



AUSTRALIAN RAIL TRACK CORPORATION LTD

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Rail Defect Standards

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Applicability

New South Wales	✓	CRIA (NSW CRN)	
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Primary Source

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Amendment Record

Version	Date Reviewed	Clause	Description of Amendment
1.0	01 Dec 09		Implementation draft. Supersedes NSW Standard TES 02 v1.6
1.1	18 Jun 10		Banner added regarding mandatory requirements in other documents and alternative interpretations.

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Mandatory requirements also exist in other documents.

Where alternative interpretations occur, the Manager Standards shall be informed so the ambiguity can be removed. Pending removal of the ambiguity the interpretation with the safest outcome shall be adopted.

1 General

This standard sets out the definitions for the classification of rail defects by size and type, together with remedial actions to be taken.

2 Classification of rail defects

All rails contain discontinuities e.g. inclusions, micro cracks etc., and are classified by type and size as shown in Table 1.

Minor Discontinuities

Where a discontinuity is less than the minimum size shown in Table 1, it is to be treated as a "Minor Discontinuity" and no remedial action is required.

Rail Defects

Where a discontinuity is greater than the minimum size shown in Table 1, it is to be classified as a Rail Defect in accordance with the type and size as specified in Table 1.

Broken Rail

A broken rail is defined as forming two separate pieces (ie clean break or piece broken out (Note 1). It includes breaks in switches and welds. It does not include breakaways or broken plates.

Note 1: Small sections of rail <100mm in length eg shelling or foot damage are not included as broken rails.

3 Base operating standard

The Base Operating Standards for various types of Rail Defects are defined as the size of the defect at which a specified management action is to be taken. The defect size and management action is detailed in Table 2.

4 Action to be taken

Table 2 sets out the various actions to be taken in order to manage rail defects, including the time period within which the action is to be taken.

Time periods used in Table 2 are based on the assessment of the rate of propagation of rail defects. Where a defect cannot be repaired within the nominated time period, the Infrastructure Manager or nominated representative is to review the certification of the running line. This is based on the severity of the defect, the time to planned repair completion, whether and under what circumstances trains can operate over the defect and what arrangements for regular retesting and increased surveillance are to be made.

5 Classification of Rail Defects

Table 1

CLASSIFICATION OF RAIL DEFECTS				
TYPE OF DEFECT	CODE		SIZE DEFINITION	
	Type	Size		
1 Transverse defects in rail head (transverse fissures, transverse shelling, shatter cracks)	SC	-	0 to 5% (less than 10 mm) treat as TD small	
	TD	S	5 to 10% (10 to 20 mm)	
		M	11 to 30% (21 to 30 mm)	
		L	over 30% (over 30 mm)	
2 Engine Burn Fracture	TD/EBF		Same as TD if complete reading not possible treat as TDM	
3 Multiple Transverse Head Defects	TDX	S	5 to 10% (10 to 20 mm)	
		M	11 to 30% (21 to 30 mm)	
		L	over 30% (over 30 mm)	
4 Horizontal Split Head	HSH	S	25 to 100mm	
		M	101 to 200mm	
		L	over 200mm	
5 Vertical Split Head If there is visible discolouration (Under Head Stressing) or if cracked out or if the defect runs into any other defect or if the defect comes within 100mm of a weld, bolthole or joint gap or if there is rail tangent wear more than 10mm - go to next size up	VSH	IB ⁽³⁾	Less than 50mm in length or up to 3mm in height. *	
		S	25 to 200mm	
		M	201 to 400mm	
		L	over 400mm	
		E	Visible cracking or rail head collapse (dip of VSH greater than 0.5mm measured with a 1m straight	
6 Head and Web separation If at weld or rail end – use HSW sizing	HW	S	20 to 75mm	
		M	76 to 200mm	
		L	over 200mm	
7 Foot and Web separation	FW	S	20 to 40mm	
		M	41 to 75mm	
		L	over 75mm	
8 Horizontal Split Web	HSW	S	20 to 40mm	
		M	41 to 75mm	
		L	over 75mm	
9 Split Web Vertical transverse	SW	S	20 to 40mm	
		M	41 to 75mm	
		L	over 75mm	
10 Bolt Hole Crack (all angles)	BH		Refer to engineering instruction ETI-01-05 for instructions on sizing bolthole cracks.	

CLASSIFICATION OF RAIL DEFECTS				
TYPE OF DEFECT	CODE		SIZE DEFINITION	
	Type	Size		
11 Vertical Split Web longitudinal	VSW	S		Any registration in one rail length
12 Piped Rail	PR	S M L		25 to 150mm 151 to 300mm over 300mm
13 Defective Welds	DW			
	Head			As for TD
	Web	S M L		25 to 50mm 51 to 75mm over 75mm
	Base	M L		15 to 35mm (If at edge-10 to 35mm) over 35mm
14 Wire Feed Weld	DWFW	S M L		3 to 10% (5 to 20 mm) 11 to 20% (21 to 30 mm) over 20% (over 30 mm)
15 Broken Rail	BR			Size notation not applicable
16 Mechanical Joint Suspect	MJS			Size notation not applicable
17 Corroded Rail	CR			See remedial action

Note 1: Sizing *IB – Inclusion Band*
 S – Small
 M – Medium
 L – Large

Note 2: Percentage figures are in relation to rail head area.

Note 3: To be classed as an IB the following criteria must also be met
- *No visible cracking or discolouration*
- *Must not come within 100mm of a weld (thermit or flashbutt) or a bolthole or a joint gap*
- *Must be no significant dip in the rail when measured with a 1m straight edge*
- *Rail tangent wear less than 10mm*
- *The VSH defect has not been detected in the web area (below the fillet at the underside of the rail head).*

6 Remedial Action to Protect or Correct Rail Defects

Table 2

REMEDIAL ACTION TO PROTECT OR CORRECT RAIL DEFECTS						
Defect Type		Size	Immediate Speed Restriction Km/hr until defect removed	Plate Within	Remove Within	Other Action(Refer also to Section 4)
1	Transverse Defect (TD)	S	20 km/hr	7 days	5 months	If TD is reported in shatter cracked rail, the full length must be replaced weld to weld
		M		24 hours	5 weeks	
L	2 hours	48 hours				
	TD in Shatter Cracked Rail (SC)	Same as TD. If multiple – same as TDX				
2	Transverse Defect at Engine Burn (TD/EBF)	S	20 km/hr	7 days	5 months	Where several engine burns exist in the same rail length, consideration should be given to replace full rail length, weld to weld.
		M		24 hours	5 weeks	
		L		2 hours	48 hours	
3	Multiple Transverse Defects (TDX)	S	40 km/hr	Monitor defect and stop trains if necessary until defect removed	7 days	Replace full rail length – weld to weld
		M	20 km/hr		24 hours	
		L	10 km/hr			
4	Horizontal Split Head (HSH)	S	10 km/hr	Monitor defect and stop trains if necessary until defect removed	5 weeks	
		M			7 days	
		L				
5	Vertical Split Head (VSH) See Note below for additional requirements	IB	60 / 40 km/hr 20 / 10 km/hr Or emergency guidelines	Monitor until removal, 1 hourly visual inspection and check of dip. Stop trains if necessary. Alternatively deal with in accord with VSH Emergency Guidelines attached	Monitor	Via routine ultrasonic testing
		S			5 weeks ⁽⁴⁾	
		M			7 days	
		L			5 days	
		E				
6	Head and Web Separated (HW)	S	20 km/hr 10 km/hr	Monitor defect and stop trains if necessary until defect removed	7 days	
		M			48 hours	
		L				
7	Foot and Web Separated (FW)	S	20 km/hr 10 km/hr	Monitor defect and stop trains if necessary until defect removed	7 days	
		M			48 hours	
		L				

REMEDIAL ACTION TO PROTECT OR CORRECT RAIL DEFECTS						
Defect Type		Size	Immediate Speed Restriction Km/hr until defect removed	Plate Within	Remove Within	Other Action(Refer also to Section 4)
8	Horizontal Split Web (HSW)	S			7 days	
		M	20 km/hr		48 hours	
		L	10 km/hr	Monitor defect and stop trains if necessary until defect removed		
9	Split Web (SW)	S			7 days	
		M	20 km/hr		48 hours	
		L	10 km/hr	Monitor defect and stop trains if necessary until defect removed		
10	Bolt Hole Cracked (BH)	Refer to engineering instruction ETI-01-05 for responses to bolthole cracks.				
11	Vertical Split Web (VSW)	S			6 months	Replace full rail length weld to weld
12	Piped Rail (PR)	S			5 weeks	
		M			7 days	
		L	10 km/hr	Monitor defect and stop trains if necessary until defect removed		
13	Defective Welds (DW)	S		30 days	12 months	Keep under observation until removed.
		M		24 hours	5 weeks	Keep under observation until removed.
		L	20 km/hr	2 hours	48 hours	Keep under observation until removed.
14	Wire Feed Weld (DWWF)					As for TD if in switch or crossing, speed restriction and retest until removed
15	Broken Rail (BR)					
16	Mechanical Joint Suspect (MJS)					Remove plates and inspect within 14 days. If defect found refer to Item 10 in this Table.
17	Corroded Rail (CR)					If reported by rail car, perway staff to inspect in accordance with rail inspection in tunnels standard

7 Additional Requirements for Vertical Split Head defects

1. **Additional inspection requirements required for VSH examination are detailed as follows:**
 - a) Measure the dip in the rail at the VSH defect using a 1 metre straight edge and a taper gauge.
 - b) Visually inspect the area for cracking or discolouration (rust band) especially on the root radius area where the web adjoins the underside of the head. Note especially the proximity to welds, bolt holes and joint gaps. Both sides of the rail must be inspected.
 - c) If significant tangent wear is obvious measure the tangent wear of the rail.
 - d) The area at the top of the web should also be checked where VSH indications have been found in the rail head. This is to check if any cracks from the head have progressed into the web below the fillet area (the fillet area itself cannot be examined with current probes).
 - e) At the initial inspection at least 500mm must be checked beyond the marked defect. In any subsequent inspection this distance can be reduced to 200mm
2. **Other Requirements for VSH Defects.**
 - a) Defects found in night inspections and where full requirements for inspection as detailed above cannot be carried out must be inspected in daylight hours. Defects classified as Medium (M) or larger must be reinspected in daylight hours the next day. Similarly Small (S) defects must be reinspected in daylight hours within 7 days.
 - b) When repairing a VSH defect no new Thermit welds are to be installed within 500mm of a VSH of any classification. As a temporary measure a weld can be installed but only for defects classified as IB and clear of the weld by at least 200mm. These temporary welds must be removed within 30 days.
 - c) If the gap between two or more defects is less than 100mm the defects must be classified as one continuous defect.
 - d) VSH Smalls may be left in track more than 5 weeks for growth monitoring purposes provided they are thence inspected at no more than two weekly intervals. The inspection is to include visual assessment, ultrasonic examination and by measuring the dip. If growth takes the defect beyond the Small classification they must be removed in accord with the requirements for the larger defect size.
 - e) All VSH large defects should be removed as soon as possible. The maximum periods given are only applicable where larger numbers of defects have been found than can be dealt with quickly.

8 VSH Emergency Guidelines

Use of the guidelines is restricted to the Infrastructure Manager or nominated Representative or staff certified as competent in the use of these guidelines by the Infrastructure Manager or nominated Representative or by the Wheel/Rail Interface Manager. Physical inspection can be carried out by others under the direction of the Infrastructure Manager or nominated Representative.

Stop Trains

Visible crack with disjoint across crack faces

Or visible crack which has turned up into the head or turned down into the web (including down into a weld) or any crack running into a bolt hole

Or visible crack on both sides of the rail

Or visible crack greater than 1m in length

Or a dip greater than 3.5mm

Priority 1 20/10kph, monitor and remove urgently

Any visible crack

Or a dip greater than 1.2mm and up to 3.5mm

Or where a VSH crack has changed into another type of defect at a weld (such as a horizontal crack or transverse defect)

Priority 2 40/20kph remove defect within 48hrs but visually reassess each 12hrs and ultrasonically reassess* each 24hrs

Discoloration band

Or internal defect passes within 100mm of a weld or bolt hole

Or internal defect is continuous greater than 1m (continuous including where less than 200mm between continuous internal cracks)

Or Dip is greater than 0.5mm up to 1.1mm

Defects not meeting any of the above criteria – classify defect as Large, Medium or Small in accord with standard sizing criteria as contained in Table 1 and Table 2.

Notes

1. The most stringent criterion applicable is to apply
2. All VSH large defects should be removed as soon as possible. The maximum periods given are only applicable where larger numbers of defects have been found than can be dealt with quickly.
3. Dip is measured to the nearest 0.1mm using a taper gauge or feeler gauge at the centre of a 1m straight edge placed along the rail. The centre of the defect should be checked along with any locations where there is visible widening of the contact band
4. Visual assessment includes examination of all above observable parameters and checking dip
5. * Ultrasonic reassessment involves checking length of defect and checking that no other types of crack have initiated in any included welds (such as a horizontal crack or transverse defect).
6. Discoloration band refers to the band that may be found under the rail head in the web fillet sometimes called a "rust band."
7. A "disjoint" is where the crack faces overlap or have pulled apart.