Standard

Transmission Line Design

R1037048

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Authorisations

Action	Name and title	Date
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Review cycle	30 months	

Responsibilities

This document is the responsibility of the Asset Strategy Team, Tasmanian Networks Pty Ltd, ABN 24 167 357 299 (hereafter referred to as "TasNetworks").

Please contact the Primary Systems Asset Strategy Leader with any queries or suggestions.

- Implementation All TasNetworks staff and contractors.
- Compliance All group managers.

Minimum requirements

The requirements set out in TasNetworks' documents are minimum requirements that must be complied with by all TasNetworks team members, contractors, and other consultants.

The end user is expected to implement any practices which may not be stated but which can be reasonably regarded as good practices relevant to the objective of this document.

Record of revisions

Section number	Details
All	Standard revised to adopt AS/NZS7000-2016 (the Standard) as TasNetworks transmission line design standard and as amended by a companion TasNetworks specific normative R1047190. All design requirements previous specified in this standard are now covered by that standard or the associated normative.

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1 General

1.1 Purpose

This Standard defines the design parameters for extra high voltage (EHV) transmission lines and their electrical performance and is applicable for new and existing transmission lines under the responsibility of Tasmanian Networks Pty Ltd (hereafter referred to as 'TasNetworks').

1.2 Scope

The Standard specifies the requirements that shall be met for the design of new transmission lines within the TasNetworks network according to AS/NZS 7000 - Overhead line design.

The Standard shall also be applied to existing site-specific maintenance, transmission line augmentation or diversions to existing overhead lines unless expressly excluded by the Project Specification.

Unless the Contractor indicates otherwise at the tender stage, it shall be assumed that all Contract components will be designed and supplied to meet this standard and the applicable Australian Standards. TasNetworks reserves the right to approve the use of any alternative standard to the Australian Standard for any component.

The Standard is applicable to TasNetworks assets only, however TasNetworks may require that this standard be applied to third party transmission line under its operational and maintenance control.

1.3 Objective

TasNetworks requires this standard to ensure:

(a) that relevant Australian legal requirements are met;

(b) that the requirements of the National Electricity Rules are met;

(c) personnel and public safety;

(d) safety of TasNetworks' assets;

(e) ease in operation and maintenance;

(f) reliability and continuity of supply from the transmission network;

(g) minimum disruption to the power supply system following a fault;

(h) alignment with TasNetworks' network management strategies and established practices;

(i) that the requirements of TasNetworks' business plan are met; and

(j) that TasNetworks' exposure to business to risk is minimised.

1.4 Precedence

Any apparent conflict between the requirements of this standard and the law, mandatory requirements, industry standards, project specifications, non-statutory standards or guidelines, and any other associated documents should be brought to the immediate attention of TasNetworks for resolution and no action must be taken that might result in a breach of law or mandatory standard. Where there may be a conflict between the requirements of this standard and any:

(a) law, mandatory requirement or industry standard, then that law or statutory requirements will prevail over this standard;

(b) non-mandatory standard, or guideline, then this standard will prevail over that standard or guideline; and

(c) project specification, then the contract documentation will prevail over this standard.

1.5 Deviation

Special approval for a deviation to this standard may only be accorded if it does not reduce the quality of workmanship, does not deviate from the objective of this document or from the intent of the standard. A request for a deviation shall follow a designated procedure that involves approval from TasNetworks.

Deviations, if any, shall be specifically requested and requires approval in writing by TasNetworks prior to award of Contract.

1.6 References

This standard is to be read in conjunction with other standards and documents as applicable. In particular this includes the project specifications and the following:

1.6.1 TasNetworks standards and documents

R1047190	TasNetworks Normative to AS/NZS 7000:2016 - Overhead line design
R248806	Fibre Optic Overhead Groundwire (OPGW) Standard
R1047217	Transmission Line Construction Standard
R1112043	High Voltage Disc Insulator Standard
R246427	Protection of Transmission Lines Standard

1.6.2 Other standards

AS/NZS 7000	Overhead Line Design
AS 5804	High-voltage live working
AS 2344	Limits of electromagnetic interference from overhead A.C. powerlines and high voltage equipment installations in the frequency range 0.15 MHz to 3000 MHz
AS 4435.1	Insulators - Composite for overhead power lines - Voltages greater than 1000 V A.C. - Definitions, test methods and acceptance criteria for string insulator units
AS 2067	Substations and high voltage installations exceeding 1 kV A.C.
AS 4325.1	Compression and mechanical connectors for power cables with copper or aluminium conductors - Test methods and requirements
AS 1531	Conductors – Bare overhead – Aluminium and aluminium alloy

2 Introduction

The transmission line system in Tasmania is a well-established system and has had few incidences of failure in its history. TasNetworks as a minimum, aims to maintain this reliability. In using the referenced design documents for this standard, the historical design parameters applicable to Tasmania have been retained where appropriate and applicable.

3 Design requirements

The design shall be in accordance with the requirements of AS/NZS 7000 as modified by the requirements of the TasNetworks specific normative document, R1047190. In all cases the TasNetworks normative shall take precedence over the AS/NZS Standard unless otherwise required in the Project Specification.

The electrical design of transmission lines must include consideration of the following aspects to determine the parameters of the line:

(a) Conductor selection to meet radio interference voltage (RIV), television interference (TVI) and audible noise levels;

(b) Conductor rating;

(c) Structure geometry;

(d) Insulation selection;

(e) Lightning performance;

(f) Electric and magnetic fields;

(g) Earthwires; and

(h) Maintenance.

The design must make allowance for the practical aspects of constructing, inspecting, repairing and replacing components on the line. This includes attachment points for rigging devices, gin poles, davits and insulated ladders. Consideration must be given to live insulation replacement, access amongst live component via defined paths. A defined path could include ladders, step dogs and walkways.

3.1 Safety in design

Designs shall be in accordance with Safe Work Australia, Safe Design of Structures Code of Practice.

4 Conductor selection

TasNetworks may nominate the conductor to be used, which will be based on ongoing management issues such as spares management and maintainability. Where TasNetworks does not nominate the conductor, the following sections apply.

4.1 Conductor type

Conductors shall be ungreased, all aluminium alloy (AAAC) 1120, in accordance with AS1531.

4.2 Voltage selection

The nominal phase to phase voltage will typically be provided by TasNetworks in the project specifications.

4.3 Impedance

TasNetworks will specify any impedance characteristics required in the project specifications.

4.4 Interference levels

The conductor proposed must meet the radio interference voltage (RIV), television interference (TVI) limits and audible noise limits as described by AS 2344.

Guidance in the selection of the conductor to meet the RIV, TVI and Audible Noise levels is set out in AS/NZS 7000. An approximate geometric cross-section with the relative spatial position of the conductor/phase in the span will be required prior to these required levels being determined. This will determine the required minimum conductor size for the given spatial geometry.

The structure geometry could lead to an iterative process in meeting these environmental requirements. The corona discharges are influenced by the conductor diameter, the distance between phases and the average phase height off the ground (which is dictated by the tower attachment height and span length the structure can carry).

The final design must ensure the surface voltage gradient on the conductor does not exceed the value of 16 kV per cm for nominal system voltages. This will ensure any corona effects are minimised and resultant interference levels are also reduced.

Bundling of conductors to reduce surface voltage gradient will only be considered if a single conductor arrangement is not practicable.

4.5 Ratings

Guidance in respect to conductor rating is set out in AS/NZS 7000 section 3.2. Calculation method for the ‘conductor rating’ are given as well as the ambient parameters applicable for Tasmania. Generally, TasNetworks will specify the conductor-rating requirement, or additionally the preferred conductor.

Conductor ratings for planning and design purposes are derived using the information shown in the Table 1.

Table 1 Environmental design considerations for conductor ratings

	Winter	**Summer**
Temperature	15 degrees	25 degrees
Wind speed	0.5 m/s	0.5 m/s
Wind angle	90 degrees	90 degrees
Direct solar radiation	750 W/sq m	960 W/sq m
Diffuse solar radiation	75 W/sq m	100 W sq/m

The conductor selection process could potentially lead to an iterative loop, due to the availability of varying conductor types and arrangements. The conductor selected must meet the requirements of its proposed service environment, thermal service performance and permanent elongation.

Consideration may be given to high temperature conductors, however these will only be accepted on very short distance transmission lines.

The conductor temperature is a function of ambient temperature, emissivity and absorptivity and the temperature rise due to power transfer. It can be shown that, especially if the power transfer is low and if a wind slightly more than zero metres per second blows, the conductor temperature will be near or very near to the ambient temperature.

AS/NZS 7000 has a considerable number of references to temperature, some of which are clearly not applicable to Tasmania. For the purpose of determining the conductor tensions, the following temperatures only will be utilised in this Standard.

4.5.1 Coincident everyday temperature

Temperatures referring to Everyday, shall be taken as the 'Mean Temperature of the Coldest Month', t_{ed}, also referred to as the Mean Minimum Temperature in the "Climate of Tasmania" 1979 Edition (or later) prepared document by the Bureau of Meteorology, which will be referenced by the designer. The transmission line route shall be approximately positioned on the isothermal temperature's graphical overlay map of this publication and the temperature for tension sections shall be assessed to the nearest degree centigrade. The lower temperature will be assumed where a long tension section straddles isothermals.

4.5.2 Temperature coincident with maximum wind

The coincident temperature with Maximum or High wind, t_{mw}, shall be taken as the above Mean Temperature of the Coldest Month plus 10°C. The temperature stated in AS/NZS 7000 section 7.2.6 (b) of 15°C shall be employed as a maximum value for any of TasNetworks' transmission lines.

4.5.3 Temperature coincident with ice

The coincident temperature with all the ice conditions, tice, shall be the TasNetworks' historical value equal to -10°C (minus).

4.5.4 Maximum operating temperature conductor rating

The maximum temperature conductor rating is the highest temperature to which the conductor is designed to rise, allowing for the required power transfer, the theoretical projected weather conditions, its emissivity and absorptivity parameter and for AS/NZS 7000 1.4.46 the limiting temperature for electrical clearances. Summer and winter power transfer ratings could be different at this maximum temperature. This shall be the temperature for which the transmission line profiles are templated. The value shall be as stated by TasNetworks.

4.5.5 Minimum temperature

Detailed weather history is available from the Bureau of Meteorology (BOM) for many Tasmanian sites, but these are generally referenced to urban areas only. Due to the 'isolated' nature of transmission lines, and especially for locations and elevations where ice loading is considered for TasNetworks' lines, accurate information is not available.

The lowest extreme temperature expected shall be used for the line design dependant on its route and elevation. This shall be:

(a) In urban areas, where the lowest recorded temperature for various Tasmanian sites is available, the minimum temperature, t_{min}, shall be taken from the following BOM website < http://www.bom.gov.au/climate/averages/tables/ca_tas_names.shtml >

(b) Outside urban areas, or where the lowest recorded temperature is not available from the BOM web site, this shall be taken as the lowest extreme temperature value from either:

  i. At elevations where ice loading is considered, the assumed iced condition temperature of –10°C, or

  ii. The closest known recorded urban site temperature shall be employed adjusted by the temperature reduction of 1°C per 100m rise in elevation, ie.

  t_{min} = - 0.01 x (Alt) – closest site lowest recorded temperature.

4.6 Everyday pressure

The Everyday pressure, also referred to variously, as nominal or still air conditions, shall be considered in the Standard as a wind pressure (which yields W_{ED}) of 100 Pa.

4.7 Laminar flow wind speed (vibration limits)

The 'laminar flow wind speed' associated with the vibration limit for conductors in this Standard is to be taken as detailed in AS/NZS 7000 Appendix B and Appendix Y, Section Y3.

5 Structure geometry

The structure geometry is influenced by electrical, mechanical and structural elements. As such, the electrical clearances and requirements defined by this standard will need to be confirmed to ensure compliance with the *TasNetworks Normative to AS/NZS 7000:2016 - Overhead line design (R1047190).*

Structural geometry air clearances must consider:

(a) accommodating personnel access for live line maintenance;

(b) the minimum spacing required between phases and circuits (where structures support multi circuits);

(c) lightning performance requirements;

(d) any communications cabling to be installed;

(e) possible birdlife or wildlife interaction (especially on post standoff insulators and nesting on flat arms);

(f) accommodation of helicopter aerial work; and

(g) phase separation allowance (for ice accretion elevations).

The overall structure geometry design must be assessed for electric field strength and magnetic flux density limitations within the easement.

The vertical and horizontal phase distances given by the phase to phase and phase to earth spacing requirements are additional to the clearance envelopes described above. The phase spacing at the structure must ensure sufficient phase spacing for conductors, both current carrying and earthwire at midspan.

Conductor vertical, horizontal and angular distances are described by AS/NZS 7000 sections 3.6, 3.7 and 3.8.

For 220 kV circuits strung vertically, phase spacing must not be less than 6m, which includes for the possibility of helicopter based maintenance being performed on the line.

Where two circuits are supported by a common structure, the structure geometry must locate one circuit on each side of the common structure, with phases being diagonally located, unless directed by the project specifications.

At elevations subject to ice and snow accretion, a horizontal offset between vertically adjacent wires equal to the minimum separation distance for the applicable voltage allowing for line deviation angle must be implanted. The offset allows for unbalanced ice and snow accretion on the phases.

Any earthwire or communications cables required on the structure are to be treated as phases for determining phase distances.

The required insulator assembly length must be established (see Section 6), making allowances for the length of additional hardware attached to the insulators. The clearance envelope to the earthed structure is created, for the specified voltage, from the assembly live end. A typical envelope geometry required for double circuit structures is illustrated in AS/NZS 7000 Figure 3.9. (The values in this figure should not be used, as the values appear to correspond to 132 kV lines.) The envelope to any earthed metal of the structure is created as follows:

The minimum corridor for climbing must be 800mm from any climbing face unless otherwise specified by the project specifications.

The TasNetworks' assembly swing angle formula, under the action of wind, shall be as given in AS/NZS 7000 appendix Q2. The swing angle estimate may be made using a simplified deterministic approach or, where greater precision is required or where unusual and/or extreme local conditions prevail, using a detailed procedure based on meteorological data.

The swing angle estimate shall take into consideration the following requirements:

(a) The required conductor 'switching surge' or maintenance clearance distance is assessed under the action of 'still air' (100 Pa) and the 'mean temperature of the coldest month' for the design area. In this condition, independent of the calculation approach undertaken for the 'power frequency' clearance below, TasNetworks require that the assembly angle calculation span correction factor, k, shall equal 1.0.

(b) The required conductor "power frequency" clearance under the action of the 'maximum working wind pressure' is assessed coincident with the temperature 'mean of the coldest month' plus 10°C for the design area, in one of the two recommended swing methods, set out in AS/NZS 7000 Appendices B, C Q and Z:

   i. In the 'simplified' procedure, the wind pressure is assumed as 500 Pa and the span correction factor is taken as k =1.0; and

   ii. The detailed procedure employing the reference pressure (not the 3 second gust in this case) based on a 5 minute gust period wind and the appropriate span correction factor.

5.1 Power frequency

Power frequency clearances shall be calculated using the maximum permissible nominal system voltage of 1.1

5.2 Switching surge

Switching surge clearances shall be calculated using withstand voltages of 550 kV and 1050 kV for the nominal system voltages of 110 kV and 220 kV respectively. Any alternatives to these values will be stated in the project specifications.

5.3 Transposition

Where required, phase conductors shall be transposed to balance the mutual impedance and load current imbalance. Consultation with TasNetworks is required regarding the possible need for transposition.

5.4 Approach distances

TasNetworks' clearance distances to structures shall be as listed in AS/NZS 7000 section 3.5, based on the TasNetworks' defined lightning/switching impulse withstand voltage for the required voltage.

The conductor "live line" minimum approach distances, if required, are listed in AS 5804.

A further 700 mm should be added to the minimum approach distance to provide some ergonomic relief for live line work crews.

These clearances are required to any climbing corridor and to any temporary live-line maintenance equipment that might be required.

AS/NZS 7000 Figure 3.1 specifies the minimum corridor for climbing from any climbing face unless otherwise specified by the project specifications.

5.4.1 Vertical (and horizontal) phase Distances at the structure

Insulator lengths will be given as a result of the insulation coordination.

Where different circuits are located vertically on common structures, the vertical spacing is to be checked for the situation of different sags from temperature combinations i.e., with the ambient temperature circuit below and maximum temperature rated conductor sag on top.

TasNetworks require all new transmission lines with voltages equal or greater than 220 kV to allow for helicopter live-line maintenance. In all cases the required minimum vertical aerial wire spacing for helicopter live-line maintenance is 6m at 220 kV unless specified otherwise by TasNetworks in the project specifications.

At elevations subject to ice or snow accretion in order to allow for unbalanced accretion (unbalanced wire loading and subsequent sagging between wires), TasNetworks require a horizontal offset between vertically adjacent wires, equal to the minimum separation distance for the applicable voltage allowing for the line deviation angle.

5.5 Lightning performance

Guidance in respect to lightning performance is set out in AS/NZS 7000 Section 3.4 and Appendix E.

For new overhead lines, TasNetworks will specify any earthwire and/or communication cable requirements.

Generally, Tasmania is a low ceraunic activity level area, based on the number of thunderstorms statistically listed in the BOM “Climate of Tasmania” document. The Cenelec document BS EN 50341-1:2001 “Overhead electrical lines exceeding AC 45 kV” pages 75 and 102 give additional guidance.

TasNetworks considers Tasmanian transmission lines must be designed for a low ceraunic level. The overhead earthwire will be placed to create a shielding angle smaller than 30 degrees, or as specified by the project specifications.

Where overhead earthwires or optical groundwires are installed, a downlead connecting the earthwire directly to ground must be installed on every tower to minimise the resistance of the tower, thereby reducing possible earth potential rise and ensuring sufficient fault current is created to enable protection systems to operate correctly.

Additional earthwires strung below phase conductors may be considered where the likelihood of lightning back flashovers is deemed to be high.

Overhead earthwire must not be placed directly above any phase conductor.

5.5.1 Footing resistances

TasNetworks requires that tower footing resistances must average below 10 Ohms along a transmission line. An overhead earthwire may be required due to lower higher foundation earthing resistances.

Tower footing resistances shall average less than 5 Ohms for the first 2 kilometres emanating from the substation.

5.6 Electric and magnetic fields

TasNetworks practices prudent avoidance when designing for electric and magnetic fields. Therefore electric and magnetic fields must be reduced where practical at a reasonable cost.

Under no circumstances will TasNetworks accept a design which does not meet the current National Health and Medical Research Council guidelines for electric and magnetic field exposure.

5.7 Overhead earthwire and optical ground wire (OPGW)

Unless otherwise specified by TasNetworks all new transmission lines will require optical ground wires (OPGW) to be installed with the following requirements:

(a) The wires are to be treated as additional phases for the purpose of determining the required minimum distances as described above.

(b) The overhead earthwire/OPGW, will be placed to create a shielding angle no larger than 30 degrees. Where multiple OPGW is required to achieve shielding of the phase conductors both OPGW shall have fully functional communications fibres.

(c) The overhead earthwire sag shall be designed as a ratio of the phase conductor sag the historical TasNetworks' transmission line ratio shall be maintained, hence, the ratio of earthwire sag to phase conductor sag which shall not be exceeded is 85% at 15°C.

Overhead earthwires and optical ground wires must be capable of carrying fault current without being damaged, withstand maximum short term temperature rise and withstand lightning strikes with a low risk of strand breakage.

Therefore, all conductors used as overhead ground wires must have strands of a minimum 3mm diameter. Each earthwire must be capable of carrying the maximum likely substation fault current for the maximum time period allowed for a remote end fault, as described by *Protection of Transmission Lines Standard (R246427)* and the NER.

5.7.1 Overall structure geometry design check

When the new transmission line supporting structure geometry design has been completed, the overall structure geometry design must be assessed to ensure that the 'electric field strength' and 'magnetic flux density' are within the required maximum limits for the line corridor or easement, measured at the edge of the easement.

The standard easement widths for TasNetworks' transmission lines are set out in the *TasNetworks Normative to AS/NZS 7000:2016 - Overhead line design (R1047190)*

5.8 Prototyping and testing (type testing)

All structures shall be prototyped to ensure that fabrication is as per design and to meet the quality requirements specified on drawings and specifications.

Generally all new designs should be load tested. The decision to load test structures should be made by the design engineer and submitted to TasNetworks for approval, taking into account the following factors:

- Similarity of existing designs and design principles,
- Quantity of structures to be used, including consideration should be given to their utilisation on future lines,
- Confidence in the adequacy of the design, and
- Cost of testing.

The load testing shall confirm the overall strength of the structure as well as the strength coordination between components.

6 Insulation selection

All new ceramic insulators must comply with TasNetworks' *High Voltage Disc Insulator Standard*. New composite insulators must comply with AS 4435.1.

Any further site specific insulation requirement such as pollution levels or additional withstand levels will be stated in the project specifications.

Guidance in respect to insulation is set out in AS/NZS 7000 section 3 and section 5. TasNetworks will specify the selection of insulation with the level of pollution contamination severity insulation required for any new overhead line.

7 Conductor clearances

The route selection and profiling will be planned on the basis of the terrain type, topography and obstacles requiring **electrical clearance**, which will dictate the assessment or positioning of any overhead line structure along a selected line route. For various voltages, sections 3 and 4 of AS/NZS 7000 cover the required conductor vertical distance to differing ground usage and clearances from structures respectively. The conductor parameters for this condition will be at the rated maximum temperature and with nil wind on the conductors.

Clearance distances to cover most transmission line requirements are given AS/NZS 7000 Section 3 and Section 4, and *ESAA NENS 04*-2003, except for navigable shipping and recreational waterways and over highways and freeways. These additional TasNetworks' clearances are as listed in Table 2 below.

Table 2 Additional Clearance Requirements

Waterways Shipping	**The distance will be as negotiated with the appropriate Marine Board Authority**
Waterways Shipping	The distance will be as negotiated with the appropriate Marine Board Authority
Waterways Recreational Navigable required under both 110 and 220 kV lines	12.0m
Highways and freeways under 110 kV line (subject to TasNetworks' confirmation)	9.5m
Highways and freeways under 220 kV lines (subject to TasNetworks' confirmation)	10.5m
All TasNetworks' transmission line profiling (Clearance safety margin)	An additional 0.3m vertical clearance to all ground distance requirements

The methodology and **route easement** width requirements define the clearances to specific structure locations. The wind **blowout pressure** for this assessment:

(a) To buildings, structures and supports (other than a support to which the line under consideration is attached) and in particular where people can stand, shall be checked for the nominal design pressure minimum of 900 Pa on the conductor and 1400 Pa on insulator assemblies, as setout in AS/NZS 7000 Appendix B.

(b) Elsewhere within the easement the blowout shall be checked for either a nominal design pressure minimum of 500 Pa on the conductor and the insulator assemblies, set out in AS/NZS 7000 Section 3.7, Table 3.7 and Figure 3.10 and Figure 3.11.

AS/NZS 7000 Appendix B, gives a detailed formula method for determining the angular conductor blowout position. The conductor temperature in this condition will be taken at the 'high wind' temperature of the 'mean temperature of the coldest month' plus 10°C.

TasNetworks' standard easement widths for various transmission line voltages are set out in *TasNetworks Normative to AS/NZS 7000:2016 - Overhead line design (R1047190)*

The **conductor spacing** requirements and conditions to conductors of **different circuits** on both **different** supports (also referred as unattached crossings) and on the **same** support, is set out in tables 10.1 and 10.2 of AS/NZS 7000 Section 3.7. These include the conductor parameters requiring checking, either where the crossing occurs in the span or if crossing shares the same support point.

The **design plan and profile** drawings shall show the conductor catenary shape (and ground line profile), hence **ground clearances**, based on 'final modulus of elasticity', $E_{f,}$ of the conductor at its maximum rated temperature position.

As lines in Tasmania generally traverse sharply uneven terrain, the sag and tension calculations shall as a minimum be based on hyperbolic equations, with the 'ruling' span based on chord lengths.

7.1 Landing span conductors

The conductor stringing basic tension and clearance in the closing span to the substation termination structure shall take due cognisance of the original termination structure design loads and the maximum tensions notes in TasNetworks' *General Substations Requirements Standard (R522687).* Do not rely on the relieving balancing tension of the substation termination structure as also mentioned in Section 5.1.1(e).

The interface of the closing span to the substation termination structure shall be checked to AS 2067 for swing, angle, clearances and short circuit forces to AS/NZS 7000 Appendix Z.

8 Conductor joints

8.1 Tension joints

Where in-span joints are used in aerial conductors they should have a conductivity and tensile strength complying with the relevant Australian Standard or IEC publication.

Joints should be located so as not to cause damage to conductors when the conductor is subject to vibration. Damage can be caused if the joint is placed in close proximity to the conductor support.

8.2 Wedge clamps

Wedge clamps for conductors should be type tested in accordance with AS/NZS 4325.1, IEEE 837 and ANSI C1119.4 or their equivalent.

9 Failure contingency

Design of new transmission lines to AS/NZS 7000 should be auditable to AS 5577 for contingent events.

10 Fauna considerations

TasNetworks transmission lines may traverse potentially sensitive environments with rare and endangered species. All structures shall be designed to be bird and vermin proof including work maintenance platforms and anti-climbing barriers.

TasNetworks will advise on spans where bird mitigation is required and the acceptable forms of bird diverters to be fitted to OPGW or conductors where applicable.