Engineering Practices Manual

Civil Engineering

Maintenance of Welded Track (General)

RTS 3648

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1 Scope

This document provides guidelines for the maintenance of all types of welded track.

This document is to be read in conjunction with the following ARTC Standards and Engineering Practices.

Standard	Engineering Practice	Title
TMP 08		Anchoring of Track
TMP 10	RTS.3646	Continuously Welded Rail - Control of Creep
TMP 14		Maintenance of Welded Track (Summer Periods)
	RTS.3652	Adjustment of Ballast Cleaned Welded Track
TMP 06		Speed Restrictions for Welded Track Under Extreme Weather Conditions (WOLO)
TMP 16		Rail Inserts and Slotted Plates - Use and Maintenance
TMP 03	RTS.3655	Maintenance of Mechanical Joints and Examination of Rail Ends in Welded Track
	RTS 3640	Rail Adjustment Manual

Effective maintenance of welded track requires a high standard of workmanship because the rise and fall of temperature acting on the long lengths of rail or continuously welded rail causes greater forces in the rails, sleepers and ballast than is the case of ordinary loose rail track.

These instructions are for use by Track Maintenance Staff as well as other levels of management.

By following the rules for good track maintenance and the instructions shown below, safe and good quality track will result.

2 Reason and nature of change

Reference to superseded NSW Standard TEP 17 replaced with ETE-01-03 and Rail Fail form replaced with Rail Flaw Report.

3 Definitions

For definitions of terms used in this Technical Standard refer to ARTC Standard TMS 07.

4 Creep

After mechanically jointed track is laid the expansion gaps are to be carefully adjusted. Any creep that occurs with welded track alters the correct adjustment of the gaps making some too tight and others too wide. When this is observed the movement is to be reported to the Team Manager, who will take any action necessary to arrange for the track to be readjusted.

Similarly with continuous welded rail, creep measurement marks are to be monitored as set out in ARTC Standard TEP 11 and the necessary action taken to correct creep when it is observed.

Creep is more rapid in loose ballast, and newly ballasted track is to be carefully watched for signs of movement.

5 Mechanical Joints

5.1 Gaps

If mechanical joints are open in hot weather or closed in cold weather the condition is to be investigated. This may be due to creep or frozen joints (the rails not moving in the fishplates due to rust or excessive tightness of bolts). In this case the fishplates are to be taken off and correctly greased, but this must not be done when the rail temperature is below 30^{o}C as there is a danger of their 'jumping'.

When removing fishplates, the instructions in ARTC Engineering Practice RTS 3655 are to be observed.

5.2 Packing

Joints must be properly packed. The weakness of the mechanical joint transmits vibrations to the ballast. This causes it to fret away quicker than elsewhere. Regular packing is necessary, either by hand or by tamping machine.

5.3 Rail End Condition

Flowing metal on rail ends reduces the expansion allowance and also causes rail end chipping when rails close up during hot weather. When this flow occurs the rail ends must be filed or ground back square. This work should be done regularly before the summer.

Any chipped rail ends are to be reported to the Team Manager.

6 Mechanical Insulated Joints

Mechanical insulated joints are not expansion joints and the rail ends should be hard up against the fibre key at all but very low temperatures. In cases where there is so much pull on the rails that the bolts bend and allow the gap to become excessive the matter must be brought under the notice of the Team Manager, who must arrange for the rails to be adjusted.

The condition of the insulating components must be monitored and arrangements made with the Signals personnel to supply new components when necessary.

7 Glued Insulated Joints

Glued insulated joints are not expansion joints but are designed to act as part of the adjacent welded rail.

Should a glued insulated joint show signs of failure of the glue with a visible crack line at the endpost or under the fishplates, the joint is to be treated as a mechanical insulated joint and anchored accordingly.

Once a glued insulated joint has failed mechanically, as above, it should be programmed for replacement since its electrical failure is also likely.

8 Line, Top and Superelevation

Track alignment must be checked frequently by measurement from monuments or other permanent marks and any variation from the correct line, level, or superelevation must be adjusted. No superelevation outside normal tolerance must be allowed on straight track, unless indicated by the monuments.

The track must be maintained within the standards of ARTC Standard TMS 03 unless otherwise specified.

9 Lifting, Fettling and Lining of Track

All ballast must be replaced and the sleepers properly boxed up.

The fettling task cannot be considered completed unless the track has been pulled to line.

Mechanical fishplated joints require considerably more fettling than the rest of the track and should be given special attention.

Under no circumstances is the track to be lifted in a face without a direction from the Team Manager, and when such a general lift is to be undertaken it must not be carried out until additional ballast is provided.

No lifting or lowering should be carried out during hot weather, as set out in ARTC Standard TMP 14.

All sleepers including the run-outs must be well packed after each lift. Run-outs must be gradual to ensure smooth running of trains.

On curves, the lifting jack must always be placed under the high side of each rail.

When the welded track is out of line it must not, under any circumstances, be forced over with lifting jacks but must be pulled with bars held almost vertically, or preferably with specialised track lining jacks, placed so as not to lift the rails.

Extensive lining must not be carried out during hot days.

Ballast must be replaced at the sleeper ends after lining.

Substantial pulling to realign curves will alter adjustment of rails and this must be corrected as soon as practicable after realigning is completed. The procedure is laid down in ARTC Engineering Practice RTS 3650.

10 Pulling Curves to Line

Teams will pull curves to pegs and adjust realignment as set out hereunder.

When aligning welded track to pegs or monuments the operation should be carried out in the temperature range within which the track can be adjusted.

If it is necessary to align track to monuments outside the temperature range of 15^{o}C to 38^{o}C the track is initially to be pulled as close as possible to the pegged alignment. At a later stage, when adjustment can be made, this is to be done and the track pulled finally on to the correct alignment, in adjustment.

11 Machine Tamping and Lining

Machine tamping and lining will alter the length of steel in welded track where substantial realignment is done. Indiscriminate and unsupervised 'smooth lining' is not permitted. On a 400m radius curve the lining of a 110m rail by an average of 10mm will alter the length of steel required by 3mm which is equivalent to changing the temperature by 2°C.

On Class 1XC, 1X, 1C, 1 and 2 main line welded track, monuments and pegs must always be referred to in any machine lining. It is necessary to measure and record the rail gaps and the distance of pegs before and after all surfacing and lining operations together with the rail temperature at the time of working.

Where the net variation is more than the effect of 5°C temperature, the track is to be adjusted.

During the months of temperature extremes general lifts must not be made when the rail temperature is below 15^{o}C or above 38^{o}C.

Where machines have compaction equipment provided this equipment should be used to assist in providing better track stability.

12 Use of Short Closures

When welding short closures into curves on main running lines, it is essential that the closure be cut from rail which conforms as closely as possible to the curve wear on the existing rails.

For curves of 800m and under both the closure and each adjacent rail are to be crowed to the correct curvature.

13 Use of Jim Crows and Rail Benders

Crows or Rail Benders may be used at welded joints.

Bending of rails must always be done to produce a smooth progressive curve rather than a sudden change of direction.

14 Gauge of Track

The gauge should be uniform and must be frequently checked. When the gauge exceeds the standard limits of ARTC Standard TMS 03 regauging is to be arranged.

On curves with sleeper plates and sound sleepers, the high rail is to be allowed to wear to condemning gauge, providing the 'foot' gauge is maintained correctly if possible without regauging by reboring of the timber sleepers.

Where the sleepers are not sound, tying up and regauging is to be carried out where necessary.

15 Sleepers and Spikes

The condition of sleepers must be maintained to a high standard, particularly at fishplated joints.

In addition to the ordinary inspection the Team Leader must, from time to time, test all sleepers for drumminess.

Loose spikes must not be allowed to remain.

Condition of sleepers and fastenings is critical to the control of stresses generated in CWR track.

16 Rail Anchors on Dogspiked Track

Rail anchors are provided to prevent creep and limit the movement of rails with the rise and fall of temperature. The standard of anchoring as laid down in ARTC Standard TMP 08 is usually sufficient to prevent creep, but in certain locations, such as approaching stations, signals, or on heavy down grades, additional single anchors against creep are necessary and must be fixed.

Anchors must be maintained against the sleeper. Anchors found away from the sleeper are to be removed and refixed against the sleeper. They must not be hammered along the rail.

17 Resilient Fastenings

Where resilient fastenings are used they replace dogspikes and rail anchors, and require a total of four elastic lockspikes to secure the sleeper plate to the sleeper. Lockspikes must be firmly driven into sound sleepers.

Resilient fastenings must be kept driven fully home (not overdriven) into their fittings or housings, using the method appropriate to the type of fastening. If a special tool is necessary to fit and/or remove resilient fastenings, then they should not be fitted or removed without use of such tool.

Resilient fastenings must not be overstressed by vertically lifting rail off the sleeper plate with the fastenings in place, or by levering upward between the toe of the fastening and the foot of the rail.

For adjustment or longitudinal movement of lengths of rail fitted with resilient fastenings the fastenings must be completely removed. Do not try to pull rail through resilient fastenings.

Where wrap round insulated rail pads are used the rail must be lifted free from the pad to allow unimpeded longitudinal movement of the rail lengths for adjustment.

18 Running Back and Adjustment of Rail Gaps in Mechanically Jointed Track

Manual screw type running back jacks or power operated jacks are used, operated by two men, with one or two men engaged removing anchors to allow the rails to move in the desired direction.

Where only small movement is required, or where, for some reason, a special jack is not available, adjustment can be done by what is known as the 'Temperature' method. This consists of removing anchors on one side of the sleepers in the cool of the morning and allowing the rising temperature to push the rails in the proper direction. The anchors are again clipped on, hard up against the sleepers, before the temperature starts to fall. By this means urgent cases of very tight or very wide joints can be quickly relieved, and by repeating the process on successive days, very long lengths can eventually be adjusted.

The equipment required for adjusting gaps correctly includes a manual or power operated running back jack, rail Thermometer, Rail Gap Gauge, and set of Rail Gap Keys.

If necessary a cut may be made in the centre of a 110m leg or elsewhere on longer rails to assist in running back. This should only be done when the rail temperature is below 35^0C and power jacks and aluminothermic welding equipment are available to complete the restoration of the track on completion of the adjustment.

19 Adjustment of CWR Track

The adjustment process for CWR track is different from that applying to mechanically jointed track and is set out in RTS 3650 in detail. This process is the only approved method of CWR adjustment that reliably produces adjusted CWR track.

Any work on CWR track which causes a broken rail will change the adjustment of the rail and make readjustment necessary at the completion of the work.

During the adjustment of CWR track, particular emphasis must be placed upon initial destressing of the rail and subsequent equalisation of adjustment stresses by use of a vibrating machine or an equivalent manual process.

20 Ballast

Ballast must be maintained to the standard section with a minimum of 400mm outside the sleeper ends (See also ARTC Standard TDS 11).

Manual boxing up must be done with forks. Shovels must not be used.

Standard Grade ballast must be used on Class 1, 2 and 3 lines. Ashes, screenings and quarry dust are prohibited for use as ballast. Fine Grade ballast is acceptable for Class 4 and 5 lines (refer ARTC standard TDS 11).

When ballast is ordered and supply delayed, the boxing up should be completed on the high side of the curve by taking metal from the low side, and on straight road, from the four foot provided cold weather is not anticipated. This ballast shortage must not be allowed to persist.

Adequate ballast is essential for welded track stability.

Ballast should be compacted using mechanical compactors whenever such equipment is available.

21 Drainage

Special attention must be given to drainage. Where sub-drainage work has been carried out; the outlets must be kept clean to allow water to run off.

The cesses in cuttings must be kept formed so that the water will run at the toe of the batter. On banks the cesses must be graded away from the track.

Where bog holes exist, ample metal ballast should be kept on hand to replace the continued loss of metal through fettling. The attention of the Team Manager must be drawn to this so that he may have sub-drainage work carried out, when practicable.

Effective drainage is a major factor in minimising maintenance work necessary on welded track.

22 Survey Monuments

Survey monuments must be kept free of ballast and visible at all times for checking purposes.

If monuments are damaged or it is suspected that they have moved or are unreliable, the matter should be reported so that a check survey may be made.

The alignment of the rails must be maintained within the tolerances set out in ARTC Standard TMS 03.

Replacement and checking of the location of permanent survey marks (monuments) will be carried out by surveyors.

23 Examination of Welded Track

A thorough examination of welded track can only be carried out by a walking inspection. During such examination notation must be made of the amount of creep, irregular sleeper spacing or skewed sleepers, changes in alignment, anchors that have moved from the sleeper, frozen fishplate joints and other maintenance defects. Inspections are carried out as part of the requirements of the Track Examination System (ARTC Standards TEP 14, TEP 04, TEP 08, XEP 01, TEP 06, TEP 11, TEP 09, LEP 02, TEP 10, TEP 03, TEP 12, TEP 05).

Welded track should be examined twice a year to measure the gaps in all mechanical joints. In order to do this properly, the examinations must be carried out while the rail temperature is between 20^{o}C and 35^{o}C. The gaps measured must be compared with the correct gap as shown in ARTC Standard TEP 09.

Continuously welded track must be regularly examined for signs of incorrect adjustment which must be corrected as set out in RTS 3650.

This examination is critical before the onset of hot summer weather.

Creep measurements as detailed in ARTC Standard TEP 11 must also be recorded for assessment of Welded Track Stability.

Rail defects in welded and CWR track must be reported and rectified in accordance with the ARTC Standard ETE-01-03.

24 Broken Rails and Welds

When a rail breaks in welded track it must be properly secured with fishplates and reported immediately.

If the break is such that traffic cannot be safely allowed over it, a closure must be cut or welded in as detailed in RTS 3650.

The closure rail is to be cut to a tight fit without expansion. A rail saw is to be used for cutting of rails and great care taken to see that the ends are cut square and the holes correctly drilled.

Where possible, as soon as staff and equipment is available, the closure rail is to be welded in, rail is to be repaired by welding as detailed in RTS 3602 and in CWR track, adjusted as detailed in RTS 3640.

Before cutting out the broken portion on dogspiked track, all anchors on adjacent rails must be securely fixed in each direction, and, if available, additional anchors should be fixed to prevent the rails moving.

In the event of a weld breaking or developing a crack, action must be taken, such as:

- Replacement with a closure rail
- Wide gap weld
- temporarily plated

The matter must be reported to the Team Manager, who will advise what action is required and arrange for a Rail Flaw report as per ETE-01-03.

If the welded joint is to be cut out, it is to be treated as a broken rail and the piece of rail 75mm long on each side of the weld is to be forwarded for testing if directed.

Broken or cracked welds are to be reported similarly to broken or defective rails as required by the Rail Flaw Report in accordance with ETE-01-03.

When considered necessary a speed restriction should be imposed.