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Equipment Strategy for Post Type High Voltage Current Transformers and Metering Units – Strategy	

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1. Introduction

1.1 Purpose

Equipment Strategies document Powerlink's vision for equipment technologies, to provide both Powerlink and Suppliers with consistent planning and project management platforms for the life of the Strategy. The document expresses Powerlink's vision in terms of the equipment performance requirements. It is not a detailed contract specification.

The Equipment Strategy for post type high voltage current transformers and metering units has been developed with input from relevant teams in Powerlink.

1.2 Scope

This document covers post type high voltage current transformers and metering units ranging from 72.5kV to 362kV for use in new and existing air insulated substations (AIS) for replacement, refurbishment and augmentation projects.

It is envisaged that the Equipment Strategy for post type high voltage current transformers and metering units will have a life of ten years. A review of the equipment strategy is required in the fifth and the eighth year to enable inclusion of technologies which have matured and show merit.

1.3 References

Document code	Document title
IEC 61850	IEC (2013) <i>Communication networks and systems for power utility automation</i>
ISO/IEC 17025	ISO (2005) <i>General requirements for the competence of testing and calibration laboratories</i>
NER	National Electricity Rules

1.4 Defined terms

Terms	Definition
AEMO	Australian Energy Market Operator
APLAC	Asia Pacific Laboratory Accreditation Cooperation
ILAC	International Laboratory Accreditation Cooperation
Metering unit	Combined current transformer and voltage transformer in a single unit. Typically is produced using gas as main insulation medium.
NATA	National Association of Testing Authorities
NCIT	Non-Conventional Instrument Transformers
NER	National Electricity Rules
SAP	Software package used for computerised maintenance management system and asset register

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1.5 Monitoring and compliance

This equipment strategy guides the development of the technical specification. The success is monitored through regulatory information notice, annual reporting and SAP records review of installed equipment.

The success of this strategy is measured by monitoring life cycle costs associated with this equipment as well as availability and service history.

The minimum records required are:

- Technical specification
- Tender evaluation report
- Period contract
- Purchase orders
- SAP equipment records
- Operation and Manufacturer Manual
- Nameplate details

1.6 Risk management

The risks considered in the development of this strategy are:

- **Network Operations Risk** – risk related to the increased probability of network outages and their impact on customers and stakeholders.
- **Safety Risk** – risk associated with the malfunction of current transformers or metering units resulting in the prolonged or lack of protection operation exposing personnel and public to fault conditions – this can result in serious injuries and fatalities due to electrocution. There is a safety risk to personnel associated with catastrophic failures of current transformers and metering units.
- **Environmental Risk** – related to gas or oil leaks.
- **Compliance risk** – associated with non-compliance of accuracy requirements as set up by National Electricity Rules.
- **Financial and Contractual Risk** – risk associated with the inability to make warranty claims, request access to adequate technical support and spares, increased maintenance costs, and additional capital investment costs.

2. Strategy

The vision of the Strategy and Planning Group and the procurement manual drives equipment strategy documents. The main features of the vision for post type high voltage current transformers and metering units are as follows:

General

- Annual Operation and Maintenance cost less than 0.5% of the asset value.
- Availability and reliability to meet network requirement.
- Appropriate monitoring and remote interrogation facilities to allow maintenance staff to optimise site visits.
- Standard variants to cover operational requirements.

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- Current transformers and metering units have to be tested by NATA certified laboratory or by facilities accredited to ISO/IEC 17025 and have mutual recognition through ILAC or APLAC.
- Minimal site assembly and installation time.
- Evaluation and assessment through Life Cycle Cost Analysis (LCCA)
- Equipment shall be designed and constructed, packaged and transported to withstand transport shocks, and to ensure and demonstrate the equipment is delivered in good condition.
- Only units using gas as main insulation medium shall be considered.
- The manufacturer's ability to be able to provide support for the whole of life of the current transformer and metering unit including the ability to install, commission and service it, perform failure root cause analysis, provide detailed work instructions, supervise or perform repairs as well as holding the spares required to support the voltage transformer across the 40 year life will be well regarded.

Maintenance

- Minimal maintenance requirement:
 - Minimal routine inspections, no more than once a year.
 - Long service intervals, being at least 12 years between services.
 - Services should be non-intrusive as far as possible and achieved while the equipment is in operation.
 - Enables addition of online condition monitoring.
 - Provision for gas sampling.
 - Provisions to allow use of modern accuracy testing methods.

Safety and Environmental

- The risk of explosive failure is to be kept low, so far as is reasonably practicable.
- Failure modes should be non-life threatening and as safe as reasonably practicable for personnel working in the yard.
- The design of the unit allows for safe and environmentally appropriate disposal.
- Minimum leakage rates to meet or exceed environment standards and reduce operational costs.
- Porcelain shall not be a part of the construction, non-ceramic insulators only.
- Oil shall not be part of the construction.
- Gas used in equipment should be recyclable and/or recoverable.
- Minimal leakage rates of insulating gas with the aim of being less than 0.1% per annum, with a maximum guaranteed of less than 0.5% per annum.

2.1 Projected use of equipment

All post type high voltage current transformer and metering units to be purchased will be used for protection and metering of transmission lines, transformers, generators, capacitors/reactors, SVCs or for bus-coupling.

2.2 Technologies available now

At the present, there are oil filled and gas (SF6) insulated current transformers in the Powerlink network as well as a number of SF6 insulated metering units. There is a mix of porcelain housed and non-ceramic housed units.

Non-Conventional Instrument transformers (NCIT) are yet to be considered a commercially viable solution for Powerlink. A number of trials are being conducted in order to gain service experience with various construction

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types of NCITs. National Electricity Rules do not have provisions for accuracy testing and requirements for NCITs. However development is ongoing and it is expected for NCITs to become viable during the life of this equipment strategy.

2.3 Equipment strategy elements

The future post type high voltage current transformers and metering units specification shall include the following main features:

- Designed for an operating life of 40 years in Queensland climate conditions.
- Composite insulators and gas used as insulating medium.
- Safe operation, availability and reliability to meet network requirement.
- Inclusion of overpressure devices (for example, rupture disks).
- Analog on-line density monitoring of gas available to be fed into the substation automation system.
- Service and spare parts support during the complete life of equipment with preference for Australian based support.
- Availability of spares in Australia.
- Minimal leak rate of gas (less than 0.1% per annum, with a maximum guaranteed of less than 0.5% per annum).
- Preference will be given to design which actively minimises the chance of corrosion in all aspects. Anti-corrosion measures applied especially in areas of known corrosion e.g. unprotected flanges, rupture disks, gas ports, gas pipes, etc. and/or external weather sealant on all flange joints will be well regarded.
- Designed to have minimal routine inspection/maintenance.
- Demonstrate the calibration of measuring / testing equipment used by NATA certified laboratory or by facilities accredited to ISO/IEC 17025 and has mutual recognition through ILAC or APLAC. Evidence of this shall be provided with routine test reports.
- The manufacturer's ability to be able to provide support for the whole of life of the equipment as well as holding the spares required to support the equipment during the 40 year life will be well regarded.

2.4 Concurrent investigations

The market position for Non-Conventional Instrument Transformers / Circuit breaker with Fibre Optic Current Sensors (FOCS) and Electronic Current Transformer (ECT) / Electronic Voltage Transformer (EVT) with merging units integrating with IEC 61850 secondary systems will continue to be monitored. Powerlink will continue to collaborate with AEMO to modify NER to allow for their use for metering and protection.

2.5 Summary

The equipment strategy utilising gas insulated post type current transformers and metering units with non-ceramic housing as detailed in this document will be adopted for all future requirements of post type current transformers and metering units in order to achieve the minimum life cycle cost as well as ensuring the benefits of high reliability ease of commissioning, simple operation and low-cost maintenance are obtained.

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