snowy hydro Limited renewable energy	
Snowy Technical Standards	
SHL-ELE-156 (I)	***Annexure I - Current and Voltage Transformers General Low Voltage Electrical Requirements***
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This annexure forms part of the General Low Voltage Electrical Requirements Standard (SHL-ELE-156).

1. Scope

This Annexure sets out the requirements for current and voltage transformers.

Current and voltage transformers must be constructed and supplied conforming to the General Electrical Requirements and this Annexure.

1.1. Applicable Standards

The design, manufacture and testing of equipment and components detailed in this annexure must comply with the requirements of all relevant Australian Standards or in the absence of appropriate Australian Standards, with relevant IEC, ISO or International Standard, together with the requirements of competent authorities having jurisdiction over all or part of the manufacture, installation or operation of the equipment, except where modified by this specification.

All works must comply with the requirements of the most recent releases of the regulations and standards noted in Snowy Standard SHL-ELE-156. In the event of a conflict between different Codes, Standards or Regulations, the highest requirement must apply.

2. Safety Requirements

Current and voltage Transformer must be designed, manufactured and tested with the safety requirements detailed in the General Electrical Requirements. (SHL-ELE-156) Specifications.

3. Technical Requirements

3.1. Current Transformers

3.1.1. General

The design on the current transformer must comply with the requirements of AS 60044.1.

The installation of current transformers must ensure that the current transformer primary and secondary connections are readily accessible.

3.1.2. Ratings

Primary

The primary current rating of current transformers must be selected to be greater than the plant nominal rating, and rounded to the nearest suitable rating.

It must be confirmed that the protection or metering device can provide adequate functionality with the selected ratio.

Secondary

Every current transformer secondary must be rated at 1 amp. If the primary current rating is greater than 6000 amps, the secondary current rating may be increased to 5 amps. This will require the approval of the Protection Engineer.

3.1.3. Accuracy class and burden

The class of the current transformer must be selected during the design phase.

The class selected must include analysis of the X/R ratio, resistance of terminations and cables, and provide an allowance for increased fault levels.

The class selection will require the approval of the Protection Engineer.

All current transformers must be connected in star.

Protection

Protection current transformers must be PX class.

Metering

Metering current transformers must be of accuracy class 0.1.

Earthing

The star point of every current transformer set must be earthed.

Individual phase transformers will be wired to a local junction box to form a four wire set. This four wire set will be cabled to the required panel. It is in this panel that the current transformer star point will be earthed.

3.2. Voltage Transformers

3.2.1. General

The design on the current transformer must comply with the requirements of AS 60044.2.

The installation of voltage transformers must ensure that the current transformer primary and secondary connections are readily accessible.

Transformers below 35 kV must be either three single phase units or one five limb three phase star connected unit.

Three single phase units must be installed above 35 kV.

Single phase units must be connected between the phase and earth. The High Voltage star point of multiphase units must be earthed.

In some generator protection systems, the voltage transformer needs to be connected to the generator star point rather than earth. In these situations a second set of voltage transformers must be used for this purpose. These voltage transformers must have a fully insulated neutral, and the connection between the voltage

transformer star point and the generator star point must be rated to the generator voltage.

Rack out units on integrated switchgear are acceptable.

Three limb three phase units are not acceptable.

Single phase units may be installed for busbar voltage monitoring. The instrument transformer is then generally connected to white phase. However, this may change in consultation with the Protection Engineer.

3.2.2. Voltage factor

Voltage factors must be selected to suit the design purpose. Typically a voltage factor (Vf) of 1.2 for continuous operation is suitable.

3.3. Ratings

3.3.1. Primary

The primary rating must be the same as the rated system phase to phase voltage

Single phase units must be rated at the rated system phase to phase voltage ÷√3.

If there is a risk of ferroresonance, the primary rating must be the rated system phase to phase voltage. Refer to IEC TR 61869-102 for further guidance on ferroresonance.

3.3.2. Secondary

The secondary rating must be 110 volts phase to phase.

Single phase units must be rated at 110 ÷√3 volts.

If there is a risk of ferroresonance, the secondary rating must be 110 volts. This will maintain the correct ratio, and provide a knee point above the worse case voltage rise eliminating the risk of ferroresonance. A damping resistor may also need to be added to the secondary circuit to assist in damping the resonance. Refer to IEC TR 61869-102 for further guidance on ferroresonance.

3.4. Accuracy class and VA rating

The class and VA rating of the voltage transformer must be selected during the design phase. The class selection will require the approval of the Protection Engineer.

The VA rating per phase will be either 50, 100 or 200 VA per phase. 200 VA is preferred for older plant. For new low burden installations the VA rating can be 50 VA. Any change from these values must require the approval of the Protection Engineer.

The class must meet requirements for AEMO metering accuracy. In any case the class must be 0.5M or better.

3.5. Winding arrangements

Voltage transformer secondaries for general use are connected in star.

Open delta windings are permitted for directional earth fault protection. Whilst an open delta connection allows the installation of a 200 Ω 200 Watt resistor for ferroresonance elimination, the preferred option is a higher primary and secondary rating.

Three phase four wire voltage signals will be cabled to each cubicle that requires voltage signals.

3.6. Earthing

The secondary neutral star point of every voltage transformer set must be earthed.

The neutral will be earthed at the first distribution point. For multi-use voltage transformers, this may be the first junction box. For single use voltage transformers, this may be the protection, metering or AVR cubicle.

The non-polarity terminal of any open delta winding must be earthed.

3.7. Protection of voltage transformers

Voltage transformers are to be provided with current-limiting fuses on the secondary terminals to protect the voltage transformer from bolted faults. The voltage transformer neutral terminal will be provided with a fuse link.

Miniature circuit breakers are to be used on the secondary side of the voltage transformer to supply the each of the connect loads. The miniature circuit breakers must be selected to protect the voltage transformer from overloads. Miniature circuit breakers must be 4-pole breakers.