The shank length is the important functional dimension to consider when choosing the correct coupler size to suit a particular wagon. The coupler butt and drawgear front follower must also match.

AAR Spherical butt couplers require AAR type Y46AE front followers.
### Standard plain butt coupler

<table>
<thead>
<tr>
<th>Head size (mm)</th>
<th>Coupler length (mm)</th>
<th>Shank length (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>254 (10 inch)</td>
<td>680</td>
<td>426</td>
</tr>
<tr>
<td>254 (10 inch)</td>
<td>990</td>
<td>736</td>
</tr>
<tr>
<td>254 (10 inch)</td>
<td>1220</td>
<td>966</td>
</tr>
<tr>
<td>254 (10 inch)</td>
<td>1525</td>
<td>1271</td>
</tr>
</tbody>
</table>

### AAR spherical butt coupler

<table>
<thead>
<tr>
<th>Head size (mm)</th>
<th>Coupler length (mm)</th>
<th>Shank length (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>305 (12 inch)</td>
<td>731</td>
<td>426</td>
</tr>
<tr>
<td>305 (12 inch)</td>
<td>1041</td>
<td>736</td>
</tr>
<tr>
<td>305 (12 inch)</td>
<td>1271</td>
<td>966</td>
</tr>
<tr>
<td>305 (12 inch)</td>
<td>1576</td>
<td>1271</td>
</tr>
</tbody>
</table>

**Table 1**

**Table 2**

---

**Figure 3** Coupler lengths
2.3 Reclamation of couplers, knuckles and yokes

Couplers, knuckles and yokes which are condemned, damaged or defective should be forwarded to an appropriate repair location for reclamation to ESR 0321.

Knuckles found to have the knuckle pin hole worn 3 mm or more are unsuitable for reclamation and should be scrapped.

3 Inspection

When inspecting couplers and coupler operating mechanisms the checks listed below should be followed.

Reference to each inspection method and allowable limits are contained in this instruction.

3.1 When to inspect

<table>
<thead>
<tr>
<th>Train Inspection</th>
<th>R1 Periodic Maintenance</th>
<th>R2 Workshop Maintenance</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Fractures in coupler body</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>2. Coupler shank alignment, wear or wear plate worn or missing</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>3. Yoke fractures</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Amount of slack in drawgear</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Coupler contour</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Knuckle wear</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>7. Knuckle pin &amp; pin hole wear limits</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Coupler operation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. Anti-creep protection</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. Coupler height and droop</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>11. Drawgear carriers</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>12. Murray Key inspection</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13. Coupler release mechanism</td>
<td></td>
<td>x</td>
</tr>
</tbody>
</table>

Table 3
3.2 Fractures in coupler body

Couplers are to be withdrawn from service if fractures are found as follows:

a) Any fracture in the external surface at the bottom of the head, shown as "fracture type A" on Figure 4.

b) A fracture in the bottom of the head adjacent to the load bearing face of the bottom pulling lug, shown as "fracture type B" on Diagram 5, that has extended more than 10 mm downwards or 30 mm across. Note that this fracture can only be seen with the knuckle removed and a small mirror (dentist type) is needed to examine behind the pulling lug effectively. This is the type A fracture at an earlier stage of development.

c) Any fracture running more than 10 mm vertically in the front face of the coupler head above the knuckle opening, shown as "fracture type C" on Figure 5.

Fractures are permissible at the front of the bottom pulling lug in the head, shown as "fracture type D" on Figure 5, provided that they do not extend inwards to the load bearing face of the lug or extend and join to a type B fracture.

Fractures are permissible in the internal web of the head as shown on Diagram 6.

Only the more obvious fractures will be seen during train inspection. More rigorous inspection is therefore needed at maintenance centres and workshops.

At R2 inspections remove the knuckle then magnetic particle test for the fracture types A, B, C and D.

Figure 4
Error! Objects cannot be created from editing field codes.

Figure 5

Error! Objects cannot be created from editing field codes.

Figure 6
3.3 Coupler shank alignment wear; wear plate worn or missing

Carry out a visual inspection of the shank to ensure that it is not bent out of alignment with the head by 12mm. Replace if bent more than 12 mm.

Replace coupler body if the shank has wear more than 6 mm deep.

Inspect wear plate welds for cracks. Replace the wear plate if worn below 3mm thick. If the wear plate is missing, fill any shank wear with weld metal and dress before fitting replacement. Wear plate welding to be in accordance with ESR 0322, shank welding to ESR 0321.

Wear plates and shank are shown in Figure 7.

If during train inspection wear plates are found to be loose or missing or more than 50% of weld length cracked, wagons should be green carded for attention.

![Figure 7.](image)

3.4 Yoke fractures

Yokes are to be withdrawn from service if any fractures are found in the areas shown in Figure 7.

Maintenance Centre and Workshop Staff need to look carefully for fractures at both top and bottom positions with the drawgear in situ if it is not being removed for any reason.

If drawgear is removed carry out magnetic particle inspection at the fracture locations on the yoke.
3.5 **Amount of slack in drawgear**

The amount of free slack can be determined by first sledging the coupler back solid and then measuring the clearance between the coupler horn and striker face (bump block or breast plate).

Next, by inserting a long bar between coupler horn and striker face, pry the coupler out as far as possible and again measure the space between the horn and striker (see Figures 8, 9 and 10).

The difference between these two measurements is the amount of free slack present.

The maximum permissible free slack in the drawgear is 25mm.

Free slack exceeding 25mm is an indication of worn or defective parts.

With heavy duty drawgear inspect the coupler yoke connection and replacement of a worn coupler yoke pin may reduce free slack. If not then the complete drawgear should be removed for further examination.

Inspect coupler shank and yoke bushes for wear, draftgear follower wear, draftgear and drawgear pocket.

The exact cause for excessive drawgear slack must be determined for proper repair.

Remember always to insert the yoke pin with the threaded tapped hole to the bottom. A stuck yoke pin may be prised out by using this tapped hole.

Striker face indentation is an indication of worn or deformed components which act in a buff direction such as the coupler butt, follower, draft gear housing or rear drawgear pocket lugs.

The following components wear limits are:

- Yoke pin 3 mm
- Yoke pin bushes 3 mm
- Follower 3 mm

Sledging need only be carried out on wagons fitted with keyed drawgear or where striker face indentation has been noted during scheduled inspection.

See Clause 3.14 for Murray Key inspection and wear limits.

![Figure 8](image-url)
Draft gear is to be considered defective when any one of the defects below are found:-

a) Broken, cracked or split housing

b) Rear housing wall bulged or distorted more than 5mm

c) Broken, cracked or otherwise damaged friction components which bear against the follower or yoke, discounting small chips.

d) Free length less than 568mm
e) Stuck or jammed in one position

f) Depressed friction elements that may be moved by hand (except National NC type when not compressed).

### 3.6 Coupler contour

Coupler contour is critical to the proper engagement and restraint of couplers in service. A worn or distorted guard arm can cause separation of wagons.

Method of checking contour using Contour Gauge Drawing No. 55857:-

![Coupler contour gauge drawing No. 55857](image-url)

**Figure 11 Coupler contour gauge drawing No. 55857**

To apply the gauge, first close and lock the knuckle, then pull it out to its fullest extent to take up slack in the closed position.

The faces each side of the recess ‘A’ are placed against the inner face of the guard arm as shown in Figure 11.

The gauge is moved inwards until protrusion ‘C’ contacts the knuckle.

If ‘C’ passes the knuckle over more than half the depth of the knuckle, the contour is out of gauge.

Selectively replacing any or all of the following parts may return the contour to gauge:-

- Knuckle
- Knuckle pin
- Lock

If not, the coupler must be replaced.

If Coupler Gauge Drawing No. 55857 is not available, the dimension ‘X’ shown on the diagram above must not exceed 135mm with the knuckle closed and locked, and pulled out to take up slack in the closed position.
3.7 Knuckle wear

Inspect the knuckle for wear, cracks or broken pieces.

The knuckle shall be condemned when it is worn to the "wear recess" (condemning contour) or when Nose Wear Gauge is passed vertically over one half or more of the nose length. See Figures 12 & 13.

![Figure 12: Knuckle wear recess](image)

![Figure 13: Knuckle nose wear gauge](image)

3.8 Knuckle pin & pin hole wear limits

Check only when it is necessary to remove pin or knuckle.

- Wear limits:
  - Knuckle pin = 3 mm see Figure 14
  - Knuckle pin hole = 3 mm see Figure 15

![Figure 14: Knuckle pin](image)

![Figure 15: Knuckle pin hole](image)
3.9 Coupler operation

a) Lock drop

Close knuckle slowly and check that the lock drops freely into the fully locked position.

If not, clean the operating surfaces with a wire brush. The application of an air-drying lubricant may also be a benefit.

If this does not eliminate the restriction, replace lock and/or knuckle.

b) Unlocking mechanism

Check that the coupler will unlock and the knuckle will open.

If difficulty is experienced, check operating mechanism, lock lift, knuckle thrower, return spring etc. and replace bent, broken or worn parts. As in figures 16 & 17.

Figure 16. Alliance coupler

Figure 17 Sharon coupler
3.10 Anti-creep protection

To inspect for anti-creep protection, push or pry upwards with a bar inserted between the lock and the knuckle lock shelf.

The end of the pry bar shall be inserted under the lock to a distance of 12mm to 25mm only.

See Figure 18.

If the lock can be raised to permit the knuckle to open, there is no anti-creep protection.

Correction of insufficient anti-creep protection should be made by replacing:

(a) The locklift assembly
(b) The lock
(c) The knuckle
(d) All of the above

If renewal of these parts does not correct the condition, the fault is probably due to worn anti-creep protection or wear of the rear wall of the bottom lock hole in the coupler head and the coupler body must be renewed.

The various types of automatic couplers in service have different arrangements of anti-creep devices.

See Figures 18, 19 and 20 for individual types and points to be checked.

Particular attention should be given to automatic couplers as failure of the anti-creep device can cause wagons to unintentionally uncouple in service.

![Figure 18.](image-url)
Figure 19  Alliance bottom rotary type

Figure 20  Sharon top lift type
3.11 Coupler height and droop

3.11.1 Coupler centre-line height

The centre-line of the coupler corresponds to the mid-height point on the knuckle.

Coupler heights shall be within the following limits:

**Locomotives:**
- New condition, full provisions: 880 to 890 mm.
- In service condition: 840 to 900 mm.

**Freight vehicles:**
- New condition: 870 to 880 mm.
- In service condition: 780 to 915 mm.

**Passenger vehicles:**
- Electric fleet new: 865 +/- 25 mm.
- Electric fleet in service: 853 to 890 mm.
- XPT: 875 to 915 mm.
- Xplorer/Endeavour: 905 +/- 1 mm.

To adjust coupler height check wear plates, replace if worn or missing.

The use of shims may also be necessary to restore coupler height.

3.11.2 Coupler droop

A drooping coupler is an indication of worn, broken or missing components which act in a vertical direction such as coupler shank, coupler shank wear plate, coupler carrier wear plate, yoke pin, and for Murray Key couplers the coupler key slot, and yoke key slot.

Carry out a visual check for droop. Droop not to exceed 50 mm.

During train inspection the inspector should ensure that adjoining vehicles are coupled by no less than half the depth of the knuckle. Where a low auto is discovered the vehicle
with the low auto is to be re-marshalled. If a suitable substitute vehicle cannot be found the vehicle with the low auto should be detached and carded accordingly.

Diagram 22

3.12 Drawgear carriers

Drawgear carriers must be in good order when checking coupler and drawgear alignment.

Repair or replace drawgear carriers if found bent, cracked or broken, or worn to less than 75% of their original thickness.

Carrier wear plates shall not be less than 3 mm thick and welds shall not be cracked or broken for more than 50% of weld length.

Tighten and/or replace securing bolts, nuts, washers if worn, loose or missing.

3.13 Security of drawgear carriers

3.13.1 Huckbolting

Carriers are drilled for 22mm (7/8") bolts:-

Use Huckbolt Pin Part No C50LR-BR28- (GRIP)  

Note: GRIP = Actual thickness of material in inches divided by 0.0625

Huckbolt Collar Part No. LC-2R28GL.

For enquiries regarding Huckbolts contact:-

Huck Australia Pty Ltd.

Sydney Telephone: 02 792 3443, Fax 02 792 3409

3.13.2 Bolting

Secure in position with high strength friction grip structural steel bolts, nuts and hardened washers to Australian Standard AS1252.

Bolts shall be installed with hardened washers under both nut and bolt head.

Tensioning of the bolts may be in accordance with the requirements of AS 4100 using the part turn method of tightening. Using this method bolts with up to 114 mm grip are to be
tightened by rotating the nut 4/6 of a turn (4 flats of hexagonal nut) from the snug tight position.

It is permissible to tension bolts using other acceptable methods provided the torque value is in the range 400 – 500 Nm.

3.14 Murray key inspection

The following inspection procedure must be carried out to couplings fitted with Murray Keys:

1. Murray Keys must be inspected at each R1 inspection.
2. Murray Keys must be replaced at each R2 inspection.
3. Murray Keys Retaining Bolts and Automatic Coupler Butts shall be examined at R2 inspections.

Note: Three months grace may be allowed in order that the vehicle may be worked to a major depot without disruption to train operations and schedules.

4. Examine butts on Automatic Coupler shanks ensuring that no fractures exist and that at least 25mm thickness of metal remains between Murray Key hole and back of butt. Renew automatic coupler if any of these abnormalities exist.
5. Examine Murray Keys for wear. If worn or deformed more than 3mm, discard and renew. If not, retain and replace.
6. Fit new retaining bolts and lock the nuts with 5mm split pins.

Note: Murray Key dates are no longer to be stencilled on headstocks.

3.15 Coupler release mechanism

Check coupler release mechanisms for correct and easy operation and for any wear which impairs the operation. Repair or replace faulty parts as required.

4 References

4.1 RailCorp standards
ESR 0321 Welding reclamation and repairs of drawgear
ESR 0322 Welding of wear plates

4.2 RailCorp drawings
Drawing No.55857 Worn coupler condemning gauge

4.3 Australian standards
AS 1252 Steel sheet & strip – Terne (lead-tin alloy) coated
AS 4100 Steel structures