



AUSTRALIAN RAIL TRACK CORPORATION LTD

Discipline: Engineering (Track & Civil)

Category: Standard

Rail Weld Geometry Standard

ETM-01-01

Applicability

ARTC Network Wide	✓	Western Jurisdiction	
New South Wales		Victoria	

Primary Source

RIC Standard TS 3601 Version 2.1/ARTC Standard TMS 08 Version 1.3

Document Status

Version	Date Reviewed	Prepared by	Reviewed by	Endorsed	Approved
1.2	16 Jan 09	Standards dept	Manager Standards	Chief Operating Officer	Risk & Safety Committee 07/10/2008 as part of ETE-01-03 approval

Amendment Record

Version	Date Reviewed	Clause	Description of Amendment
1.0	19 Oct 05	Various	Previously TMS 08. Part 2 of SC approved changes (see TMS 08 1.3 for Part 1). Re-issued to include details of modified 1m straight edge. Extended to cover flash butt welds. Various amendments after review and consultation. Issued as ARTC Common Standard.
1.1	04 Jan 06	Title; 5	Change title. "Semi-finished" weld added (Section 5)
1.2	16 Jan 09	4; 7	Timeframe for testing of new welds updated to reflect requirements in ETE-01-03 and reference to superseded NSW Standard TEP 15 removed.

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1 General

Welding of rails should be carried out to meet these standards. Only approved aluminothermic, flash butt, wire feed or head repair welding processes are to be used.

2 Welding of rails

2.1 Fishbolt Holes

Bolt holes which are being, or have been, used in track to form a mechanical joint must be closely examined and if there is any damage, no matter how slight, then all the bolt holes must be removed or tested Ultrasonically.

If there is no damage, then they may be treated as if they were unused but the new weld is to be no closer than 65mm from any bolt hole.

At a turnout sometimes this is not achievable – in this case the hole/s should be steel plugged for heat transfer.

2.2 Junctions

Rails of dissimilar section can usually be welded together using the Thermit SKV or SMW-f process and correct junction rails. The correct junctions are to be ordered and used.

2.3 Ultrasonic testing prior to welding

Where wire feed or head repair welding is to be used for wheel burns, squats, etc, prior ultrasonic testing should usually be completed as specified in approved procedures. In general, if damaged rail is left untreated for more than 24 hours, ultrasonic testing should be carried out.

3 Standards of Finished Weld

Table 1

Factor	Standard upon completion
Peak in running surface (over 1 metre)	up to 0.3 preferred, maximum 0.5mm
Dip in running surface (over 1 metre)	Strictly no dip allowed
Vertical deviation in rail running surface (Change in weld ramp angle)	7 milliradians over 50 mm base
Gauge widening (over 1 metre)	0.5 mm max (Less preferred)
Gauge narrowing (over 1 metre)	0.5 mm max (Less preferred)

On completion, the welded rail is to be checked for correct surface straightness and proper alignment, using a 1 m straight edge (see appendix A for details) or an approved alternative straightedge/measuring device.

Required measurements should be taken with a metric taper gauge, feeler gauge or electronic measuring system.

The top surface must also be checked with a P1 (dipped weld) gauge or an approved measuring system capable of gauging changes of weld ramp angle.

3.1 On Straight Track

On completion of grinding, the top and gauge surfaces are to be checked.

Peak, dip and change in weld ramp angle must comply with the standards in Table 1 and be checked with the straightedge/measuring device across the rail head from the gauge corner to the outside edge of the wheel/rail contact band.

The peak must be checked with the centre of the straightedge positioned at the point of maximum peak. This will usually be at the weld but may be at some point in the area subject to grinding.

While these limits are based on a 1m straightedge, it is not acceptable to extend grinding past that area to permit the weld to comply. The standards prescribed in Table 1 must be achieved for each weld over the entire area affected by grinding of the weld.

**TOLERANCES FOR FINISH OF WELDED RAIL USING
THE ARTC FINISHING STRAIGHTEDGE**

Top Surface

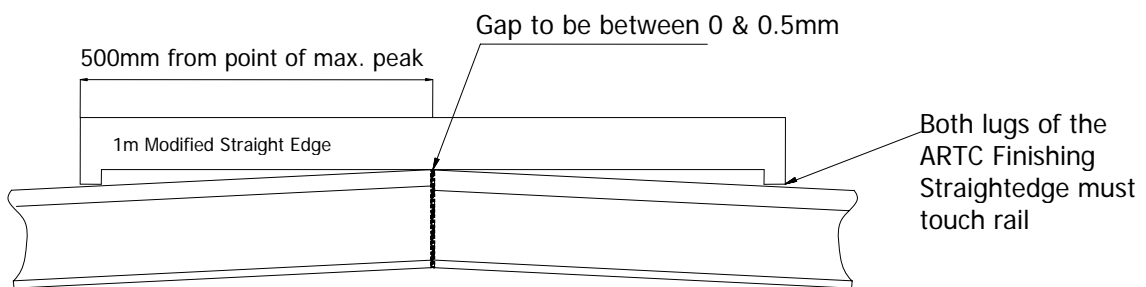


Figure 1

Weld misalignment tolerance in vertical plane (peaking)
Maximum peak allowed in 1m is 0.5mm

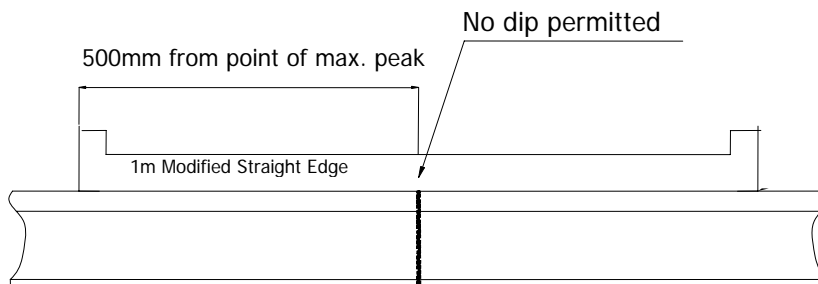


Figure 2

Weld misalignment tolerance in vertical plane (dip)
No dip permitted

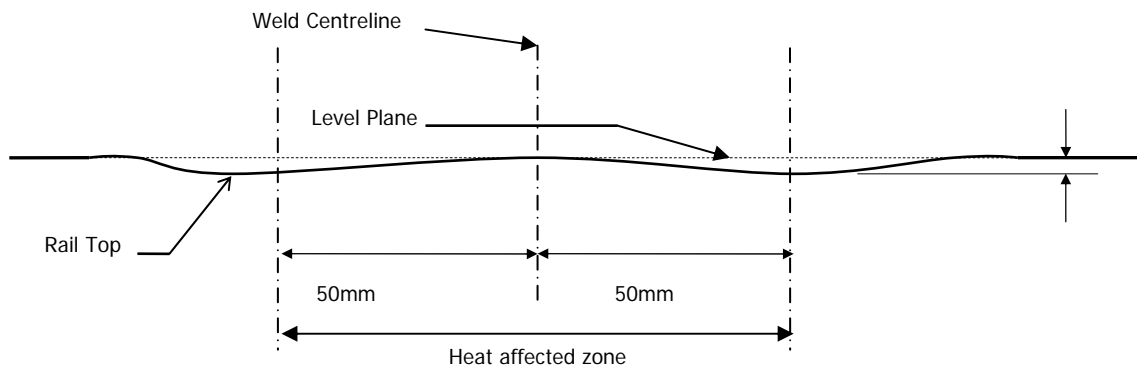


Figure 3

Vertical deviation in rail running surface (Change in weld ramp angle)

Case where peak and dip are within tolerance but change in ramp angle recorded by P1 Gauge may be outside of 7 milliradians tolerance.

Changes in the weld ramp angle over a small base length can be assessed with a P1 Gauge to determine whether the weld finish meets the requirements of this Standard for the change in weld ramp angle. A situation where this requirement may determine acceptance of the weld is shown in Figure 3.

3.2 On Curved Track

Top Surface

On completion of grinding, the top surface is to be checked as for a straight track – see above.

Gauge Face

On completion of grinding, the newly welded portion of rail must have a curvature consistent with the curvature of the existing rail, and the gauge face at the weld(s) must be smooth and continuous.

4 Limits on Welds Adjacent to Joints and Other Welds

Plain Track

On plain track (main line or siding), aluminothermic welds may not be placed within 4.0 metres of any weld (flashbutt or aluminothermic) or mechanical joint. This restriction does not apply to the distance of welds each end of a new glued insulated joint to the central joint.

Turnouts

In turnouts, new welds may have to be placed closer than 4m to a minimum distance of 1.2 metres to other welds due to fixed constraints. This is acceptable provided that:

- The existing weld has been ultrasonically tested during the last cycle and no significant defects found.
- The rail is well secured, so that in the unlikely event of a rail break, the rail will not skew.
- The new weld is ultrasonically tested within the timeframe specified in *ETE-01-03 Non-Destructive Testing of Rail (for Internal & Surface Defects)*.

5 Semi finished Welds

Where there is insufficient time for a weld to fully cool to the same temperature as the adjoining rail, thus preventing final grinding to be completed, the weld can be left in a "semi finished" state (as defined Table 2 below) for a period not exceeding 14 days. It is important that in this state the weld is peaked, to allow sufficient metal to be left for the final grind.

Under normal circumstances, during this period, trains can run over the weld at normal speeds.

Table 2

Factor	Standard for semi finished state
Peak in running surface	+0.8 to +1.2 mm over 1 metre (About 1 mm preferred)
Dip in running surface	Strictly no dip allowed
Vertical deviation in rail running surface (Change in weld ramp angle)	approx. 7 milliradians over 50 mm base
Gauge widening over 1 metre	0.5 mm max (Less preferred)
Gauge narrowing over 1 metre	0.5 mm max (Less preferred)

6 Visual Inspection of Welds

Each weld must be visually inspected closely by the qualified welder after the weld has been completed and prior to leaving the worksite.

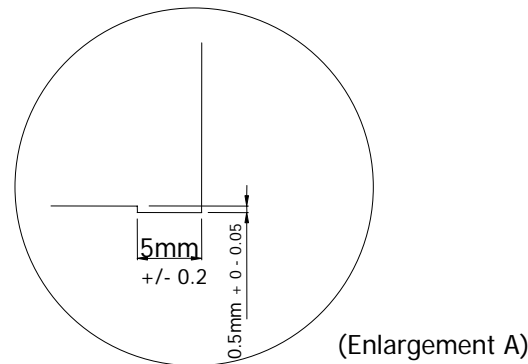
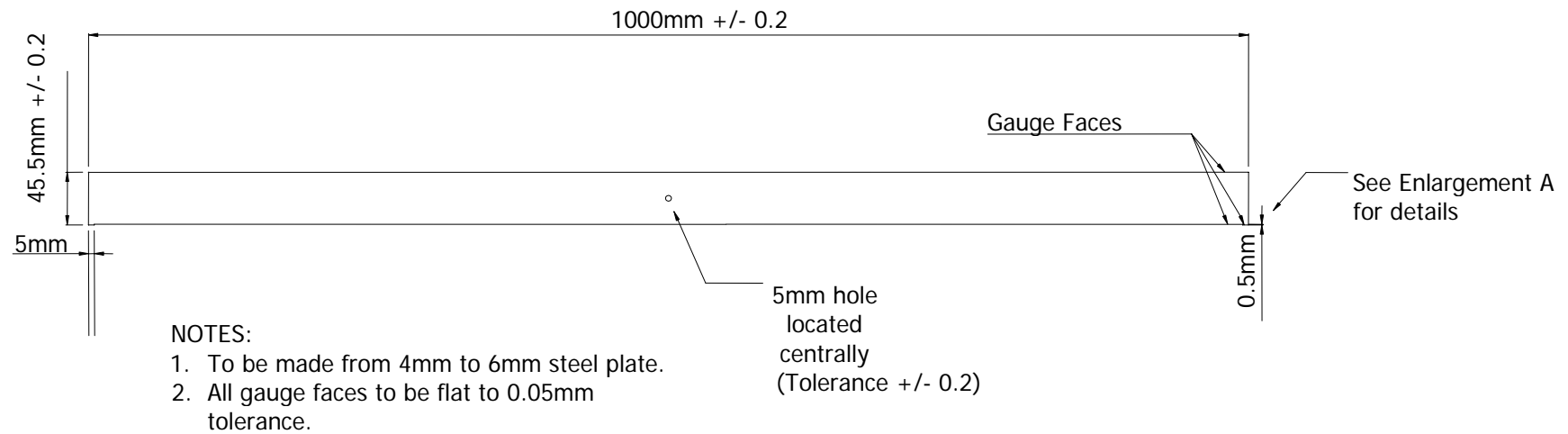
Any welds that show holes, slag inclusions, hot tears or other defects must be removed immediately.

7 Ultrasonic testing of new welds

Ultrasonic testing of new welds is to be completed within the timeframe specified in [ETE-01-03 Non-Destructive Testing of Rail \(for Internal & Surface Defects\)](#).

8 Appendix A

ARTC FINISHING STRAIGHTEDGE



Note: Approved alternatives such as electronic straightedges can also be used.