



TS 03943:1.0
EP 09 00 00 01 SP
Specification

Trackside Negative Busbar

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Document history

Revision	Effective date	Summary of changes
2.1	10 July 2019	Previous issue with original designation EP 09 00 00 01 SP
1.0	14 December 2023	First issue with new designation TS 03943:1.0 Version recommenced in line with new designation. The change to previous content includes minor amendments and clarification to content, and a change to the title from “bus-rail” to “busbar.”

Preface

This document supersedes EP 09 00 00 01 SP *Trackside Negative Bus*, version 2.1 and is the first issue with designation TS 03943:1.0.

The changes to previous content in EP 09 00 00 01 SP are as follows:

- replacement of TAHE organisation roles and processes with those applicable to the current AMB organisational context
- minor amendments and clarification to content
- conversion of the standard to AMB format and style
- updated references to the Australian Standards to their latest revisions
- changed the title from “bus-rail” to “busbar.”

This document specifies the requirements for trackside negative busbars that are used on the TfNSW heavy rail electrical network.

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1 Scope

This document specifies the manufacturing and installation requirements for trackside negative busbars that are located near traction substations and sectioning huts for use in the TfNSW heavy rail electrical network.

2 Application

The requirements of this document apply to new trackside negative busbars that are located near traction substations and sectioning huts for use in the TfNSW heavy rail electrical network. These requirements are applicable from the date of issue of this specification.

The requirements of this document are not applicable to existing trackside negative busbars currently in service in the TfNSW heavy rail electrical network.

If, when using this specification, the intent of the stated requirements is not clear, then a clarification should be sought from the TfNSW Asset Management Branch.

3 Referenced documents

The following documents are cited in the text. For dated references, only the cited edition applies. For undated references, the latest edition of the referenced document applies.

Australian standards

AS 1566 Copper and copper alloys – Rolled flat products

AS/NZS 3679.1 Structural steel Part 1: Hot-rolled bars and sections

AS 4100 Steel structures

AS/NZS 4680 Hot-dip galvanized (zinc) coatings on fabricated ferrous articles

Transport for NSW standards

TS 03741 (T HR EL 00006 ST) Electrical Power System Signage

TS 03749 (T HR EL 20002 ST) 1500 V DC Cables and Cable Ratings

TS 03881 (T HR EL 99001 ST) Substation and Sectioning Hut Commissioning Tests and Processes

TS 05168 (SPG 0709) Traction Return, Track Circuits and Bonding

Other referenced documents

EL0099579 General – Negative Bus Rail Termination – Type 4 (A, B, C) – Assembly and Drilling Details (Sheet 1 of 2)

EL0099580 *General – Negative Bus Rail Termination Type 4 (A, B, C) – Assembly and Drilling Details (Sheet 2 of 2)*

4 Terms, definitions and abbreviations

The following terms, definitions and abbreviations apply in this document:

AMB Asset Management Branch

farside trackside negative busbar a negative busbar that is located on the opposite side of the track as the substation or sectioning hut it is connected to

impedance bond a device installed to ensure that the passage of dc traction current does not interfere with the operation of signalling track circuits. Connections between system substation negative busbars and the track are made via impedance bonds.

negative busbar a metal bar supported above ground level, and insulated from earth, for the termination of negative cables

mid trackside negative busbar a negative busbar that is located in between tracks

nearside trackside negative busbar a negative busbar that is located on the same side of the track as the substation or sectioning hut it is connected to

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traction rail the rail that conducts the traction return (negative) current. It can include both rails or just one rail depending on the type of signalling system used in the section.

5 Functional requirements

The trackside negative busbar shall provide an interface for the termination of traction 1500 V dc negative cables from a substation or sectioning hut and traction negative cables from the traction rail (via an impedance bond).

See Appendix A for examples of trackside negative busbar connections.

6 Standard arrangement

The standard arrangement for trackside negative busbars at traction substations and sectioning huts are detailed in drawings EL0099579 and EL0099580.

Where a location requires a different arrangement (for example, the number of cables to be connected is greater than those shown on the standard arrangement drawings) consultation is required with the AMB.

7 Technical characteristics

Sections 7.1 to 7.5 outline the technical requirements for the trackside negative busbar.

7.1 Design life

The negative busbar shall have a minimum life of 40 years.

7.2 Electrical

Sections 7.2.1 to 7.2.3 outline the specific electrical requirements for the trackside negative busbar.

7.2.1 Current rating

The trackside negative busbar shall withstand the heating effect, without deformation, of the total heat that could be generated based on the current carrying capacity of the negative return cables connected between the busbar and the substation.

At a sectioning hut the total heat generated shall be based on the current carrying capacity of the negative return cables connected between the tracks.

The above shall be achieved in an ambient air temperature of 50°C and in full sunlight.

Refer to document TS 03749 for the current carrying capacity of the negative return cables.

7.2.2 Insulation level

All parts of the negative return circuit shall be isolated from earth with an insulation level of 3 kV dc.

Any insulators used as part of the trackside negative busbar shall have a minimum insulation rating of 3 kV dc to ensure that there is no flashover or leakage between parts carrying 1500 V dc negative return current and earth. The insulator shall be made of resin or similar.

Cables used in the negative return circuit shall comply with TS 03749.

7.2.3 Busbars

All negative busbars shall be made of copper C11000 alloy and meet the requirements of AS 1566.

The negative busbar shall have a spare capacity of two cable terminations or 30%, whichever is higher.

The use of two busbars on a single negative busbar arrangement is permitted when the amount of cable terminations required exceeds the amount that can fit on a single bar.

The negative busbar shall be mounted at a minimum height of 500 mm between ground level and the bottom of the busbar.

7.3 Mechanical

The trackside negative busbar is typically installed adjacent to the track and shall be mechanically suitable for the location. The copper busbar shall be protected from damage with cover plates (on the top and sides).

The negative busbar shall withstand the physical forces exerted on it by the maximum number of cables that can be attached.

This shall be achieved, while the busbar is carrying full current in an ambient air temperature of 50°C and in full sunlight, without deformation.

7.4 Installation

The trackside negative busbar should be ground mounted. At locations where there is insufficient space to ground mount the trackside negative busbar, it may be mounted on a wall (for example, tunnels).

Sections 7.4.1 to 7.4.3 provides details on the installation requirements.

7.4.1 Concrete footings

The negative busbar shall be held in place with concrete footings. The footings shall be 600 mm minimum embedded depth and an exposed height of 80 mm.

7.4.2 Metallic supports

The negative busbar bars shall be supported off the ground and mounted to mild steel supports. The mild steel supports shall be:

- Grade 250 in accordance with AS/NZS 3679.1
- meet the requirements of AS 4100
- galvanized in accordance with AS/NZS 4680.

7.4.3 Location

A negative busbar shall be installed on the same side of the track as the substation or sectioning hut. This busbar shall be referred to as the nearside trackside negative busbar. For substations or sectioning huts connecting multiple tracks in parallel, a

second negative busbar shall be installed on the opposite side of the tracks. This busbar shall be referred to as the farside trackside negative busbar.

Where there is a second set of tracks perpendicular to the first set, separate negative busbar shall be installed. See Figure 2 and Figure 3 for details.

There can be locations where it is necessary to install a negative busbar in-between tracks. This shall be referred to as the mid trackside negative busbar.

The negative busbar shall be located as close as possible to the substation or sectioning hut, along the length of the track, consistent with the requirements of the signalling system as specified in TS 05168.

The distance between the negative busbar and the track shall be taken into account regarding safe working for persons connecting or disconnecting cables from the negative busbar and to not impede with kinematic envelope of trains.

The clearances between the trackside negative busbar and adjacent conductive structures shall be considered to ensure no hand-to-hand touch potential risks are present.

The location of the trackside negative bus bar shall take into consideration the build-up of dirt over time at the base of the trackside negative busbar and avoid areas where stormwater runs.

The location of the trackside negative busbar/s shall be coordinated by the design Technically Assured Organisation with both the electrical and signalling operator or maintainer.

Typical locations for substations and sectioning huts are shown in Figure 1.

7.5 Signage

Signage shall be placed in accordance with TS 03741.

8 Testing and Commissioning

Trackside negative busbars shall be tested at 3 kV dc, between the busbar and earth. The minimum insulation resistance shall be 20 M Ω (at 20°C).

Where there are multiple bars (for example, double bar ground mounted configuration) continuity between the bars shall be tested with a minimum current of 100 A. The resistance across each joint shall be less than 20 $\mu\Omega$ (at 20°C).

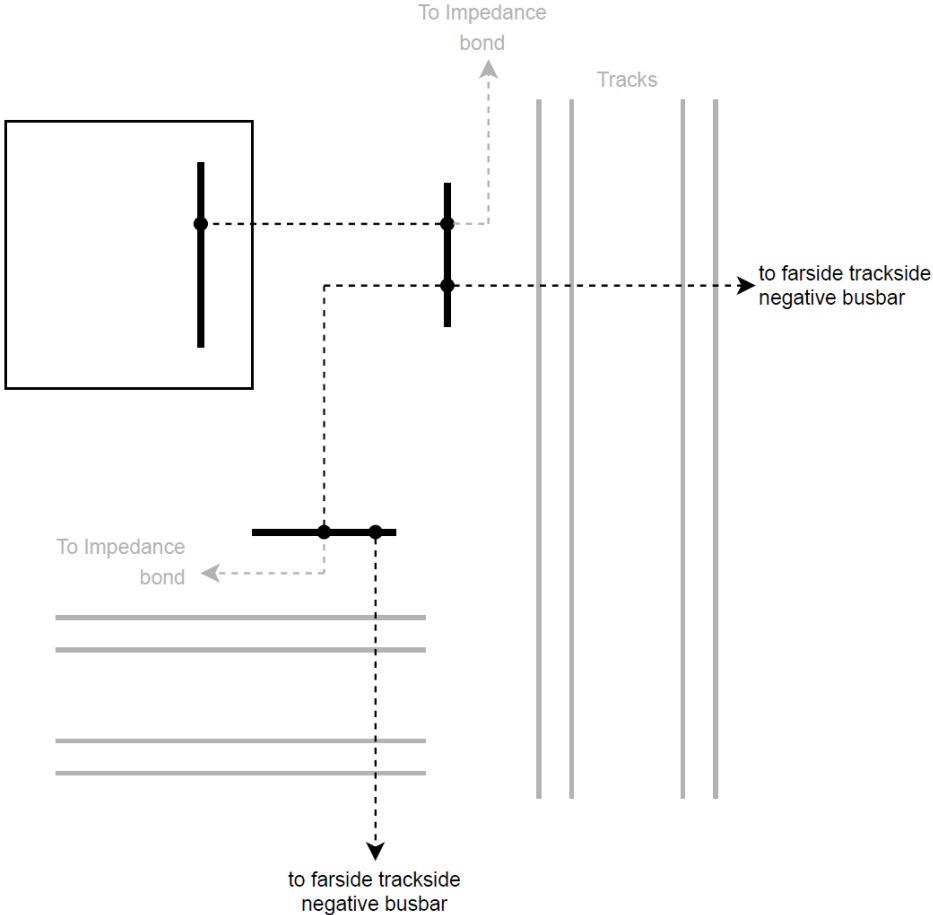


Figure 2 – Typical arrangement with perpendicular tracks with nearside trackside negative busbars connected in series

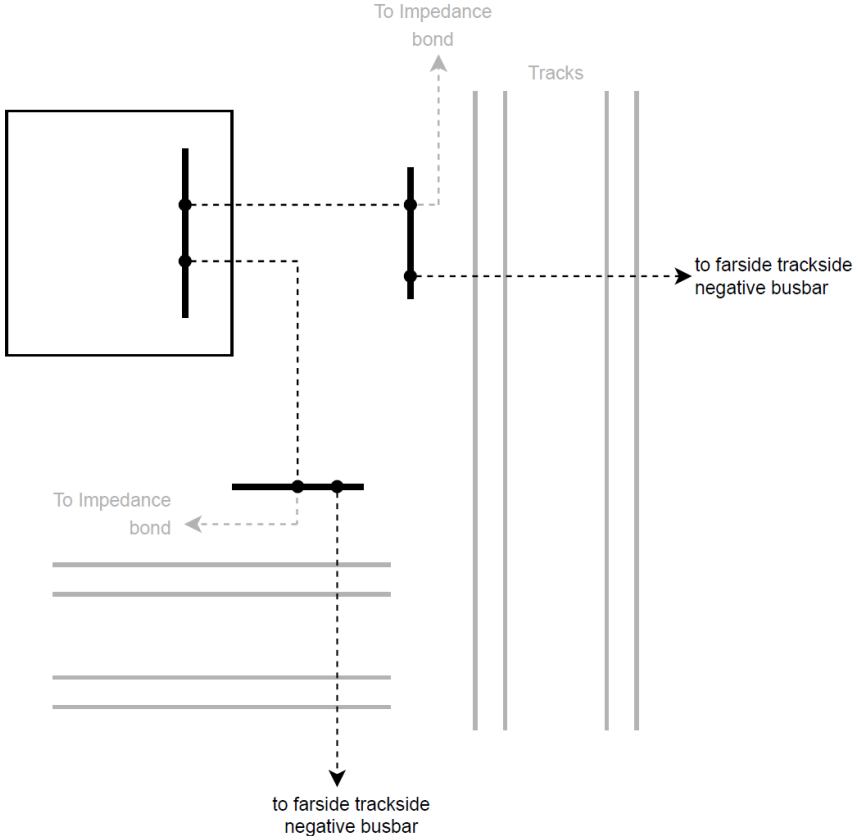


Figure 3 – Typical arrangement with perpendicular tracks with each nearside trackside negative busbars connected directly to main negative bus (preferred)