

## Design physical layout for substations up to 72.5kV

**Level** 5

**Credits** 12

**Purpose** People credited with this unit standard are able to: analyse and interpret main circuit diagrams for physical layout for substations up to 72.5kV; select main equipment type, and size, to meet design requirements; develop a physical layout plan for main substation equipment; develop cable and line access route plans for substation; plan for auxiliary services and security facilities; and verify design and present drawings.

**Subfield** Electricity Supply

**Domain** Electricity Supply - Design and Commissioning

**Status** Registered

**Status date** 27 April 1998

**Date version published** 21 November 2008

**Planned review date** 31 December 2009

**Entry information** Prerequisite: Unit 14299, *Design power network substation electrical arrangement up to 72.5kV*; or demonstrate equivalent knowledge and skills.

Advanced core electrical theory is essential knowledge underpinning the performances required by this unit standard.

**Accreditation** Evaluation of documentation and visit by NZQA and industry.

**Standard setting body (SSB)** Electricity Supply Industry Training Organisation

**Accreditation and Moderation Action Plan (AMAP) reference** 0120

This AMAP can be accessed at <http://www.nzqa.govt.nz/framework/search/index.do>.

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### Special notes

- 1 This unit standard can be assessed against in a workplace environment, or in a training or educational environment if simulated market conditions are able to be provided, or in a combination of both environments.

- 2 Performance and work practices in relation to the elements and performance criteria must comply with all current legislation, especially the Electricity Act 1992, and any regulations and codes of practice recognised under that statute; the Health and Safety in Employment Act 1992; and the Resource Management Act 1991. Electricity supply industry codes of practice and documented industry procedures include the *Safety Manual – Electricity Industry (SM-EI)* (2004) Wellington: Electricity Engineers' Association. A full list of current legislation and industry codes is available from the Electricity Supply Industry Training Organisation, PO Box 1245, Hamilton 3240.
- 3 The phrase *in accordance with industry requirements* is implicit in all elements and performance criteria in this unit standard.
- 4 'Industry requirements' include all asset owner requirements; manufacturers' specifications; and enterprise requirements which cover the documented workplace policies, procedures, specifications, business, and quality management requirements relevant to the workplace in which assessment is carried out.
- 5 A *project brief* is the scope of study and the reference document agreed with the customer for undertaking a substation design study. The information gathered during preliminary investigations and load studies can be used to develop a *project brief* or *design brief*.
- 6 Statutory building codes and planning consent approvals must be complied with unless there is valid technical reasons for not, and exemption should be applied for from district scheme plans.
- 7 *Seismic design criteria* includes national standards used for consistent industry wide application, but may also include client imposed seismic security levels deemed relevant for the particular substation application and/or substation site seismic risk level.

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## Elements and performance criteria

### Element 1

Analyse and interpret main circuit diagrams for physical layout for substations up to 72.5kV.

### Performance criteria

- 1.1 The main circuit diagram is interpreted and developed into a physical layout plan.  

Range	may include but is not limited to – project brief, proposed single line diagram, client instructions.
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- 1.2 The physical access routes for feeders and supply lines are identified, sized and numbered.  

Range	may include but are not limited to – project brief, client instructions, site investigation.
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1.3 Future development space requirements are quantified.

Range may include but is not limited to – project brief requirements for future site developments, number of feeders, direction of approach.

## **Element 2**

Select main equipment type, and size, to meet design requirements.

### **Performance criteria**

2.1 The selected equipment type meets the rating capacity size needed.

Range may include but is not limited to – rating required by design brief, maintenance needs, service access.

2.2 The equipment selected meets seismic strength requirements.

Range may include but is not limited to – project brief requirements, strength of equipment, seismic risk level of site, standard seismic design criteria.

2.3 The equipment selected meets the requirements of the environmental constraints.

Range may include but is not limited to – noise, visual impact, construction constraints.

## **Element 3**

Develop a physical layout plan for main substation equipment.

### **Performance criteria**

3.1 The operation and maintenance space needs are identified and provided for in the physical design.

Range may include but is not limited to – space for main equipment, relay protection system, system control and data acquisition (SCADA), local service supply, access for maintenance servicing.

3.2 The physical layout design for the substation developed optimises space needed.

Range may include but is not limited to – operational, service and capacity requirements.

3.3 Adequate electrical clearance is provided between main equipment and earthed material.

Range may include but is not limited to – minimum safe distance for operation and maintenance requirements.

3.4 The environmental limitations are provided for in the physical design.

Range may include but is not limited to – noise, visual impact, access ways, emissions.

#### **Element 4**

Develop cable and line access route plans for substation.

#### **Performance criteria**

4.1 Adequate provision is made for high voltage cable access routes.

4.2 The high voltage cable routes are arranged to minimise cross overs.

#### **Element 5**

Plan for auxiliary services and security facilities.

#### **Performance criteria**

5.1 All the required auxiliary services are provided for on the physical layout plan.

Range includes but is not limited to – oil services, drainage, oil interceptors, water fire fighting.

5.2 All the required security facilities are provided for on the physical layout plan.

Range may include but is not limited to – climb proof fences, intruder alarms, visual supervision, controlled access.

5.3 All perimeter fences, access points and road ways are identified on the plan.

#### **Element 6**

Verify design and present drawings.

#### **Performance criteria**

6.1 The physical layout design is approved by a peer review as meeting statutory, and project brief main circuit diagram, requirements.

6.2 The review reports are assessed for any design modifications and changes recommended.

6.3 The physical layout design is presented to the client and is accepted as meeting requirements.

Range may include but is not limited to – written report supported with drawings, or verbal report supported with drawings.

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**Please note**

Providers must be accredited by NZQA, or an inter-institutional body with delegated authority for quality assurance, before they can report credits from assessment against unit standards or deliver courses of study leading to that assessment.

Industry Training Organisations must be accredited by NZQA before they can register credits from assessment against unit standards.

Accredited providers and Industry Training Organisations assessing against unit standards must engage with the moderation system that applies to those standards.

Accreditation requirements and an outline of the moderation system that applies to this standard are outlined in the Accreditation and Moderation Action Plan (AMAP). The AMAP also includes useful information about special requirements for organisations wishing to develop education and training programmes, such as minimum qualifications for tutors and assessors, and special resource requirements.

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**Comments on this unit standard**

Please contact the Electricity Supply Industry Training Organisation [info@esito.org.nz](mailto:info@esito.org.nz) if you wish to suggest changes to the content of this unit standard.