

Steel Sleepers – Usage and Installation Procedure

ETC-02-04

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SMS

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1 Introduction

1.1 Purpose

This procedure provides guidance to meet requirements for the use and installation of steel sleepers in accordance to ARTC standards.

1.2 Scope

This procedure covers those aspects of replacing timber sleepers with steel sleepers which may be different to the replacement of old timber sleepers with new timber sleepers or concrete sleepers. These aspects include:

- installation requirements
- ballasting and resurfacing
- inspection after installation

1.3 Responsibilities

The Manager Standards is responsible for the content of this procedure.

The Delivery Manager is responsible for the implementation of this procedure

1.4 Reference Documents

All activities and materials used in the installation of steel sleepers shall conform to relevant ARTC Standards, Procedures, Guidelines, and Work Instructions, Australian Standards, and Codes of Practice including:

AS 1085.17, Railway track materials – Steel sleepers

AS 1085.19, Railway Track Materials – Resilient Fastenings.

ARTC Steel Sleeper Specification

ARTC Specification ETA-04-01, Ballast Specification

ARTC track geometry standards and procedures

ARTC Standard Classification of Lines

ARTC Standards and procedures for track lateral stability

ARTC Timber Sleeper Maintenance Standard

ARTC Standard ETC-02-03 Steel Sleeper Usage and Installation Standard

ARTC Procedure for Mechanised Track Surfacing

1.5 Definitions

The following terms and acronyms are used within this document:

Term or acronym	Description
Back Canting	Rails are normally inclined 1:20 towards the track centreline. Back canting is where rails are tilted towards the field side of this normal position (typically due to timber sleeper wear).
Centre Binding	Where there is greater bearing pressure below the centre of the sleeper compared to the ends of the sleeper. Steel sleepers can deform and timber sleepers can break when “centre-bound”.
Clumping	Where more than two adjacent steel sleepers exist within an area of tie pattern of less than 50% steel sleepers
Face resleepered	A track length is considered “face resleepered” (not clumped) when the rail length with 100% steel sleepers reaches 110m on straights or the full curve (TP to TP) in curved track
May	Activity permitted by this procedure (from AS HB 162 – 2002)
Pod	The space under a steel sleeper below the sleeper deck and between the side walls of the sleeper.
PRS	Partial Re-Sleepering
Rail Anchoring	Use of “Fair” type anchors with timber sleepers and resilient rail fasteners with steel and/or timber sleepers to restrain (anchor) the rails from moving longitudinally through the sleepers.
Shall	Mandatory criterion (from Australian Standards Handbook – AS HB 162 – 2002)
Should	Guideline or recommendation (from AS HB 162 – 2002)
Tie	A sleeper installed as a partial replacement of sleepers
Tie and Surfacing	The process by which sleepers are installed in PRS and the ballast packed under and around the sleepers to required track geometry and ballast profile tolerances.

2 Installation Requirements

2.1 General

In general, steel sleepers perform best if they are installed at a consistent spacing. In addition, any proposed installation pattern shall consider future sleeper installation to ensure that subsequent spacing is not compromised.

2.2 Circuited Track

In circuited track special precautions are required to prevent signal failures. Consideration shall be given to:

- the correct fitting of insulators and any insulator damage
- any conductive material around the fastenings and insulators including: ballast fines, filings, and conductive objects (such as old fastenings)
- foul ballast material or other contamination in immediate contact with the rail foot
- adequate drainage so that water does not lay around the rails and fastenings.
- the use of special fastener clips on insulated joints to avoid short circuits.

3 Installation

3.1 General

Steel sleeper installation is different to the traditional timber sleeper and surfacing operation in three ways:

- the requirement for additional ballast to fill the pods,
- the tamping needed to get the ballast into the pods and to support the sleeper, and
- they incur a higher initial settlement rate.

3.2 Ballast

A typical requirement to cover ballast needs for resleepering with 1:4 steel sleepers is about 3 tonne per 20 m of track (including the additional ballast required to fill the pods). Higher pattern densities require proportionately more ballast. Additional ballast may still be required to address any existing deficiencies and to provide for any track lifting carried out in association with PRS.

3.2.1 Sleeper Insertion and Resurfacing

As stated in clause 3.3 of this procedure it is a requirement that during the resleepering process the track shall be mechanically packed to ensure effective support.

For guidance, the following steps are the recommended:

- 1) Install sleepers including spot tamping to hold sleepers up so they can be clipped up.
- 2) Ballast and regulate (alternatively regulator can bring in the required ballast from outside shoulders if extra is available).
- 3) Tamp, line and level all track with two insertions of tynes at steel sleepers.
- 4) Take “after” alignment, superelevation, and pod ballast height measurements.
- 5) Final ballast, regulate and broom to give correct ballast profile.

For installation of spot steel sleepers, resurfacing of all track is not required however the sleepers immediately adjacent to the installed sleeper should be tamped. This is often achieved using a tamping head on a mini excavator or similar.

Manual installation and tamping of steel sleepers is not recommended, as effective tamping is difficult to achieve. Steel sleepers may be manually installed in emergencies. In such cases appropriate measures shall be taken to bring the installation to standard as well as take any short term protective action required. Sleepers shall not be supported under trains by the spade ends.

3.3 New Construction

Steel sleepers should be placed on ballast that has previously been laid, levelled and compacted. Steel sleepers shall not be placed on a bare, level formation and subject to train loads including ballast trains. If new track is being constructed on bare formation, steel sleepers shall be well supported under the rail with a gap under the centre of the sleeper to distribute wheel loads and prevent the sleepers being centre-bound.

4 Inspection following Installation

4.1 Inspection at Conclusion of the Work

Newly installed steel sleeper locations shall be inspected at the conclusion of the work to ensure that the installation requirements specified in this procedure have been achieved.

At locations where measurements are required following resurfacing (“after” alignment and superelevation measurements as required by ARTC Mechanised Track Surfacing procedure) the measurement of any gap between the ballast in the pod and the sleeper deck shall also be made at an inspection hole adjacent to each rail. These measurements are to be recorded on the measurement form and appropriate action taken to rectify any deficiency, or if additional tamping is not practical any defect shall be reported as defined in ETC-02-03 Steel Sleeper Usage and Installation Standard.

The tape measure or alternate measuring tool shall not be pointed as it could penetrate the ballast. It should have a flat, blunt end as large as allowed by the 20mm inspection holes.

4.2 Follow Up Inspection Requirements

The in-service performance of the steel sleepers PRS is an important aspect and any obvious problems will be identified during track patrol inspections, the results of the track geometry recording car, the annual track stability inspection, and assessment during detailed walking inspections including:

- Where ballast inspection holes are provided, visually inspect the pod levels with height measurements to be taken when the visual inspection indicates the deficiencies are to the defect reporting limit of 50 mm.
- Otherwise, all other aspects are covered by compliance to the generic track inspection and assessment Standards.

During periodic maintenance resurfacing ballast pod height measurements shall be taken as detailed in clause 4.1.