Standard

Extra High Voltage (EHV) Current Transformer Standard

R522690

Version 2.0, December 2020

Authorisations

Action	Name and title	Date
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Review cycle	30 months	

Responsibilities

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

Please contact the Substation 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

Document Version	Section number	Details
1.0	Entire doc	Copied over verbatim from superseded Transend to TasNetworks template. Updated Transend to TasNetworks document reference numbers where known including Australian Standards.
1.0	Entire doc	Improved clarity and minor grammatical alterations.
1.0	1.5	Combined sections. Improved clarity regarding the need for notification and approval of any deviation from standard.
1.0	6.6	Updated medium and format of drawings.
2.0	Entire document	Minor grammatical and other improvements
	1.5	Combined precedence and deviation, providing greater clarity regarding need for approval by RPSAM
	Various sections	Updated number of standard cores per CT from 5 to 6.

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1 General

1.1 Purpose

To define the requirements for extra high voltage (EHV) outdoor post type current transformers (hereafter referred to as 'current transformer/s'), under the responsibility of Tasmanian Networks Pty Ltd (hereafter referred to as 'TasNetworks').

1.2 Scope

This standard specifies the requirements for the design, manufacture, construction, testing at manufacturer's works, secure packaging, supply, transportation and delivery to site, with complete documentation, of current transformers.

1.3 Objective

TasNetworks has developed this standard for current transformer design, manufacture and testing 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) risk to TasNetworks' assets is minimised;

(e) ease of operation and maintenance;

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

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

(h) that the exposure of TasNetworks' business to loss is minimised; and

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

1.4 Certificate of conformance

(a) Before any new current transformers are put into service in TasNetworks' system, a 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 forms for certificate of conformance, to be completed by the Contractor.

(c) The current transformers will be put into service only after TasNetworks has accepted the certificate of conformance.

1.5 Precedence and deviation

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 requirement.

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; or

(c) project specification, then a deviation must be specifically requested and approved in writing by TasNetworks' Substations Asset Strategy Team Leader.

Approval for a deviation to this standard may only be provided if it does not reduce the quality of workmanship, pose a safety risk to personnel or equipment and does not deviate from the intent of this standard.

1.6 References

As a component of the complete specification for a current transformer or 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:

1.6.1 TasNetworks standards

R586386	Extra High Voltage System Standard
R590634	Substation Civil Design and Construction Standard
R517371	Insulating Oil for Transformers and Switchgear Standard
R246497	Testing, Commissioning and Training Standard
R574176	EHV Current Transformers Schedule
R574175	EHV Current Transformers Deliverables
D11/86620	Metering Standard

1.6.2 Other standards

Insulated bushings for alternating voltages above 1000 V	AS/NZS 60137
Structural steel welding	AS 1554
Metal finishing and pre-treatment of surfaces	AS 1627
Insulating Oil for transformers and switchgear	AS 1767
Degrees of protection provided by enclosures (IP code)	AS 60529
Substations and high voltage installations exceeding 1 kV a.c.	AS 2067
Common specifications for high-voltage switchgear and controlgear	AS/NZS 62271.1

Electrical installations (known as the Australian/New Zealand Wiring Rules)	AS/NZS 3000
Steel structures	AS 4100
Instrument Transformers – Part 1: Current transformers	AS 60044.1
Instrument Transformers – Part 2: Single-phase inductive voltage transformers	AS 60044.2
Instrument Transformers – Part 3: Combined transformers	AS 60044.3
High Voltage switchgear and controlgear part 301: Dimensional standardisation of terminals	AS/NZS 62271.301
Hot-dip galvanized (zinc) coatings on ferrous hollow sections, applied by a continuous or specialised process	AS/NZS 4792

2 Service conditions

Service conditions shall not exceed the limits stated in AS/NZS 62271.1 Clause 4, together with the particulars of the system stated in Table 1 of this standard.

Specific environmental conditions for particular works will be stated in the project specifications.

3 Design requirements

Current transformers supplied to TasNetworks must comply with the requirements within Table 1 of this standard, the requirements detailed in AS 60044.1 and other applicable Australian and International Standards. Where a conflict exists, the most onerous requirement shall apply.

Any specific design, installation, operation and maintenance criteria for particular works will be stated in the project specifications.

Table 1 Parameters for current transformers

Sr. No.	Parameter	Unit	Value	
	Particulars of the System			
1	Nominal system voltage (V_n)	kV	110	220
2	Highest voltage	kV	123	245
3	Power frequency withstand voltage (PFWV)	kV_{rms}	230	460
4	Lightning impulse withstand voltage (LIWV)	kV_{peak}	550	1050
5	Normal voltage variation (criteria for equipment design)	$\%V_n$	±10	
6	Frequency	Hz	50	
7	Normal frequency variation	Hz	±2	
8	Frequency variation at times of system disturbance	Hz	44.5 to 52.0	

Sr. No.	Parameter	Unit	Value	
9	Normal combined voltage and frequency variation (criteria for equipment design)	%	± 10	
10	System earthing	-	solidly earthed	
11	Number of phases	-	3	
12	Design maximum continuous ambient air temperature	°C	45	
13	Design minimum continuous ambient air temperature	°C	minus 10	
	Particulars of Current Transformers			
14	Number of phases	-	single	
15	Installation	-	outdoor	
16	Construction (preferred)	-	It is preferred that CT functionality is provided by CTs within dead-tank circuit breakers, however where this is not possible then a post-type CT can be used (as defined within this Standard)	
17	Number of cores per phase	-	6	
18	Insulation medium	-	oil	
19	Minimum creepage distance of bushings	mm	3075	6125
20	Rated short-time thermal current	kA	40	
21	Rated dynamic current	kA	100	
22	Rated short-time	s	1	
23	Rated continuous thermal current	A	2500	3150
24	Primary terminal palm type (AS 62271.301)	-	8	9
25	Static withstand load (horizontal and vertical) on primary terminal	kN	3	4
26	Dynamic withstand load (horizontal and vertical) on primary terminal	kN	4.2	5.6
27	Transformation ratio, duty, rated output and performance designation for each core (available for principal taps, intermediate taps and any derived ratios)	-	refer Table 2	refer Table 3
28	Output voltage limiting device operating voltage	kV	4.5	
29	Nominal secondary current	A	1	
30	Rated secondary continuous thermal current	A	2	
31	Test taps	-	No	

Sr. No.	Parameter	Unit	Value
32	Degree of protection by enclosure	IP	66
33	Degree of protection by enclosure of secondary terminal box	IP	55

4 Current transformer design requirements

Current transformers must utilise the electromagnetic construction principle. Current transformers other than those working on inductive technology may be accepted only if proven to be more reliable and present lower whole-of-life costs. All such evidence must be submitted to TasNetworks prior to award of Contract.

Optical current transformers and other technology such as sensors can be proposed as an alternative only if they have been tested in accordance with Australian Standards and have certification from relevant authorities in Australia for application to revenue metering measurement applications as per the Code. Any such technology proposed must have been in commercial service for at least three years in the electricity supply industry.

4.1 Performance requirements

- Minimum requirements for 110 kV current transformers are listed in Table 2.
- Minimum requirements for 220 kV current transformers are listed in Table 3.

Transformation ratios detailed within Option A (see tables below) are for application to current transformers at existing substation or existing switching stations, eg spares or replacement units.

Transformation ratios detailed within Option B (see tables below) are for application to current transformers at green-field substations or green-field switching stations.

Option A or B will be specified within project specifications.

Current transformer parameters deviating from this standard, such as additional cores, modified ratios, performance designations, accuracy class, will be allowed only if it is proven to TasNetworks' satisfaction that the proposed parameters are more onerous than those listed in Table 2 and 3 or are required to satisfactorily integrate with protection, control and metering equipment, eg revenue metering, high-impedance bus-zone schemes.

Table 2 Specific parameters for 110 kV current transformers

Sr. No.	Parameter	Unit	Value
1	Number of protection cores per phase	-	4
2	Number of revenue metering cores per phase	-	1 for Type 3-4 revenue metering, 2 for Type 1 or 2 revenue metering
3	Order of assembly (core 1 to 6)	-	$P_1 – P_2 – M_3 – M_4 – P_5 – P_6$
4	Location of core P_1	-	adjacent to primary terminal P1
5	Data for revenue metering core		
5.1	Core number/s	-	3 & 4
5.2	Duty	-	Revenue metering
5.3	Transformation ratio	-	1500/1200/1000/750/400/1

Sr. No.	Parameter	Unit	Value
5.4	Rated Output @ 750/1	VA	25
5.5	Revenue metering accuracy class (applicable to all principal ratios)	-	0.5M for Type 2/3/4 metering installations, or 0.2M for Type 1 metering installations (Specified at time of tender)
5.6	Extended primary current rating	%	120
5.7	Instrument Security factor (FS)	-	FS = ≤ 10
6	Data for protection cores		
6.1	Core number/s (relates to 6.2 to 6.4, below)	-	1, 2, 5 & 6
6.2	Duty	-	protection
6.3	Transformation ratio	-	1500/1200/1000/750/400/1
6.4	Performance designation (available for principal taps, intermediate taps and any derived ratios) (relevant derived ratios for Option A core 1, 2, 5 & 6 testing are 800/600/500/300/250/200/1) (relevant derived ratios for Option B core 1, 2, 5 & 6 testing are 500/250/1)	-	$I_e PXE_k RR_{ct}$, where I_e=0.1 and E_k=100(R_{ct}+2)

Table 3 Specific parameters for 220 kV current transformers

Sr. No.	Parameter	Unit	Value
1	Number of protection cores per phase	-	4
2	Number of revenue metering cores per phase	-	1 for Type 3/4 revenue metering, 2 for Type 1/2 revenue metering
3	Order of assembly (core 1 to 6)	-	$P_1 – P_2 – M_3 – M_4 – P_5 – P_6$
4	Location of core P_1	-	adjacent to primary terminal P1
5	Data for revenue metering cores		
5.1	Core number/s	-	3 & 4
5.2	Duty	-	Revenue metering
5.3	Transformation ratio	-	1500/1200/ 1000/750/400/1
5.4	Rated Output @ 400/1	VA	25

Sr. No.	Parameter	Unit	Value
5.5	Revenue metering accuracy class (applicable to all principal ratios)	-	0.5M for Type 2 or 3-4 revenue metering installations, or 0.2M for Type 1 revenue metering Installations (Specified at time of tender)
5.6	Extended primary current rating	%	200
5.7	Instrument Security factor (FS)	-	FS = ≤ 10
6	Data for protection cores		Option A
6.1	Core number/s (relates to 6.2 to 6.4, below)	-	1, 4 & 5
6.2	Duty	-	protection
6.3	Transformation ratio	-	1500/1200/ 1000/750/1
6.4	Performance Designation (available for principal taps, intermediate taps and any derived ratios) (relevant derived ratios for Option A core 1, 4 & 5 testing are 500/300/250/1) (relevant derived ratios for Option B core 1, 4 & 5 testing are 500/250/1)	-	$I_e PXE_k RR_{ct}$, where I_e=0.1 and E_k=100(R_{ct}+2)
6.5	Core number/s (relates to 6.6 to 6.8, below)	-	2
6.6	Duty	-	protection
6.7	Transformation ratio	-	1500/1200/ 1000/750/400/1
6.8	Performance Designation (available for principal taps, intermediate taps and any derived ratios) (relevant derived ratios for option A core 2 testing are 800/600/500/300/1) (relevant derived ratios for option B core 2 testing are 500/250/1)	-	$I_e PXE_k RR_{ct}$, where I_e=0.1 and E_k=100(R_{ct}+2)

4.2 General design requirements

Current transformers must:

(a) comply with this standard and requirements detailed in AS 60044.1 and AS/NZS 60137 for 'normal service conditions' and other applicable Australian Standards;

(b) be oil insulated, with insulating oil as per AS 1767 and satisfy the requirements of TasNetworks' insulating oil for Transformers and Switchgear standard R517371;

(c) be hermetically sealed;

(d) be designed to minimise the risk of accidental short circuit by animals, birds and vermin;

(e) be manufactured with reliable components to provide for an expected 50 year service life;

(f) have terminal markings and rating plate in accordance with AS 60044.1. Polarity markings must be provided on the primary and secondary terminals of each current transformer and affixed so that they can be easily read without requiring any disconnection of the current transformer; and

(g) be provided complete with independent enclosures, support structures and other associated accessories, if specified within the project specifications.

5 Primary circuit requirements

5.1 Current transformers

Current transformers must:

(a) be capable of withstanding the highest voltage continuously;

(b) be capable of withstanding the continuous thermal current and short-time thermal current, without exceeding the temperature rise limits as per the relevant applicable standard;

(c) have composite polymeric bushing insulation, silver grey in colour, capable of withstanding all environmental conditions, including those imposed by fauna, heavy pollution and salt spray;

(d) have insulators with sufficient static and dynamic mechanical strength to withstand normal loads, operating forces, together with electro-magnetic forces produced from short-circuits;

(e) have a test tap provided for Dielectric Dissipation Factor (DDF) tests and for Partial Discharge tests. The tap shall be brought out as a hermetically sealed test terminal housed in the secondary terminal box and connected to earth through a slide-disconnect link. The earthed shield shall be earthed through the test terminal and slide-disconnect link;

(f) not require reconnection of primary windings to obtain intermediate and derived transformation ratios; and

(g) if provided with dual primary conductors, be capable of series or parallel connection without access to internal links. When primary conductors are connected in series, the associated transformation ratios must be as per Table 2 or 3. When primary conductors are connected in parallel, the associated transformation ratios must be double those listed in Table 2 or 3.

5.1.1 Primary line terminals

(a) Current transformers must be provided with aluminium alloy primary terminals, with silver or tin coating suitable for connection to copper or aluminium conductors.

(b) The terminals must be of a type as listed in Table 1 of this specification, as per AS 62271.301.

(c) The terminals must be supplied in a horizontal orientation.

5.2 Secondary circuit requirements

Current transformers must have:

(a) a nominal secondary current as per Table 1 of this specification for all secondaries;

(b) a secondary continuous thermal rating as per Table 1 of this specification for all secondaries;

(c) intermediate and derived transformation ratios available from taps on the secondary windings only;

(d) an output secondary winding tap that is common to the principal and intermediate taps;

(e) obtained the specified performance without recourse to compensation devices or ancillaries for calibration;

(f) a fixed output voltage limiting device fitted across the secondary terminals of each current transformer core. The device shall be fitted with a protective cover and preferably be mounted in the secondary terminal box of the current transformer; and

(g) metering cores that saturate under primary fault conditions.

5.2.1 Secondary wiring and terminals

(a) Unless otherwise approved by TasNetworks in writing, secondary wiring must:

(i) use the following colour code:

- Unspecified phase and neutral cores – Black; and
- Earth – Green/Yellow;

(ii) be brought out through a hermetically sealed barrier and terminated in the marshalling/termination box;

(iii) utilise not less than 0.6/1.0 kV grade wiring; and

(iv) not be jointed or teed between terminal points.

(b) Terminals must be:

(i) comprised of 'Klippon' Weidmuller type SAKT1-4379.2, Phoenix type URTK/S-BEN 10 or equivalent slide-disconnect terminals for all protection, metering or test circuits;

(ii) comprised of yellow/green feed-through terminals for secondary earthing circuits;

(iii) fully shrouded;

(iv) arranged to not clamp wiring directly under screws;

(v) consecutively and permanently labelled to indicate the applicable core and tap of the current transformer to AS 60044.1;

(vi) grouped according to function, providing for neat use of an external PVC insulated, copper screened, multi-core cable for each separate core of the current transformer; and

(vii) arranged to allow for connection of external cables and wires to the bottom of each terminal.

(c) Terminal blocks must:

(i) utilise 32 mm DIN rail mounting to ensure easy and safe access to terminals; and

(ii) have a separator plate to segregate each set of terminals for each core of the current transformer and to segregate any earth or test terminals.

6 Other requirements

6.1 General construction

(a) All equipment associated with the current transformer assembly must be designed to avoid pockets in which water can collect.

(b) Lifting lugs must be provided near the base of each current transformer and stabilising lugs provided near the top of each current transformer.

(c) Ferrous surface finishes must be hot dip galvanised, in accordance with AS 1650.

6.2 Fittings

(a) All fittings must be located in positions to minimise risk of mechanical damage.

(b) An internal oil expansion system must be provided.

(c) A pressure relief device or rupture disc must be provided to prevent uncontrolled explosion in the event of an internal insulation failure and shall be positioned near the top of the current transformer.

(d) O-ring seals, where required, must be employed to eliminate water ingress.

(e) An oil sampling valve must be provided, located at the base of the current transformer, suitable for obtaining samples for dissolved gas analysis (DGA) at recommended intervals.

(f) The oil sampling valve must have at least 20 mm bore.

(g) Any vents in the base of the secondary terminal box must be screened by fine gauze to prevent ingress of insects and designed to prevent the ingress of water.

(h) Screw threaded parts must utilise ISO metric head and nut sizes and ISO metric threads.

(i) An oil level indicator must be provided and be capable of being read while the equipment is in-service, reliably indicating oil level. The oil level indicator material and indicating colours must be capable of withstanding continuous exposure to ultra-violet radiation.

6.3 Support structures

If specified within the project specifications, support structures supplied for the current transformer must:

(a) be hot dipped galvanised and of at least 300 mm diameter;

(b) be of a height specified within the project specifications;

(c) conform to AS 1554, AS 1627 and AS 4100 for steel structures and welding; and

(d) comply with the requirements of TasNetworks' Substation Civil Design and Construction Standard, R590634.

6.4 Earthing

(a) Frames of all equipment supplied must be provided with reliable earth connections and comply with relevant Australian Standards.

(b) Earthing terminals must be suitable for connecting copper earthing strip size 40 mm x 6 mm using at minimum 2 x 13 mm bolts with 44 mm centres.

6.5 Special tools

Any special tools required for the operation or maintenance of the current transformer must be provided. Tools and equipment for obtaining oil samples for DGA must be provided.

6.6 Documentation requirements

(a) Dimensional plan and section drawings for the current transformer and its associated accessories must be produced and submitted for approval by TasNetworks. The drawings must show the final outline dimensions, total mass, centre of gravity, mass and volume of oil, details of insulator, primary

and earth terminals, support structure attachment points, lifting lugs, oil level indication, oil sampling device, other fittings and accessories, and the materials utilised.

(b) Separate rating, nameplate and warning label drawings must be produced and submitted for approval by TasNetworks.

(c) Separate schematic and wiring diagrams, current transformer tapping schedule must be produced and submitted for approval by TasNetworks.

(d) A material safety data sheet (MSDS) for the insulating material must be provided.

(e) Details on packaging and handling the equipment during transport and erection must be provided and submitted for approval by TasNetworks.

(f) Operation and maintenance manual must be provided and submitted for approval by TasNetworks.

(g) Separate construction drawings must show recommended mounting structures and all detail required to install the equipment, including minimum clearances in air (between poles and to earth), rated static and dynamic mechanical terminal loads.

(h) All documents and drawings must be clear, legible and free from errors or omissions.

(i) All documents and drawings must be in the English language ONLY.

(j) Only SI system of units can be used. Units must be stated for all values.

(k) Scales, wherever used, must be as per the applicable Australian Standards.

(l) All drawings that are made to scale must include a scale block.

(m) Electronic copies of drawings must be supplied on a USB in both Adobe Acrobat 'pdf' format, and in the latest version of AutoCad.

(n) Only information relevant to the supplied current transformer must be shown in the documentation and drawings.

6.7 Labels

(a) Warning labels fitted within the secondary terminal box must be traffolyte, with black text on yellow background.

(b) Warning labels must be fitted within the secondary terminal box and clearly state:

'ATTENTION: WHEN HIGH VOLTAGE IN-SERVICE, THE DIELECTRIC DISSIPATION FACTOR TEST TERMINAL MUST BE CONNECTED TO GROUND'.

'ATTENTION: DO NOT OPERATE THE CURRENT TRANSFORMER WITH ANY CORE OPEN-CIRCUIT'.

6.8 Nameplates

(a) The current transformers must be provided with nameplates that are:

(i) legible and in the English language;

(ii) permanently and indelibly marked;

(iii) securely fixed in position to the body of the secondary terminal box of the current transformer (not to be fixed to a removable component, such as a hinged door);

(iv) weather proof and corrosion-proof;

(v) made of brass, stainless steel or material of equal durability; and

(vi) readable from ground level.

(b) In addition to the requirements of clauses 10.2, 11.7 and 14.5.2 of AS 60044.1, the following information must be included on the current transformer nameplate:

(i) Mass of the oil (in kg) and volume of the oil (in litres);

(ii) Mass of the device (in kg), indicating whether the filled and unfilled mass is provided;

(iii) Rated continuous thermal current (A);

(iv) All principal and intermediate transformation ratios;

(v) Purchaser: Tasmanian Networks Pty Ltd; and

(vi) Purchaser's contract number: refer to project specifications.

7 Data for Asset Management Information System

(a) TasNetworks maintains a comprehensive 'Asset Management Information System' (AMIS) that contains all design, test results and the condition of all TasNetworks assets. The AMIS also contains maintenance regimes for all assets.

(b) The supplier must provide information required to maintain the currency of AMIS for each asset in standard forms. TasNetworks will provide the forms to the selected supplier. Forms are required to be filled in for all new assets.

8 Maintenance procedures and plans

(a) Detailed maintenance procedures covering the entire life of the current transformer must be provided, including installation, commissioning, maintenance and decommissioning procedures.

(b) Oil sampling procedures and diagrams must be provided.

(c) Blank inspection and test plans for commissioning, maintenance and routine testing, for use by TasNetworks maintenance personnel, must be provided.

9 Testing

(a) All components of the current transformer must be duly tested in accordance with 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.

(b) All test reports must be forwarded to TasNetworks for approval and acceptance. The tests will be considered as completed only after approval and acceptance of test results by TasNetworks in writing. The tests to be conducted on current transformers are referred to in the following sections.

9.1 Type tests

(a) Type tests are intended to prove the soundness of design of the current transformer/s and their suitability for operation under the conditions detailed in the standards. Type tests must be carried out before delivery. A test report, detailing the results of such tests along with the procedures followed, must be provided to TasNetworks. These tests must have been applied to a current transformer of identical design with that offered, or on a current transformer of a design which does not differ from that offered in any way which might influence the properties to be confirmed by the type test.

(b) Where such tests have already been performed, a copy of type test report that qualifies for the exemption from conducting these tests must be provided with the tender.

(c) Type tests must be performed to the relevant Australian Standards. Where type tests differ from the requirements under the relevant Australian Standards, the Contractor/Supplier must detail and submit a list of non-conformances to TasNetworks for consideration.

(d) Type tests must include all type tests and all special tests specified in AS 60044.1.

9.2 Routine tests

(a) Routine tests must be performed for each individual current transformer.

(b) 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.

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

(d) 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.

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

(f) Routine tests must include all routine tests specified in AS 60044.1 on all principal, intermediate and derived transformation ratios and include special test 6.3.b) of AS 60044.1, for capacitance and dielectric dissipation factor.

(g) DGA, electrical strength and oil quality test results are to be provided for the parent batch of insulating oil used as per R517371.

9.3 Accuracy tests

9.3.1 Accuracy tests

Complete Accuracy Tests according to AS 60044.1, (including Clause 11, Additional requirements for measuring current transformers), are required by TasNetworks for the purposes of registration of a metering installation with the Australian Energy Market Operator (AEMO). These tests shall be submitted in the format provided in Appendix C of D11/86620, Metering Standard. It is particularly important that the table of test results included in this document is fully completed for each current transformer including all principal ratios and for burdens of both 25 per cent and 100 per cent.

9.3.2 Testing Authority Accreditation

All reference/calibration equipment utilised for the purpose of meeting test or inspection obligations must be tested to ensure full traceability to test certificates issued by a NATA accredited body or a body recognised by NATA under the International Laboratory Accreditation Corporation ('ILAC') mutual recognition scheme and documentation of the traceability must be provided to AEMO on request. The certification number, description and serial numbers of test equipment must be recorded on the test certificate for each current transformer.

10 Packaging

(a) The supplier is responsible for ensuring that adequate packaging and external signage is provided to minimize the risk of damage to equipment during delivery and removal from packaging. The packaging must be suited to the particular methods of delivery and provide protection against damage from all foreseen hazards.

(b) Packaging must be externally labelled for ease of identification of the current transformer.

(c) Details of packaging methods must be submitted to TasNetworks for review.

11 Information to be provided with tender

Requirements for information to be submitted as part of the tender are outlined in EHV Current Transformers document R574176.

12 Deliverables

Requirements for current transformer deliverables are outlined in EHV Current Transformers document R574175.