



AUSTRALIAN RAIL TRACK CORPORATION LTD

Discipline: Engineering (Track & Civil)

Category: Standard

# Used Rail and Welding Policy

## ETF-01-01

### Applicability

|                 |   |                |  |
|-----------------|---|----------------|--|
| New South Wales | ✓ | CRIA (NSW CRN) |  |
|-----------------|---|----------------|--|

### Primary Source

ARTC NSW Standards TEP 12, TMP 09, TMP 15, TMP 18, TES 06, TES 09, TES 10, TMS 08

### Document Status

| Version | Date Reviewed | Prepared by | Reviewed by       | Endorsed                     | Approved |
|---------|---------------|-------------|-------------------|------------------------------|----------|
| 1.2     | 05 Apr 11     | Standards   | Manager Standards | Exec Manager SS&P 21/06/2010 | CEO      |

### Amendment Record

| Version | Date Reviewed | Clause | Description of Amendment   |
|---------|---------------|--------|--|
| 1.0     | 01 Dec 09     |        | Implementation draft. Supersedes NSW Standards TMP 09 v1.2 in part, TMP 18 v1.2, TES 06 v1.2, TES 09 v1.2 and TES 10 v1.1  |
| 1.1     | 18 Jun 10     |        | Banner added regarding mandatory requirements in other documents and alternative interpretations.  |
| 1.2     | 5 Apr 11      | 3      | Track classification A,B,C and D amended to show "Heavy Haul Lines", "Interstate lines", "Intrastate Lines", and "Light Weight Lines".. Deleted reference to Class E Lines |

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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 Purpose

This document sets out the used rail and welding policy for all mainline tracks.

## 2 Rail Replacement

There are five criteria by which programmed major rail replacement should be considered:

- 1) Rail head loss - as determined by the wear limits.
- 2) Rail testability - where the rail is unable to be tested ultrasonically giving rise to an increase in the risk of broken rails.
- 3) Wide gauge - where curve wear is the major contribution to wide gauge outside base operating standards. This criterion usually applies in conjunction with criterion 1.
- 4) Excessive internal rail defects - where there is a heightened risk of broken rails and where the cost of defect removal is a significant maintenance burden.
- 5) Rail head defects - Where the head defects which could include, surface damage, wheelburns or dipped welds is not economical to repair by normal maintenance.

The priorities for rerailling may be determined from Table 1.

| Criterion   | Priority 1   | Priority 2                             | Priority 3   | Priority 4  |
|---|--|--|--|---|
| Rail head loss  | At or below condemning   | Within 4mm of condemning               | Within 6mm of condemning                                 | Within 9mm of condemning  |
| Rail testability  | Medium or greater defects may not be detected  | Small defects may not be detected      | Uncorrectable surface damage due to rail contact fatigue | Cost of surface damage correction less than rerailling          |
| Wide gauge<br>(see note 1)                                      | 29 mm or greater   | 26 mm or greater                       | 23 mm or greater   | 20 mm or greater  |
| Excessive internal defects - defects per track.<br>(see note 2) | Defects 9/km per year or problem with critical defects   | Defects 5/km per year or greater       | Defects 4/km per year or greater                         | Defects 2/km or greater   |
| Extensive head repair defects                                   | Damage to track will occur in short term   | Damage to track will occur in med term | Damage to track will occur in long term                  | Damage will only occur in very long term                        |
| Priority detail   | Safety concern. Control of condition is possible only by special measures such as speed restrictions | Safety Priority                        | Economic Priority  | Opportunistic priority (eg work to take advantage of closedown) |

Table 1

*Note 1 Where wide gauge cannot be controlled by other measures such as regauging or resleepering.*

*Note 2 Critical defects are those where a rail break may not be a clean square break. This is generally all defects except Transverse Defects and Defective Welds. Bolt hole defects*

*should be excluded from consideration because correction of this problem may be to remove the joints by welding to CWR rather than by rerailing.*

### 3 Use of New and Cascaded Rails on Existing track

#### 3.1 Classification of Rails

Rails for reuse are to be ultrasonically tested prior to insertion in the track. They are to comply with the top and side wear reportable wear limits and the defect limits in the ARTC T&C Code of Practice. Rails must also have:

- No visible head, foot or web fillet cracks;
- No crushed or laminated head;
- No wheel burns deeper than 3mm;
- No end batter. It must be removed by cropping if it is to be reused in mainlines);
- No excessive rust;
- Rails that cannot be checked for tracks because of grease or from tunnels must be checked ultrasonically before paint coding.

#### 3.2 Rails for existing Heavy Haul and Interstate lines

Rail for Heavy Haul and Interstate Lines should be 60kg/m Standard or 60kg/m HH rail in accordance with AS 1085 depending on the curvature and the tonnage operating on the line, as shown below.

| Tonnage<br>MGT/year | Curvature   |                         |                      |                     |
|---------------------|-------------|-------------------------|----------------------|---------------------|
|                     | Sharp <301m | Moderate<br>301 to 699m | Flat<br>700 to 1500m | Very flat<br>>1500m |
| Less than 10        | 60 HH       | 60                      | 60                   | 60                  |
| 10 to 14            | 60 HH       | 60 HH                   | 60                   | 60                  |
| 15 to 19            | 60 HH       | 60 HH                   | 60 HH                | 60                  |
| 20 or greater       | 60 HH       | 60 HH                   | 60 HH                | 60 HH               |

In addition 60HH rail should be used as follows:

- Sections of track with excessive wear rates
- In any line where axle loads heavier than 25 tonne are to be used at levels greater than 1 MGT/year then 60 kg/m HH should be used.
- Curves with 6 yearly renewal cycles or less
- Platform and approach tracks with similar renewal cycles from train braking
- Grades 1 in 40 or steeper subject to extensive train braking or skidding
- In Turnout Renewals (for Heavy haul and Interstate Lines).

The following should apply:

- Recycled 53kg/m rail may be used on Intrastate Lines operating with less than 5 MGT per year and which do not have more than one MGT per year of 25 tonne axle load freight traffic;
- To match worn rails on existing 53kg/m tracks recycled 53kg/m rail may be used when repairing rail defects or converting rails to CWR;

- On Heavy Haul Lines the use of either 60 kg/m Standard or HH rails shall be as specified above;
- Where rail changes in Interstate Lines are made in conjunction with local works, such as level crossings and new bridges, 60kg/m rail should be considered;
- When 60kg/m rail is used for rail renewal both rails should be changed over;
- Resilient fastenings are to be used with 60kg/m rail.
- Allowance is to be made for the difference in height of 13mm between 53 and 60kg/m rails in aspects such as setting of tamping tools, structures and electric train stops.

### 3.3 Rails for Intrastate Lines

New 50kg rail or suitable recovered 47kg/m or blue 53kg/m rail may be used on Intrastate Lines (provided the track classification is retained as Intrastate).

Existing Light Weight Lines may be upgraded to Intrastate by using new 50kg/m, recovered blue 53kg/m or white 47kg/m rails

### 3.4 Rails for Light Weight Lines

Spot renewals may be made with rails of the same size. If suitable rails are not available, a section of line may be railed using approved 40 - 41kg rails and the recovered rail used for spot renewals elsewhere on the line.

## 4 Testing and Marking of Rail Closures

All 53kg/m rails to be reused including for use as closures must be ultrasonically tested. In addition, testing must include a special examination for vertical split head rail defects. This is done from the outside (field side) of the rail head using a zero degree probe.

If defects of any detectable size are found, or there is any evidence of inclusions the rail length may not be used and is to be scrapped.

The closure rail heat number and manufacturers brand must also be checked. If the brand shows the rail is not BHP or AIS it is not to be used on main lines but may be used on sidings where approved by ARTC. If the heat number contains the "A" character (usually the first character in the heat number) the rail length must not be used and is to be scrapped.

Rails found to be fully satisfactory are to be paint marked with a white stripe about 200mm long on one side of the rail foot at each end of the rail length but leaving the end itself clear for about 200mm. For rails longer than 4 metres which are likely to be subsequently cut up into closures a white stripe should be painted each 3 metres along the rail.

Rails that are not satisfactory for main lines but are suitable for sidings are to be painted similarly to the above but with a blue stripe.

Rails to be scrapped are to be cut up into lengths less than 2 metres. If there is any delay in carrying this out the rails should be painted with a green stripe similarly to the above.

In addition when testing of thermit welds takes place any rail closure which does not exhibit a white stripe (indicating it has been ultrasonically tested) must be ultrasonically tested as indicated above. If defects or inclusion with features similar to a VSH but below normal size are found the defect is to be classified as VSH Small and treated accordingly.

## 5 Welding of Rails

### 5.1 Rerailing

When rerailing on welded tracks and on connected relief tracks CWR should be provided.

During rerailing the total number of welds should be minimized with flashbutt welding being preferred to aluminothermic welding;

Aluminothermic welding is to be used only for junction welds, stress welds and joining long welded strings where flashbutt welding cannot be used.

Where rails are to be welded to CWR opposing aluminothermic joints are to be staggered 10 m with a minimum of 5m;

Aluminothermic welds are not to be placed directly over a sleeper.

## 5.2 Welding Processes

The approved aluminothermic welding processes are as shown in table 2.

| RAIL (Kg)   | WELD HARDNESS (HBN)    | THERMIT PROCESS | RAILTECH PROCESS                    |
|---|------------------------|-----------------|-------------------------------------|
| <b>SHORT PREHEAT (Standard Gap Welds)</b>                 |                        |                 |                                     |
| 47  | 260 - 300              | SKVF Z90        | See One-Shot Crucible Type CJ Below |
| 53  | 260 - 300              | SKVF Z90        |                                     |
| 60  | 260 - 300              | SKVF Z90        |                                     |
| 60HH  | 340 - 380              | SKVF Z110       |                                     |
| <b>LONG PREHEAT (Standard Gap Welds)</b>                  |                        |                 |                                     |
| 41  | 260 - 300              | SMWF Z70        |                                     |
| 47  | 260 - 300              | SMWF Z90        |                                     |
| 53  | 260 - 300              | SMWF Z90        |                                     |
| 60  | 260 - 300              | SMWF Z90        |                                     |
| <b>WIDE GAP (Short Preheat)</b>                           |                        |                 |                                     |
| 47  | 210 - 250              | SKVL65 Z70      |                                     |
| <b>WIDE GAP</b>   |                        |                 |                                     |
| 47  | 260 - 300              | SKVL65 Z90      | WG68W W; SC Process                 |
| 53  | 220 - 260              | SKVL65 Z80      |                                     |
| 53  | 260 - 300              | SKVL65 Z90      | WG68W W; SC Process                 |
| 60  | 260 - 300              | SKVL65 Z90      | WG68W W; SC Process                 |
| 60HH  | 340 - 380              | SKVL65 Z110     |                                     |
| <b>JUNCTION WELDS (Standard Gap Welds, Short Preheat)</b> |                        |                 |                                     |
| 30/41   | 210 - 250              | SKVF Z70        |                                     |
| 41/47   | 260 - 300              | SKVF Z70        |                                     |
| 47/53   | 260 - 300<br>280 - 320 | SKVF Z90        | PLK CJ; X Process                   |
| 53/60   | 260 - 300<br>280 - 320 | SKVF Z90        | PLK CJ; X Process                   |
| 53/60HH   | 340 - 380              | SKVF Z110       |                                     |
| <b>ONE SHOT CRUCIBLE - STANDARD GAP</b>                   |                        |                 |                                     |
| 41  | 210 - 250              | 41 SKVF Z70 SU  |                                     |
| 47  | 260 - 300<br>280 - 320 | 47 SKVF Z90 SU  | PLK CJ; X Process                   |
| 53  | 280 - 320              |                 | PLK CJ; X Process                   |
| 50  | 280 - 320              |                 | PLK CJ; X Process                   |
| 60HH  | 340 - 380              | SKVF Z110 SU    | PLK CJ; HH Process                  |

| RAIL (Kg)                           | WELD HARDNESS (HBN)    | THERMIT PROCESS | RAILTECH PROCESS   |
|-------------------------------------|------------------------|-----------------|--------------------|
| 60                                  | 260 - 300<br>280 - 320 | SKVF Z90 SU     | PLK CJ; X Process  |
| <b>ONE SHOT CRUCIBLE - WIDE GAP</b> |                        |                 |                    |
| 60                                  | 280 - 320              |                 | WG68 W: CJ Process |
| 53                                  | 280 - 320              |                 | WG68 W: CJ Process |

Table 2

## 6 Rails Approved for Welding and for Use in Junction Rails

### 6.1 Rails Approved

The only rails approved for welding and for use in junction rails are shown in table 3. Only approved welding processes are to be used. The standard of finish of the welds is to comply with ETM-01-01

|  |                           |
|--|---------------------------|
| 60 kg A.S. 1981  | Standard                  |
| 60 kg A.S. 1981  | Head Hardened             |
| 50 kg AS. 1981   |                           |
| 53 kg A.S. 1981  | All treated as 53 kg rail |
| 107 lb A.S. 1936, 1964   |                           |
| 103 lb A.S. 1936   |                           |
| 100 lb A.S. 1928   |                           |
| 47 kg A.S. 1921  | All treated as 47 kg rail |
| 94 lb A.S. 1937  |                           |
| 90 lb A.S. 1928  |                           |
| 90 lb A.S. 1925  |                           |
| 90 lb A.S. 1916  |                           |
| 90J 1913   | All treated as 41kg rail  |
| 41 kg A.S. 1977  |                           |
| 80 lb A.S. "B" 1928 (commonly called 80 NEW)                           |                           |
| 80 lb A.S. "A" 1928 and 80 lb A. S. 1916 (Both commonly called 80 OLD) |                           |

Table 3

The following junction rails have been approved for use in ARTC tracks.

- 60 kg rail to 53 kg rail to Drawing L5353;
- 53 kg rail to 47 kg rail to Drawing L 5354;
- 47 kg rail to 41kg rail to Drawing L 5355.

### 6.2 French Rails

French rails (Longwy and Micheville) are not to be welded into CWR lengths in main line tracks. They may be field welded to longer lengths in crossing loops and sidings provided that the rails are suitable for welding, ultrasonically tested particularly the welds and the side of the rail web, for a distance of one metre from the weld.

## 7 Approved Welding Equipment

Oxy and LPG gas equipment used in aluminothermic welding needs to provide a guaranteed gas flow rate at the nozzle.

It is therefore extremely important that the combination of regulator, flashback arrestor, non return valve, cutting attachment, hand piece, mixer and quick release hose couplings operate as a unit.

Equipment has been tested and approved by ARTC's Welding Inspectors. The only configurations of welding equipment approved for use are detailed in Attachment 1.

Quick Release Fittings are only to be fitted to the torch end. The approved quick release fittings have no effect on flow rates, whereas some other fittings have a big effect on flow rates.

Inspection and tagging of welding equipment should only be undertaken by ARTC's welding specialists.



## 8 Attachment 1

| <b>Approved Oxy/LPG Welding Equipment</b>                |                |                   |
|--|----------------|-------------------|
| <b>For Thermit welds</b>                                 |                |                   |
|  | <b>Part</b>    | <b>Stock code</b> |
| Regulator  | LPG (cig weld) | 001469253         |
|  | Oxy (cig weld) | 001469246         |
| Flashback arrestors                                      | LPG            | 001882083         |
|  | Oxy            | 001882091         |
| Non return valve   | LPG            | 001885144         |
|  | Oxy            | 001885169         |
| Cutting attachment.                                      |                | 001468776         |
| Hand piece   |                | 001468735         |
| Mixer 13 mm (cigweld)                                    |                | 001468750         |
| <b>For Railtech (Boutet) welds</b>                       |                |                   |
| Regulator  | LPG (Harris)   | 001580349         |
|  | Oxy (cig weld) | 001469246         |
| Flashback arrestors                                      | LPG            | 001882083         |
|  | Oxy            | 001882091         |
| Non return valve   | LPG            | 001885144         |
|  | Oxy            | 001885169         |
| Cutting attachment.                                      |                | 001468776         |
| Hand piece   |                | 001468735         |
| Mixer - 13 mm  |                | 001468750         |
| Preheating hand piece                                    |                | 001584317         |
| Preheating mixer   |                | 001665199         |
| <b>Quick Release Fittings (for Thermit and Railtech)</b> |                |                   |
| Hose Coupling - 10mm                                     | LPG            | 001785179         |
|  | Oxy            | 001785195         |
| Nipple Male  | LPG            | 001785187         |
|  | Oxy            | 001785203         |
| Nipple Female  | LPG            | 001884212         |
|  | Oxy            | 001884220         |