Engineering System Integrity
Electrical Network Safety Rules

Engineering Specification
Electrical Distribution Unit

One Method of Safe Working

SP D 79044

Description and Labelling of the 1500 Volt DC OHW System

Version 1.0
Date in Force: 1 February 2022

Transport Sydney Trains

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Version	Date	Author/ Prin. Eng.	Summary of change
1.0	1 February 2022	ENSR Project Team	First issue as Sydney Trains document. Rebranded from PR D 78300 V1.2. Reviewed as part of the ENSR Project.

Document history (previously PR D 78300)

Version	Date	Author/ Prin. Eng.	Summary of change
1.0	28 April 2015	Chris Leung	First issue as a Sydney Trains document, rebranded from previous RailCorp SMS-06-EN-0565 V1.0
1.1	5 June 2018	Chris Leung	Removed references to gas tensioners Updated Figure 1 and 2
1.2	19 February 2019	Nick Loveday	Updated PR D 78300 "Approved by" to Associate Director Electrical Distribution Unit

Table of Contents

1 Purpose and Scope

To describe the arrangement and individual element identification of the 1500 Volt DC Overhead Wiring (OHW) system operated and maintained by Sydney Trains.

This document provides general information for:

- all workers required to carry out work near or on/within any part of the 1500 Volt DC OHW system
- workers required to have knowledge of the 1500 Volt DC OHW system.

2 Definitions

Refer to the **Electrical Safety Definitions** page available on the **RailSafe** site.

3 1500 Volt DC OHW System

Power for electric traction is supplied from substations to the trains by means of the 1500 Volt DC OHW system. The train pantograph, sliding under the contact wire, collects current to operate the motors, the current returns to the substations through the negative return traction rails.

Three basic types of OHW are in use:

a. A simple catenary, where the contact wire is supported from either single or twin catenary wire by droppers spaced along the catenary. Both single and twin contact wire arrangements are used.

b. A compound catenary, where a main catenary supports an auxiliary catenary which in turn supports the contact wire by means of droppers, and is fixed anchored.

c. Contact only which has no catenary or droppers.

The majority of OHW is the 'simple catenary' type. The 'compound catenary' is used west of Penrith and 'contact only' is used in yards for slow running. Types (a) and (c) can be either fixed anchored, where the tensions in the wires vary with temperature, or regulated tension, where the wire tensions are held approximately constant by means of weight.

In all three types, the supports for the overhead wires can take the form of wire polygons (suspended between wood poles or steel masts), cantilever arrangements (erected on wood poles or steel masts), or portal structures.

The contact wire is steadied against wind and directed around curves by pull-off arms. In span wire construction the pull off arms are held by span wires stretched across the tracks between masts. In independent registration arrangements the pull off arms are attached to the structure or cantilever so that the wiring for each track is independent of adjacent tracks.

Insulators are used to separate the live 1500 Volt DC OHW system from the support structures and to provide electrical separation between the wiring for each track.

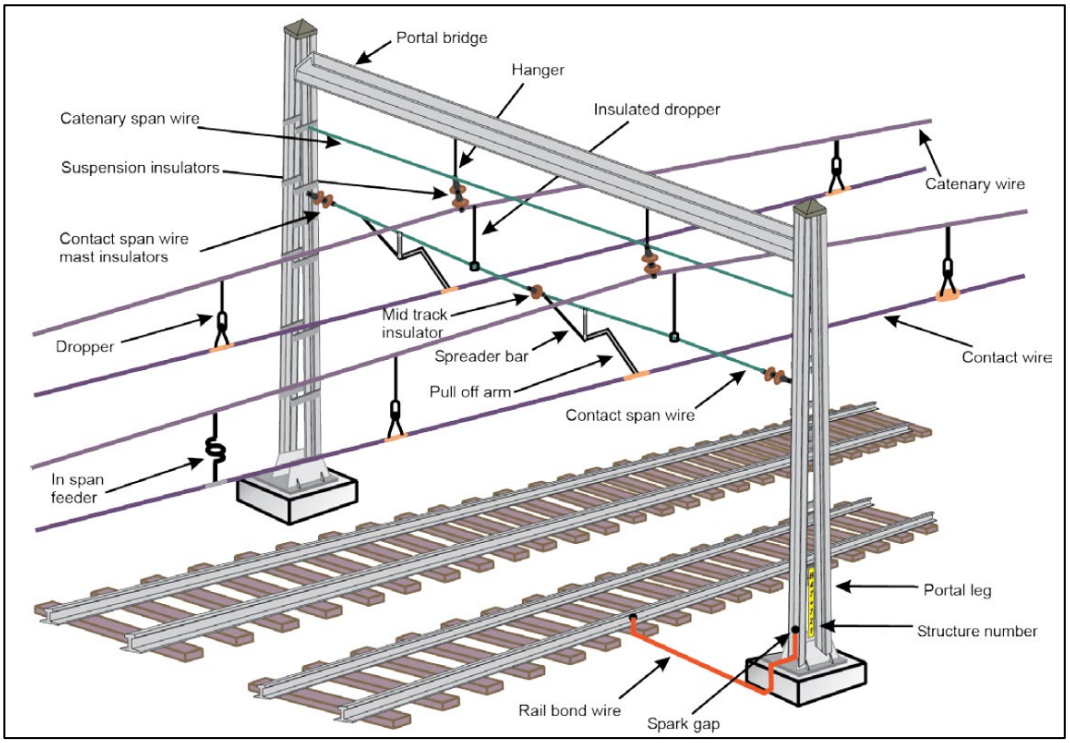

Figure 1: Simple catenary, fixed anchored, span wire construction on portal structures

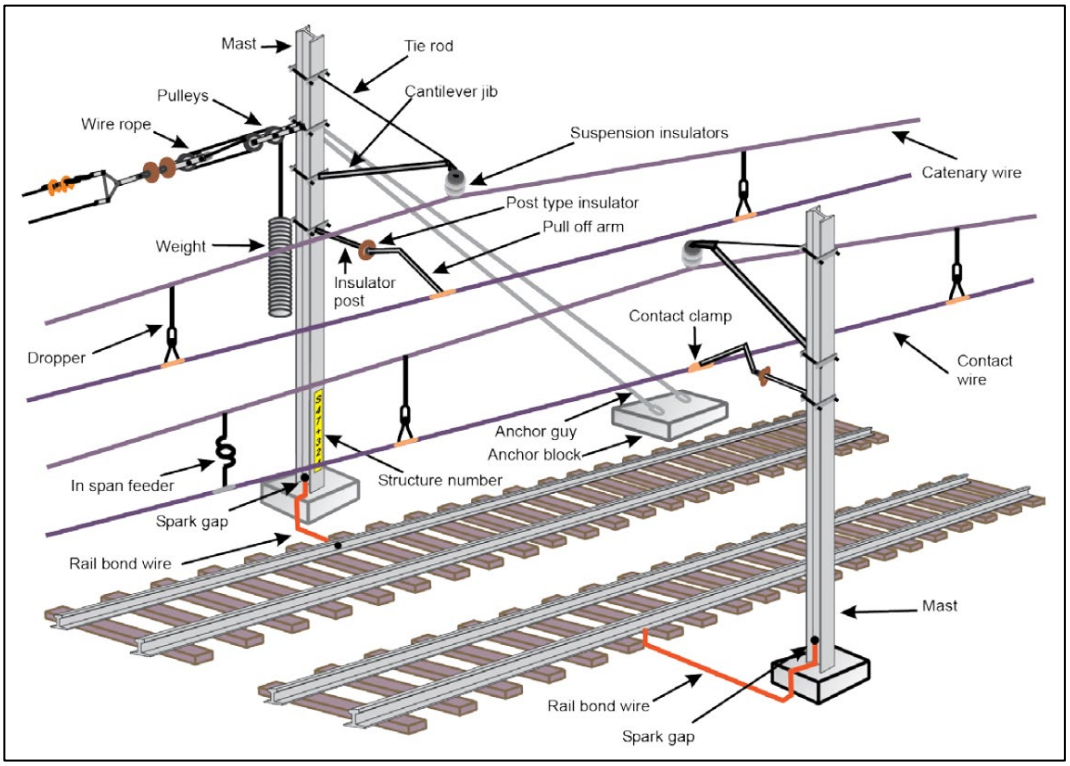

Figure 2: Simple catenary, regulated tension, cantilever construction on masts

The substations, which feed the OHW, are supplied from the high voltage distribution system and contain transformers and rectifiers to convert the high voltage alternating current to 1500 volts direct current for the trains.

Figure 3: An example of a feeding arrangement from the Substation to the Overhead Wiring

The power is fed to the OHW via DC circuit breakers (DCCB), which provide protection in the event of faults.

Sectioning huts, containing DC circuit breakers, are provided between substations to improve voltage regulation and for protection and sectioning of the OHW system.

NOTE

With respect to definitions used in the Electrical Network Safety Rules, in particular with regards to Electrical Permits, a section hut is defined as a substation. Refer to the Electrical Safety Definitions page available on the RailSafe site.

Detailed information on the 1500V DC OHW system can be found on the Transport for NSW (TfNSW) Asset Management Branch (AMB) website.

4 1500 Volt DC OHW System Identification

4.1 General – Feeders/Sections/Subsections

The 1500 Volt DC OHW system is divided into numbered electrical sections.

The 1500 Volt DC OHW feeder/section/subsection/subsection branch labelling convention is described as follows in this specification and Electrical Operating Diagram Reference Sheet E 1500 Volt Sectioning Diagrams Electrical Sectioning Identification.

Reference Sheet E is the master document dictating sectioning identification, refer to Appendix A.

This labelling convention is used to describe the OHW system. It is essential that correct section/subsection designations be used when describing the 1500 Volt DC OHW system.

4.2 Feeders

Typically, an OHW Feeder commences on the OHW side of the respective Substation or Section Hut OHW Isolating Device such as a:

- Isolating Link
- Two-Position Combined Isolating and Rail Connecting Field Switch
- a Three-Position Combined Isolating and Rail Connecting Switch
- Isolating and Rail Connecting Switch Pair.

The other side of the Isolating Device is directly connected to the substation DCCB. However in some cases the Isolating Device may be some distance from the respective Substation/Section Hut DCCB and hence connected to the Substation/Section Hut DCCB by an aerial or underground cable, for example Strathfield Junction 1500 Volt DC Sectioning Diagram (refer to EL 0358437) feeders N1 and N2.

In a small number of cases the OHW Feeder extends out of a Substation/Section Hut and finishes at the end of an electrified line.

An OHW Feeder terminates on the termination attachment plate (refer to drawings EL 0475906 or EL 0287236) attached to a post type insulator and located on the OHW support structure.

The OHW Feeder identification number may contain a letter, a number or combination of both. Odd numbers are allocated to Up Track OHW Feeders and even numbers are allocated to Down Track OHW Feeders. Sometimes these numbers are prefaced by one or two letters that identify the line, e.g.:

- CI – City Inner line
- G – Old South (Granville to Cabramatta) line.

4.3 Sections

An OHW Section (abbreviated to Section) runs from:

- Substation to Substation
- Substation to Sectioning Hut
- Sectioning Hut to Sectioning Hut.

OHW Sections usually commence and finish on the OHW side of the associated Substation and Sectioning Hut Isolating Device.

Sections are identified with the OHW Feeder number followed by /1, /2, /3 etc. for the 1st, 2nd, 3rd etc. sections respectively, commencing at the Sydney end and proceeding to the country end of the OHW Feeder.

Figure 4 shows a typical sectioning arrangement between a substation and a section hut.

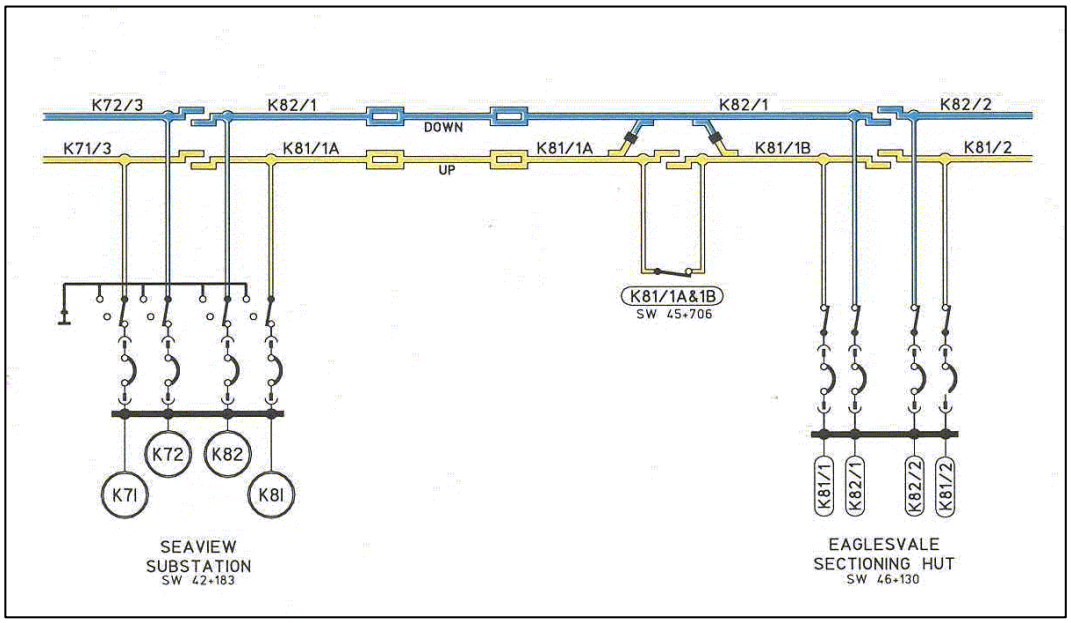

Figure 4: Sectioning diagram for a two track arrangement between a substation and a sectioning hut

A Section can be further divided into OHW Subsections at an open overlap, a switched open overlap, open knuckle overlap, insulated knuckle, section insulator or sectioning switches.

4.4 Subsections

OHW Subsections are identified by adding a letter to the OHW section number. The letter "A" is used for the Sydney end subsection with "B", "C" etc. being sequentially used for additional subsections heading towards the country end of the section.

Figure 5 shows a typical sectioning arrangement between two substations.

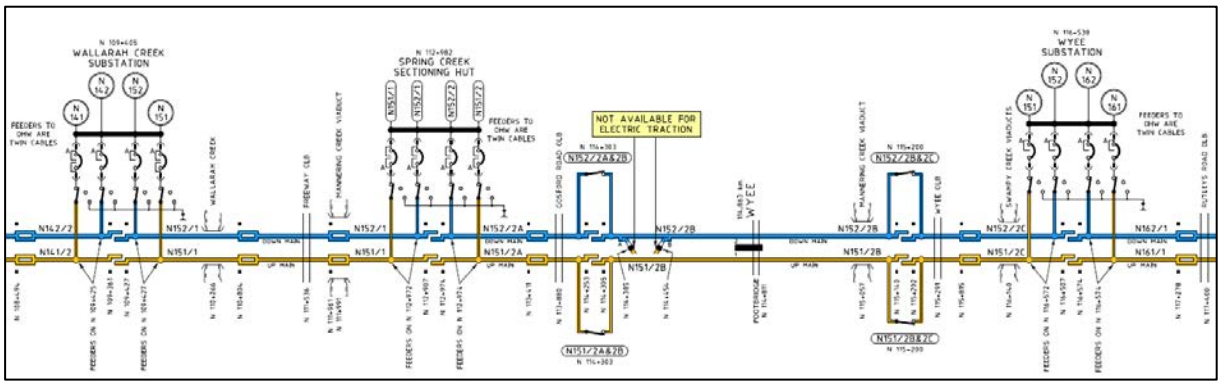

Figure 5: A typical sectioning arrangement between two substations

4.5 Subsection Branches

OHW Subsection branches can occur where electrified lines (such as dead end sidings or loops) branch off a Section. The first branch (closest to Sydney) on the Section is identified with a "1" added to the Section number with 2 and 3 etc. being used to identify further branches off the Section. For example, if the Section was 711/1, then the first OHW Subsection Branch would be 711/11 and the second 711/12 etc.

4.6 Structure Numbers

OHW structure numbers are provided to give a unique reference name to each OHW support or registration location. This provision ensures that there will not be any ambiguity when workers are directed to a specific location.

OHW structures are identified by a combination of letters and numbers.

The letters are used to identify the line and locations, main line examples follow:

B	is the prefix for the Bankstown Line (Meeks Road to Sefton)
H	Main North (Strathfield to Hornsby)
MS	Main Suburban Line (Macdonaldtown to Granville)
SL	Western Line (Granville to Bowenfels)

The numbers are used to identify the location of the structure along the route of the track as a distance from the datum point at Central.

The current method (metric measurement) uses metre increments e.g. B 15 + 091. The number in front of the + sign represents kilometres and the numbers after the + sign are metres up to 999 metres.

The old method (imperial measurement) used foot increments, e.g. BL 417 + 20. The numbers in front of the + sign represent “hundreds” of feet and the numbers after the + sign are feet up to 99 feet. In the field, all old numbers have now been replaced with new numbers. The imperial measurements only appear on some layouts and cross section drawings which have not been superseded or converted to metric.

This identification is also used to locate overbridges, substations, sectioning huts and other features which are referenced to an OHW location.

The OHW structure number is not to be confused with the track kilometrage, e.g. 15.345 km which may not be the same as 15 + 345 due to the different measuring methods of the Civil and Electrical disciplines.

The labelling convention is described in detail in the TfNSW standard *T HR EL 08005 ST Labels for OHW Structures* which is published on the TfNSW AMB website.

Figure 6: Example of an OHW structure number label

5 Reference documents

T HR EL 08005 ST Labels for OHW Structures

Appendix A Reference 1500 Volt Sectioning Diagrams Electrical Sectioning Identification