Standard

AC Distribution System Standard

R565984

Version 1.0, June 2018

Tasmanian Networks Pty Ltd (ABN 24 167 357 299)

Authorisations

Action	Name and title	Date
Prepared by	Michael Verrier, Senior Asset Strategy Engineer	June 2018
Reviewed by	Santosh Dhakal, Asset Engineer	June 2018
Authorised by	Darryl Munro, Asset Strategy Team Leader	June 2018
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 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
Entire doc	Copied over verbatim from superseded Transend D01/7205 to TasNetworks template. Updated Transend to TasNetworks document reference numbers where known.
Authorisations	Review cycle changed from 24 months to 30 months.

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1 General

1.1 Purpose

To define the requirements from AC distribution system under the responsibility of Tasmanian Networks Pty Ltd (hereafter referred to as 'TasNetworks').

1.2 Scope

This standard applies to all AC distribution systems under the responsibility of TasNetworks.

This standard contains requirements for design, engineering, manufacture, construction, testing at manufacturer's works, secured packaging, supply, transportation, delivery to site, testing and commissioning with complete documentation of the AC distribution system and is to be applied to new installations as well as redevelopment of part or all of existing installations.

1.3 Objective

TasNetworks requires design, construction, installation and commissioning of equipment and services as covered in this standard to ensure:

(a) that relevant Australian legal requirements are met;

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

(c) personnel and public safety and environmental hazards are identified, analysed and eliminated or control measures adopted;

(d) ease of operation and maintenance;

(e) reliability and continuity of power supply;

(f) minimum disruption to the electricity transmission system following an asset failure;

(g) risk to TasNetworks' assets is minimised;

(h) compliance with TasNetworks' environmental policy;

(i) that the requirements of TasNetworks' performance objectives are met;

(j) that the exposure of TasNetworks' business to risk is minimised; and

(a) that TasNetworks' responsibilities under connection agreements are met.

1.1 Certificate of conformance

(a) Before any new and/or modified AC distribution system is put into service in TasNetworks' system, certificate of conformance with this standard must be submitted to TasNetworks. The certificate of conformance must be duly supported with documents, drawings, test results, test reports, test certificates, completed check lists and other documents as applicable. Where TasNetworks has approved deviation to specific requirements of this standard, all such approvals must be included with the certificate of conformance.

(b) TasNetworks will supply blank proforma for certificate of conformance, to be completed by the Contractor.

(c) The AC distribution system will be put in service only after TasNetworks has accepted the certificate of conformance.

1.1 Precedence

Any conflict between the requirements of the codes, specifications, drawings, rules, regulations and statutory requirements or various sections of this standard and other associated documents must be brought to the attention of TasNetworks for resolution.

1.2 Deviation

Special approval for a deviation to this standard may only be accorded if it does not reduce the quality of workmanship and does not deviate from the intent of this standard. A request for a deviation must follow a designated procedure that involves approval from TasNetworks. Deviations if any must be specifically requested, and approved in writing by TasNetworks prior to award of Contract.

1.3 References

As a component of the complete specification for a system, 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:

1.3.1 Australian Standards

As a minimum the following Australian Standards will be adhered to:

Wiring rules	AS/NZS 3000
Electrical Installations Cable Selection	AS/NZS 3008
Low Voltage and Switchgear and Control Gear Assemblies	AS/NZS 3439

1.3.2 Other references

As a component of the complete specification for a system, 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:

R574183	AC Distribution System - Schedule	
R574181	AC Distribution System deliverables	
R590634	Substation Civil Design and Construction Standard	
R246439	SCADA System Standard	
R522687	General Substation Requirements Standard	
R246497	Testing, Commissioning and Training Standard	
R590630	HV and LV Cable Systems Standard	
D10/74582	Project Implementation & Finalisation (PI&F) - Master Hold Point Register - Design and Construct (P&C and Substations)	
	Standard Design drawings 400 volt Distribution Panels drawing index	TSD-SD-806-0015-001 to 018

2 Project specific requirements

Project specific requirements for the AC distribution system will be listed in the project specifications.

2.1 Service conditions

Environmental conditions and any specific design criteria for particular works will be stated in the project specifications. Minimum service conditions for AC distribution system are stated in document R522687.

All equipment must be capable of operation at its specified rating without assisted means, for example, forced cooling will not be permitted to achieve the rated capacity.

2.2 Performance

AC distribution system must ensure reliability, security and redundancy.

The selection of the equipment constituting AC distribution system must be appropriate to satisfy the design criteria and to meet or exceed the specified performance.
The selection of equipment, design and all works associated with the AC distribution system must conform to the requirements as specified in document R522687.

The selection of the equipment must be based on most severe of:

(a) requirements mentioned in this standard;

(b) project specifications; or

(c) results from system analysis and requirements as stated in document R522687.

3 AC distribution system

An AC distribution system must consist of one AC distribution board with two independent AC supplies.

Should an AC distribution system with an individual AC supply be acceptable, it will be stipulated in the project specifications. In such a case, the AC distribution system must be designed to allow for the future installation of a second AC supply.

Each AC distribution system must consist of, as a minimum, one station service transformer, one incomer module, one AC distribution board complete with distribution tier and associated interconnections.

A standard AC distribution system is shown in TSD-SD-806-0015-002 and 003.

3.1 Application of AC distribution system

The AC distribution system must be used for supplying all three phase (400V) and single phase (230V) equipment including:

(a) transformer tap-changer motors;

(b) transformer tap-changer control;

(c) transformer equipment;

(d) space heaters;

(e) battery chargers;

(f) internal and external lighting;

(g) general power circuits;

(h) air conditioning climate control equipment;

(i) oil/water pumps;

(j) SCADA system;

(k) communications equipment; and

(l) other applications as required.

3.1 Design requirements for AC distribution system

AC distribution system must be designed such that:

(a) adequate ventilation is provided to ensure the AC distribution system can operate at rated capacity with an ambient temperature of 40 degrees Celsius;

(b) it is appropriately rated to withstand the prospective fault current that can be supplied by the high voltage system for at least one second or the time taken for the short circuit protection device to operate, whichever is greater;

(c) a failure of a component on a circuit does not affect any other circuit;

(d) all outgoing circuits from the AC distribution board are in the form of cables;

(e) AC cables are clearly identified and segregated from any other supply circuits; and

(f) supplies from both AC supplies will be normally energised at the AC board. In the event of a main feeder failure the AC distribution will be automatically transferred to the remaining AC supply ie AC board to be fitted with an auto changeover switch.

4 Station service transformer

Each station service transformer must be supplied off separate protection devices from the substation high voltage system. The point and configuration of connection must be approved by TasNetworks. Where station service transformer exists for a substation, the primary source will be stated in the project specifications.

4.1 Station service transformer design and installation

Station service transformer must be designed and installed such that:

(a) station service transformer rating and design parameters must accommodate all system and loading conditions;

(b) each station service transformer must allow for the connection of a set of heat shrink terminated high voltage cables to supply a high voltage portable pad mounted transformer when required. Allowance must be made for efficiently and safely installation of these cables to a suitable location external to the building, should they be required in the future;

(c) the station service transformer installation must be designed such that:

  (i) it is not of a cage type;

  (ii) both high voltage and low voltage connections to the transformers are by cable;

  (iii) tap position indicators, nameplates and temperature indication are visible by the naked eye from floor level with the station service transformer in service; and

  (iv) it is labelled on the front, stating as a minimum the station service transformer designation (based on TasNetworks' device numbering system), transformer specifications, information that relates station services transformer to its documentation and other relevant information. The label must be in conformance with requirements mentioned in document R522687.

(d) specific design and installation requirements for each station service transformer are detailed in Table 1.

Table 1 Specific service requirements for station service transformers

Sr. No.	Description	Unit	Requirement
1.	Enclosure		
1.1	Enclosure degree of protection	-	IP31
1.2	Paint colour	-	RAL7032
2.	Type	-	Dry type
3.	Installation		Indoor
4.	Type of cooling	-	AN
5	Rated power	kVA	Type 100 system = 150 kVA Type 200 system = 100 kVA or project specified
6.	Number of phases	-	3
7.	Rated nominal voltage (HV side)	-	Refer to project specifications
8.	Primary supply voltage variation	%	$\pm$6
9.	Rated nominal voltage (LV side)	Volts	400V
10.	Secondary supply voltage variation	%	+ 10% and – 6%
11.	Vector Group	-	Dyn11
12.	Tappings	-	Required on HV windings
13.	Tap changer	-	Off load
14.	Number of tap positions	-	7 (Tap position 4 is centre tap)
15.	Tapping voltage range	%	+7.5, -7.5 of nominal voltage
16.	Tapping step	%	$\pm$2.5
17.	Temperature indication and alarm/trip contacts	-	Required
18.	Method of earthing	-	LV neutral solidly earthed and connected to station earthing system
19.	Arrangement for bolting to floor	-	Required
20.	Earth connection	-	Bolted, copper
21.	Neutral Terminal on LV side	-	Required
22.	Lifting Lugs	-	Required
23.	Base support structure	-	Swivel wheels (90◦ in horizontal plane)

4.1 Station services transformer installation location

Station service transformer must be installed such that:

(a) the station services transformer must be installed in a separate room within the control room building as required in document R590634. Where duplicate station services transformers are provided the two transformers must be physically separate and against two separate walls of the room;

(b) the layout and location of the room must be provided to TasNetworks for acceptance and approval;

(c) the room must not be utilised for installation of any other equipment other than batteries; and

(d) the room must be positioned to minimise the length of cabling between station services transformer and the main AC switchboard.

5 AC distribution board

5.1 AC distribution board design

The AC distribution board must be designed to:

(a) have at least two supply inputs with alarm and monitoring circuits independent for each supply inputs;

(b) be adequately rated so as to meet the rated power output from the AC supply system;

(c) include identical three-phase lockable moulded case circuit breakers (MCCB) for all incoming supplies (including connection for 44 kVA emergency generator supply complete with socket connection Cutler Hammer CH6A3NE01 Inlet, CH6PC 63A Plug Cap and CH6W 63A Wall box 32mm Entries);

(d) include clip-in type lockable miniature circuit breakers for all outgoing circuits, installed on a rigid mounting chassis;

(e) include neutral and earth bars with tunnel type terminals;

(f) incorporate fully insulated and phase colour coded busbars and droppers;

(g) include:

(i) the number of circuits required for the new installation;

(ii) any existing AC circuits which will be retained in service; and

(iii) allowance of 30 per cent for future load and circuits,

(h) ensure that the busbar construction allows for the complete interchangeable of single or multi-pole breakers without alteration to busbar connections or circuit breaker mounting fixtures; and

(i) include an emergency generator connection point as shown in TSD-SD-806-0015-002 and TSD-SD-806-0015-003 Generator Inlet. Connection to the emergency generator cable terminals must not require the disconnection of any existing substation equipment.

5.1 Circuit breakers

Each AC circuit must be provided with an AC circuit breaker for overload and short circuit protection. All circuit breakers on the AC supply system must be appropriately graded to prevent inadvertent operation and must have adequate making and breaking capacity to fulfil their intended function.

5.2 AC distribution board enclosure

The AC distribution board must:

(a) have an enclosure with a degree of protection by enclosure of IP54 (for indoor climatically controlled installations) and be:

(i) door lockable;

(ii) adequately ventilated;

(iii) painted RAL7032 or approved by TasNetworks;

(iv) fitted with a restraint to hold the door in an open position of 120-135 degrees;

(v) designed to include a suitably placed pocket on the inside of the AC distribution board and containing associated schematic drawings. Similarly each distribution board must be designed to include a suitably placed a circuit designation cardholder; and

(vi) labelled on the front, stating as a minimum the distribution board designation (based on TasNetworks' device numbering system), distribution board specifications, information that relates distribution board to its documentation and other relevant information. The label must be in conformance with requirements as stipulated in document R522687R522687,

(b) be of dead front type;

(c) include provision for access to all components from the front;

(d) have the escutcheon:

(i) punched to accept circuit breakers for the maximum pole capacity of the chassis. Pole fillers must be provided for all spare circuit breaker positions;

(ii) hinged on the left-hand side; and

(iii) with circuit identification numbering system and legend provide for all circuits;

(e) in the case of equipment mounted on hinged panels, have all rear terminals or live parts effectively shrouded by clear perspex covers to provide safe working access of equipment located behind such panels;

(f) have generous wiring space for the connection of cables to circuit breakers, neutral and earth bars and for incoming cable terminations; and

(g) have generous busbar systems that are rigidly supported at regular intervals along the length of the busbars.

5.1 Monitoring, metering and alarms

5.1.1 Monitoring

A three-phase supply failure relay and a three phase no volt relay must be provided to monitor the busbar voltage and alternate supply voltage. All relays and monitoring equipment must be electrically protected and relays and indicators must be accessible from the front with the AC system in service.

5.1.2 Metering

As a minimum, metering must be provided for the following:

(a) Incoming supply from each station service transformer:

(i) Current

(ii) Voltage

(iii) Power

(iv) Energy

(v) VARs

(b) Revenue metering, if required, will be stated in the project specifications

(c) All meters must be digital and to an accuracy of $\pm$1per cent

(d) All meters must be multi-function meters

(e) All metering equipment must be adequately electrically protected

(f) Meters and indicators must be visible from the naked eye at floor level without opening the door

5.1 Status and alarms

As a minimum the status and alarms as shown in Table 2 and those stated in this standard must be provided.

Table 2 Status and alarm indications from AC distribution system

No.	Alarm Description	Local (Status - Alarm)	Remote (Alarm to NOCS)
1.	Phase failure relay	Alarm	Not Required
2.	No Volt relay	Alarm	Required
3.	Incoming AC supply 1	Indicator	Not Required
4.	Incoming AC supply 2	Indicator	Not Required
5.	Selected Preferred Supply	Indicator	Not Required
6.	AC supply circuit trip	Required	Required
7.	Multifunction Meter	Required	Not Required
8.	Transformer temp alarm	Required	Required
9.	Transformer temp trip	Required	Required

5.2 Connections to SCADA and NOCS

The AC distribution system must be connected to local station SCADA system and remote NOCS. All works associated with SCADA must be as per document R246439. Signals and connections to be provided for SCADA monitoring and alarms must comply with requirements in this standard and document R246439.

6 Cable systems

All cables and cable systems associated with AC distribution system must be in accordance with document R590630.

7 Civil works

All civil works associated with AC distribution system must be in accordance with document R590634.

8 Earthing

Earthing of all equipment and works associated with AC distribution system must be in accordance with document TNM-DS-806-0845.

9 Data for asset management information system

The Contractor must provide information required to maintain the TasNetworks' current AMIS for each asset. TasNetworks will provide proformas to the selected Contractor. Proformas are required to be filled for new assets and for decommissioned assets as below.

Design information and maintenance regime information for all assets must be submitted to TasNetworks before commencing installation on site.

Information on factory test results for all assets must be submitted prior to installation.

10 Testing

(a) Testing, installation and commissioning must comply with the requirements of the document TNM-DS-806-0841.

(b) All components of AC distribution system must be duly tested in accordance with relevant applicable Australian and International standards. Where tests are optional in the standards, it will be considered that these tests are required by TasNetworks, unless otherwise requested by Contractor and agreed in writing by TasNetworks before the award of Contract.

(c) All test reports must be forwarded to TasNetworks for approval and acceptance. The tests will be considered as completed, only after, an approval and acceptance of test results by TasNetworks in writing. A list of the tests to be conducted on the AC distribution systems is given as follows.

10.1 Type tests

All major parts such as switchgear, circuit breakers, cubicles and busbar arrangements must have a type test certificate. Type test certificates for minor items such as monitoring electronics are not required, but must be approved for use by TasNetworks.

10.2 Routine tests

(a) The routine tests must be conducted on the complete system to prove quality of manufacture and conformance with the relevant performance requirements of the applicable standards. Splitting of routine tests into separate phases for individual components of the system is not acceptable. Routine testing must be performed at the manufacturer's works prior to delivery.

(b) Procedures for routine tests with supporting documentation must be submitted to TasNetworks for approval and acceptance. Routine tests will not be conducted unless the routine test procedures have been accepted and approved by TasNetworks.

(c) Routine test results and certificates must be submitted to TasNetworks for approval and acceptance. Routine tests will be considered as completed only after TasNetworks approves and accepts the test results.

(d) Routine factory test results must be approved and accepted by TasNetworks prior to dispatch of equipment to site.

(e) As a minimum, the tests stated below must be conducted.

10.1.1 Routine and special tests on station service transformer

The following routine and special tests must be performed on each station service transformer:

(a) Audible noise.

(b) AC Output Characteristics.

(c) Current and voltage characteristics during each separate cycle.

(d) Thermal rating at rated output.

(e) Insulation resistance.

(f) Alarm operation.

(g) Output EMF measurements.

10.1.1 Routine tests on AC distribution board

Routine tests for the switch board must be done in accordance with AS/NZS 61439.1 section 11 and test results must be submitted prior to despatch of the switchboard.

10.1.2 Routine tests on monitoring and measurement equipment

The following routine tests must be performed on each station service transformer:

(a) Relay operations and set points.

(b) Alarm contacts and circuits.

(c) Relay and metering equipment accuracy.

(d) Instrument accuracy.

11 Information to be provided with tender

Requirements for information to be submitted as part of the tender are outlined in document R574183.

12 Deliverables

Requirements for project deliverables are outlined in document R574181.

13 Hold points

The hold points for AC Distribution system will be included in the Project Implementation & Finalisation (PI&F) - Master Hold Point Register - Design and Construct (P&C and Substations), D10/74582.