Government of South Australia
Department for Infrastructure and Transport

Electrical and Mechanical Clearances for the 25kV Electrified Train Network

Engineering Standard

Rail Commissioner

TP1-DOC-000389

Document Amendment Record

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1. Introduction

The Department for Infrastructure and Transport (DIT) owns the Adelaide Metropolitan Passenger Rail Network (AMPRN) currently operated and maintained under the Rail Accreditation of third party. This standard is intended to ensure that the electrical and mechanical clearances for the 25kV electrified train network on the AMPRN does not create any risks not deemed to meet the So Far As Is Reasonably Practicable (SFAIRP) principles under Rail Safety National Law (RSNL).

The operation of an electrified railway requires that a range of infrastructure assets including stations, structures, signals, signs etc are located within the rail corridor in close proximity to the 25kV overhead wiring system. In order to ensure safety it is essential that the clearances of these assets to 'live' elements of the OHW system are strictly controlled.

2. Purpose

This standard provides the electrical and mechanical clearance requirements for the 25kV electrified train system for the Adelaide Metropolitan Passenger Rail Network (AMPRN).

3. Scope

This standard includes:

- Static and Passing Clearances
- Electrical and Mechanical Clearances
- Pantograph Clearances

4. Related Documents

DOCUMENT NAME	DOCUMENT NUMBER
Standard Drawing - 25 kV Overhead Wiring System - Overbridge Clearance (KNet # 13677227)	TP1-DRG-000015
Standard Drawing - 25 kV Overhead Wiring System - Safe Working Distance with Marginal Mast Arrangement (KNet # 13677230)	TP1-DRG-000016
Standard Drawing - 25 kV Overhead Wiring System - Safe Working Distance with Centre Mast Arrangement (KNet # 13677232)	TP1-DRG-000017
Standard Drawing - 25 kV Overhead Wiring System - Mainline Cross Section with ARTC Line (KNet # 13677237)	TP1-DRG-000018
Standard Drawing - 25 kV Overhead Wiring System - Aerial Power Line Crossing Clearances (KNet # 13677239)	TP1-DRG-000019
Standard Drawing - 25 kV Overhead Wiring System - Stations Clearance from Island and Marginal Platform (KNet # 13677217)	TP1-DRG-000020
Standard Drawing - 25 kV Overhead Wiring System - Stations Clearance Back to Back Cantilever Arrangement (KNet # 13677220)	TP1-DRG-000021
Standard Drawing- 25 kV Overhead Wiring System - Pantograph Electrical and Mechanical Clearance (KNet # 13677222)	TP1-DRG-000022
Standard Drawing - Swayed and Uplifted Pantograph Profiles for Contact Wire Heights (KNet # 13677225)	TP1-DRG-000023
Isolation of 25kV OHW	WI-EM-EE-930

5. References

- AS/NZS 7000: 2016 Overhead Line Design
- AS 4799: Installation of underground utility services and pipelines within railway boundaries
- FR-AM-GE-804 Development and Approval of Rail Engineering Standards (Knet # 8178595)
- TC4-DOC-000357 Non-Rail Service Installations within the Rail Corridor (KNet # 7677901)
- TC1-DOC-000463 Revision of Determination of Maximum Allowable Stagger and Mid Span Offset (KNet # 8794519)
- PR-EM-EE-112 25kV OHW Electrical Safety Instructions Trains (Knet # 6121223)
- 301-A3-85-1874 Platform Clearance 1600 mm Gauge Track Existing Platform
- 301-A3-2010-2389 Platform Clearance 1600 mm Gauge Track New or Reconstructed Platform
- 301-A2-86-2239 S.T.A. Allowable Infringements Minimum Structures - 1600 mm Gauge

6. Acronyms

ACRONYM	FULL NAME
AMPRN	Adelaide Metropolitan Passenger Rail Network
ARTC	Australian Rail Track Corporation
DIT	The Department for Infrastructure and Transport
DWG	Drawing
RC	Return Current
OHW	Overhead Wiring
OPGW	Optical Ground Wire
FW	Feeder Wire
EW	Earth Wire
CW	Contact Wire

7. Definitions

TERM	DEFINITION
Public Area - Depot	Any area where visitors to the depot can reasonably be expected to travel to unsupervised. This will include any walkway and stairs to offices within the depot.
Public Area - General	Area to which the public has unrestricted access
Restricted Areas	Area for which access is only permitted for DIT authorised persons
Uplift	This is the amount by which the Overhead Wiring System is raised during the passage of a pantograph.
Static Clearance	The minimum distance between the live parts of the Overhead Wiring System (under any permissible conditions of maintenance, and when not subject to uplift by a pantograph) and a structure or earthed part of the Overhead Wiring System or a train.
Passing Clearance	The minimum distance between the live parts of the Overhead Wiring System (under any permissible conditions of maintenance, including when subject to uplift by a pantograph) and a structure or earthed part of the Overhead Wiring System or a train.

8. Clearances Requirements

8.1. Static and Passing Clearances

1. Static and passing clearances describe the distance between live 25 kV AC equipment and earthed structures (including over bridges, signals, boom gates and above railway developments), under static state and dynamic conditions, respectively.

   The live 25 kV AC equipment includes contact wire, catenary wire, dropper wires, jumper wires, cantilevers and pantograph.

2. The minimum static clearance shall be 500mm.The absolute minimum static clearance, with Unit Manager Overhead Engineering approval, shall not be less than 270mm.

3. The minimum passing clearance shall be 300mm.The absolute minimum passing clearance, with Unit Manager Overhead Engineering approval, shall not be less than 150mm.

   Note:
   Absolute minimum static and passing clearances will only be considered when minimum static and passing clearances cannot be achieved. Any new infrastructure on an existing electrical line or a line proposed to be electrified in the future should meet the minimum static and passing clearance values.

8.2. Electrical and Mechanical Clearances

8.2.1. Return Current (RC) Conductors

1. The RC conductors shall not be positioned over station platforms.

2. The RC conductor shall be positioned below the earth wire or Optical Power Ground Wire (OPGW) cable.

3. The absolute minimum clearance of a RC conductor crossing over any live traction overhead equipment shall be 500mm under all conditions.

4. The RC conductor height shall not be less than the minimum contact wire height except in public areas where a minimum 200mm above the contact wire height shall be maintained.

5. The minimum clearance between two RC conductors shall be 200 mm under all conditions.

6. The minimum clearance between a RC conductor and any earth wire or OPGW cable shall be 500 mm under all conditions.

7. The minimum clearance from a RC conductor at a support point to any fixed equipment at earth potential shall be 50 mm under all conditions.

8.2.2. Earth Wire

1. The earth wire shall not be positioned over station platforms.

2. The absolute minimum clearance of an earth wire to any live traction overhead equipment shall be 500 mm under all conditions.

3. Where there is no RC conductor, the earth wire height shall be a minimum of 200 mm above the contact wire height in public areas.

8.2.3. Feeder Wire

1. The absolute minimum clearance between two different electrical sections of bare feeder wire shall be 700 mm under all conditions.

2. The absolute minimum clearance between a feeder wire and an RC conductor shall be 500 mm under all conditions.

3. The absolute minimum clearance between a feeder wire and an earth wire shall be 500 mm under all conditions.

4. The absolute minimum clearance between a feeder wire and an OPGW cable shall be 500 mm under all conditions.

8.2.4. Non-Rail Party Aerial Crossing

The installation of new above ground services by non-rail parties shall be in accordance with TC4-DOC-000357.

8.2.5. Existing Aerial Power Line Crossings (<66kV)

All existing aerial power line crossings (<66kV) shall be undergrounded unless approved by DIT.

Underground clearances shall be in accordance with AS 4799.

8.2.6. Existing Aerial Power Line Crossings (≥ 66kV) Above the Railway

1. The minimum clearance between traction overhead equipment and an existing aerial power line crossing, under all conditions, shall be in accordance with TP1-DRG-000019 and as follows:

   66 kV up to 132 kV Aerial Power Crossing:
   - Vertical clearance to top of rail not to be less 10 metres
   - Vertical clearance to traction overhead not to be less than 4600 mm

   132 kV to 275 kV Aerial Power Crossing:
   - Vertical clearance to top of rail not to be less than12 metres
   - Vertical clearance to traction overhead not to be less than 6500 mm

2. If the above minimum vertical clearances for an existing aerial power line crossing to the traction overhead equipment are infringed, the aerial power line shall be lifted to achieve the above minimum requirement.

3. Traction overhead structures, including masts/gantries, shall not be placed directly under any existing aerial power line crossing. Such structures shall be a minimum distance of 5000mm, measured horizontally along the railway, from any aerial power crossing under all conditions.

8.2.7. Aerial Power Line (≥ 66 kV) Parallel to the Railway

1. The minimum clearance from an aerial power line running parallel to the railway to any railway structure or traction overhead equipment shall be in accordance with those set out in AS/NZS 7000: 2016.

2. Aerial Power Lines that run parallel to the railway, as described in section 3.13.2 of WI-EM-EE-930, shall be shown on the Minor Sectioning Diagrams.

8.2.8. Station Platforms

1. No live traction overhead equipment shall be allowed over station platforms under any circumstances.

2. The minimum distance between live traction overhead equipment such as the pantograph horn or contact wire, shall be 3500 mm measured radially from the edge of the platform. If the 3500 mm minimum clearance cannot be achieved, a barrier shall be provided as protection against direct contact with live parts.

3. The taut string distance can also be used to measure this minimum distance. A taut string distance is measured from the standing point at the accessible place, round the periphery of any barrier, to any live equipment. Refer to drawings TP1-DRG-000020 and TP1-DRG-000021.

4. The minimum distance between line traction equipment such as a pantograph horn or cantilever support and a station canopy shall be 500mm as measured by a taut string. Refer to TP1-DRG-000020 and TP1-DRG-000021.

8.2.9. Overbridge or Signal Gantry Clearances

The distance between any live traction overhead equipment and the underside of any overbridge structures or signal gantries shall be calculated using the following:

- Static and passing clearances
- Uplifted contact/contenary/catenary
- Track tolerance data, and
- Rolling stock dynamic characteristics.

8.2.10. Level Crossings

1. The grade of the level crossing road approach and departure shall be considered when determining the height of all live conductors.

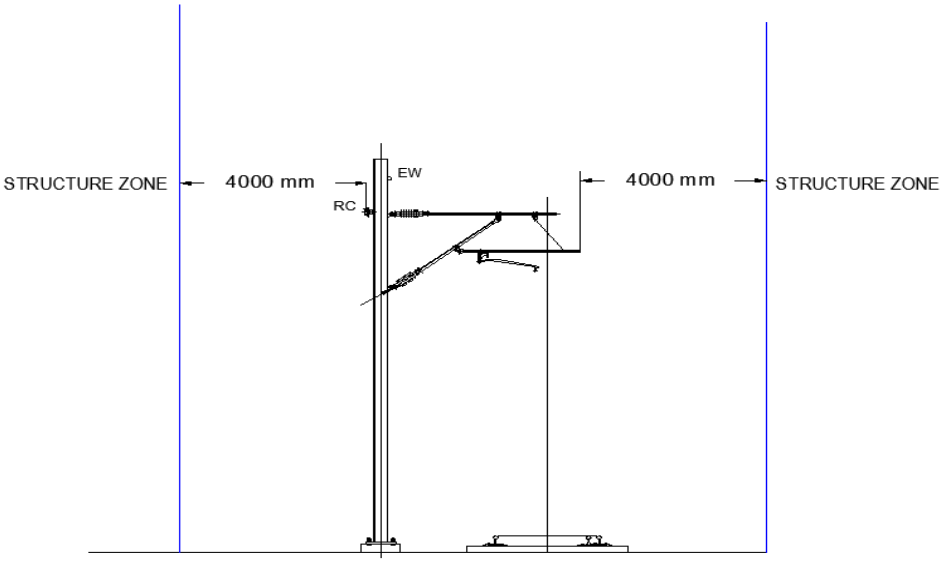
2. The minimum clearance from live traction overhead equipment to a boom gate shall be 500 mm under all conditions.

3. The minimum wire height about public level crossing shall not be less than 5700 mm.

8.2.11. Structures or Buildings

The clearance between any new structures or buildings to adjacent live 25kV AC equipments shall be 4000 mm horizontally and infinite vertically (up and

down to ground) as shown in figure below, with the exception of station canopies.



8.2.12. Face of Mast to Track Centreline

1. The clearance for all of traction overhead structures, such as masts or portals, shall be measured from the broad gauge track centreline.

2. The minimum face of mast to track centreline clearance shall be 3500 mm (desirable).

3. The minimum face of mast to track centreline clearance for tangent track shall be 3170mm with the approval of both Unit Manager Overhead Engineering and Manager Track & Civil.

4. The minimum face of mast to track centreline clearance for curved track shall be the minimum clearances determined from the table titled “Additional widths to be allowed for various track radii” on PTS drawing 301-A2-86-2239.

8.3. Pantograph

8.3.1. Electrical Clearances

1. The minimum horizontal clearance from the superelevated track centreline at 5200mm above top of rail to any earthed structure, including the 300mm clearance, allowance for static 25kV and 160mm pantograph uplift, shall be 1540mm.

2. Additional allowance **see note** must be made for pantograph sway in accordance with TP1-DRG-000023 where the contact wire height exceeds 5200mm.

Note:
The 1540 mm dimension is derived by rounding up dimensions from the individual calculations with further rounding up when the electrical clearance is added. Additional allowance is based on the minimum horizontal clearance of 1528 mm as shown in TP1-DRG-000023

8.3.2. Mechanical Clearances

1. Referring to TP1-DRG-000022, a minimum mechanical clearance shall be used to ensure that a cantilever registration component, such as a steady arm, is mechanically clear from a swayed and uplifted pantograph.

2. The minimum mechanical clearances below shall not be infringed under all operating conditions.

Registration Clearance

Item	Minimum	Absolute Minimum
Swayed and uplifted pantograph envelope to common live metal including fixed ends of steady Arms		
a) normal to cross track level	80 mm	80 mm
b) parallel to cross track level	150 mm	100 mm
Swayed and uplifted pantograph envelope to steady arms and any fittings directly attached to a CW (with fully worn Pantograph and 33.3% CW wear)	15 mm	15 mm

9. Bibliography

- TP1-DRG-000015 Standard Drawing - 25 kV Overhead Wiring System - Overbridge Clearance (KNet # 13677227)
- TP1-DRG-000016 Standard Drawing - 25 kV Overhead Wiring System - Safe Working Distance with Marginal Mast Arrangement (KNet # 13677230)
- TP1-DRG-000017 Standard Drawing - 25 kV Overhead Wiring System - Safe Working Distance with Centre Mast Arrangement (KNet # 13677232)
- TP1-DRG-000018 Standard Drawing - 25 kV Overhead Wiring System - Mainline Cross Section with ARTC Line (KNet # 13677237)
- FR-AM-GE-804 Development and Approval of Rail Engineering Standards (Knet # 8178595)
- TC1-DOC-000463 Revision of Determination of Maximum Allowable Stagger and Mid Span Offset (KNet # 8794679)
- PR-EM-EE-112 25kV OHW Electrical Safety Instructions Trains (Knet # 6121223)
- 301-A3-85-1874 Platform Clearance 1600 mm Gauge Track Existing Platform
- 301-A3-2010-2389 Platform Clearance 1600 mm Gauge Track New or Reconstructed Platform

Appendix 1: Summary of Electrical and Mechanical Clearances

All minimum clearances stated below are mandatory under all conditions. These tables shall be read in conjunction with relevant sections in this standard.

1. Static and Passing Clearances

TYPE OF CLEARANCE	MINIMUM CLEARANCE (MM)	ABSOLUTE MINIMUM (MM)
Static Clearance	500	270
Passing Clearance	300	150

2. Electrical and Mechanical Clearances

TYPE OF CLEARANCE	MINIMUM CLEARANCE (MM)
Exclusion Zone for untrained persons (In accordance with current Rail Industry Practice for 25 kV electrification)	3000
RC to 25 kV (bare and insulated)	500
RC to EW or OPGW	500
RC to RC (bare and insulated)	200
EW to 25 kV	500
25 kV to 25 kV bare conductors (between different electrical sections)	700
25 kV Traction Overhead Equipment to OPGW	500
Aerial Power line to OHW: 66 kV up to 132 kV 132 kV to 275 kV	 4600 minimum 6500 minimum
Station platform edge to 25 kV (Pantograph horn)	3500
Face of mast to broad gauge track centreline Tangent track Curved track Desirable distance	 3170 Refer to clause 8.2.12 3500

3. Pantograph Electrical and Mechanical Clearances

TYPE OF CLEARANCE	MINIMUM CLEARANCE (MM)	ABSOLUTE MINIMUM (MM)
Pantograph horizontal clearance measured from superelevated track centreline at contact wire height of 5200 mm to any earthed structure	1540	N/A
Registration Clearance: swayed and uplifted pantograph envelope to common live metal including fixed ends of steady arms: normal to cross track level parallel to cross track level	 80 150	 80 100
Registration Clearance: swayed and uplifted pantograph envelope to steady arms and any fittings directly attached to a CW (with fully worn pantograph and 33.3% CW wear)	15	15