Amendment no. 4

Substation Design Instruction

Minimum design and construction requirements for transmission and zone substations and switching stations

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Substation Design Instruction

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SDI 505 Minimum design and construction requirements for transmission and zone substations and switching stations

Contents

1.0 PURPOSE

To define the minimum design and construction requirements associated with transmission and zone substation and switching station Standards.

2.0 SCOPE

This Standard covers the basic principles that apply to all transmission design Standards associated with the design and construction of transmission and zone substation/switching station equipment.

3.0 REFERENCES

- Company Policy 2.0.5 - Risk Management
- Company Policy 4.0 - Environment
- Company Policy 9.1.7 - Commissioning Network Electrical Assets
- Company Policy 9.2.2 - Network Protection
- Company Policy 9.2.3 - Property Tenure for Network Assets
- Company Policy 9.2.5 - Network Asset Design
- Company Policy 9.6.1 - Network Connection
- Company Policy 9.7.1 - Network Asset Construction
- Company Policy 9.9.1 - Network Asset Maintenance
- Company Procedure GSY 1066 - Worksite Hazard and Risk Assessment
- Division Procedure GNV 1062 - Granting Dispensation from Engineering Documents
- Network Management Plan December 2013 Review
- Endeavour Energy Electrical Safety Rules
- Environmental Management Standard EMS 0001 - Environmental impact assessment and environmental management plans
- Substation Design Instruction SDI 515 - Drawings
- Substation Design Instruction SDI 520 - Lightning protection and insulation coordination
- Substation Design Instruction SDI 534 - Manuals, test reports and photographs
- Substation Design Instruction SDI 535 - Testing and commissioning
- Substation Maintenance Instruction SMI 119 - Transmission and zone substation data entry, asset structure and details
- ENA National Electricity Network Safety Code (Doc 01-2008)
- *Work Health and Safety Act 2011* (NSW)
- *Work Health and Safety Regulation 2011* (NSW)

4.0 DEFINITIONS AND ABBREVIATIONS

Contractor
A person authorised to work on the network including authorised external contractors and Accredited Service Providers; including their employees and sub-contractors.

Drawings
All drawings and any subsequent drawings referenced by those drawings

Ellipse
Endeavour Energy asset database

Network
Endeavour Energy's poles, wires, substations and switching stations by which electrical power is transmitted to customers.

SCADA
Supervisory Control and Data Acquisition.

SDI
Substation Design Instruction

SMI
Substation Maintenance Instruction

5.0 ACTIONS

5.1 Standards

All work shall be carried out in a professional manner in compliance with legislation, Endeavour Energy Standards, Australian Standards, manufacturers' and suppliers' literature and recommendations.

The work requirements include items such as the design, installation and testing of transmission and zone substations/switching stations and other equipment, along with all necessary liaison and restoration work associated with the installation.

Australian Standards shall be adopted in general: however, other standards, such as IEC or other international standards may be used if such standards are as exacting as the corresponding Australian Standard. If standards other than these are to be used, a copy of the relevant standard shall be forwarded to the Network Substations Manager, Primary Systems for prior approval.

Where a deviation from the requirements of an Substation Design Instruction (SDI) is desired, written approval shall be obtained from the Manager Primary Systems so that an approved solution can be developed. The process for approving requests for dispensation to deviate from the requirements of an SDI shall be in accordance with Division Procedure GNV 1062 - Granting Dispensation from Engineering Documents. Any request for deviations shall be fully documented and contain substantiating proof of performance to the recommended Australian Standard or other standard as nominated in the instruction.

5.2 Safety and liability

When carrying out work on the Endeavour Energy network, Endeavour Energy employees and all contractors, including their employees and sub-contractors, shall abide by Endeavour Energy's Electrical Safety Rules, the safe work practice requirements of the Work Health and Safety Act 2011 (NSW), the Work Health and Safety Regulation 2011 (NSW), NSW WorkCover codes of practice and any amendments to these documents; as well as the following requirements.

- Systems shall be implemented and maintained to reduce the health and safety risks of assets, plant and equipment to a level that is as low as reasonably practical during the design, manufacture /fabrication, delivery, installation, erection, commissioning, use, ongoing monitoring, repair, decommissioning, storage and disposal.

- Assets shall be designed and constructed using systems that address health and safety risks whilst considering, commercial benefits and community impact.

- Systems shall be implemented and maintained to consider the range of human capacity, both physically and mentally, during the design of assets, plant and equipment.

- Commissioning systems for transmission asset, plant and equipment shall be developed and implemented to identify and manage the health and safety risks associated with the activity. The system shall confirm that the asset, plant and equipment conform to minimum safety and operability standards.

- Reviews of newly installed and/or modified assets, plant and equipment shall be undertaken to confirm that construction is in accordance with design requirements.

5.3 Contractor indemnity

Where work is carried out by a contractor, the contractor shall indemnify Endeavour Energy from all liabilities, claims, damages, suits and risks in respect of the works, such as their installations, supply, erection, testing and existence.

The contractor shall comply with all requirements and standards that may be imposed by WorkCover NSW; they shall be entirely responsible for the works until such works are transferred and accepted by Endeavour Energy; and, they shall cover any loss or damage suffered prior to this time.

The contractor shall be responsible for any damage to Endeavour Energy's property, or third party property, as a result of activities under the control and/or supervision of the contractor.

The contractor shall be responsible for any damage to any works or property of any other utility or any individual, as a result of activities under the control and/or supervision of the contractor.

5.4 Duty of care

Endeavour Energy employees and all contractors including their employees and sub-contractors shall have a duty of care to the public, other contractors and staff of Endeavour Energy during the course of the works. If a potential safety or environmental issue is identified, it shall be corrected or made safe and reported for later repair or restoration.

5.5 Property damage

Searches shall be carried out to ascertain the location of all property or plant installed by Endeavour Energy, or any other utility, in the vicinity of the proposed work.

5.6 Underground records search

An underground records search shall be conducted prior to the commencement of any underground works.

5.7 Local council requirements

The requirements of the relevant local council such as the development application and civil works associated with the provision of electricity supply to the substation, shall be satisfied.

5.8 Easements

Where appropriate, easements shall be created in Endeavour Energy's favour for all equipment in accordance with Company Policy 9.2.3 - Property Tenure for Network Assets.

5.9 Design work

All designs shall be substantiated with engineering certificates or calculations and tests.

The qualifications of engineering staff assigned to the project shall be provided when requested.

All design work shall be conducted strictly in accordance with Endeavour Energy's design parameters.

To assist contractors in meeting Endeavour Energy's design requirements, typical designs may be available from the Substation Electrical Design Manager or the Transmission Civil Development Manager.

5.10 Environmental requirements

Reference shall be made to Environmental Management Standard EMS 0001 - Environmental impact assessment and environmental management plans, for the preparation of environmental management plans, dust and noise suppression, and protection of drains and waterways from contaminants such as silt.

All Endeavour Energy environmental Standards and regulatory requirements regarding protection of the environment shall be met.

5.11 Data requirements

Details of work, such as new equipment installation, equipment upgrades, or new construction associated with transmission and zone substations/switching stations, shall be entered into Endeavour Energy's approved database, Ellipse, within one week of the construction, testing or commissioning work being completed.

The construction, testing or commissioning work shall include the entering of data into Ellipse for the particular item on which the work is being performed. If other data not listed in the schedules is considered necessary, Endeavour Energy should be informed and the data collected.

This data shall be entered at the lowest possible level in accordance with Substation Maintenance Instruction SMI 119 - Transmission and zone substation data entry, asset structure and details.

5.12 Drawings

Drawings showing appropriate detail of the work shall be provided in accordance with Substation Design instruction SDI 515 - Drawings.

Drawings prepared by a contractor shall be approved by Endeavour Energy prior to the commencement of works.

5.13 Equipment and materials

5.13.1 General requirements

All materials and items of plant and equipment shall be of a proven design, manufacture and construction.

All items of electrical, mechanical and technological plant and equipment shall be compatible with each other, and the installation shall be complete in all respects, such as finishing, painting and labelling.

Each item of equipment, including items such as supporting structures and foundations, shall be designed, specified, selected, installed, tested and commissioned to meet the detailed technical specifications for the item, and the following requirements:

- All items of equipment shall be an Endeavour Energy approved product, and/or conform to Endeavour Energy's specifications.
- All items of equipment shall be of a quality and class that is suitable for use on the network without distortion, deterioration or causing undue stresses on other equipment.

- All materials used shall be new unless the project indicates or allows the use of other materials, or approval is given by the Network Substations Manager, Primary Systems.
- The Network Substations Manager, Primary Systems can accept or decline any offer of equipment.

Contractors shall provide details of performance, past orders, type tests, and other certificates from Endeavour Energy approved international organisations substantiating these details, along with the commercial items required by Endeavour Energy.

Where the contractor cannot provide a suitable piece of equipment for a project, Endeavour Energy may source the piece of equipment separately and charge the contractor liquidated damages for the full cost of acquisition and any penalties incurred, such as loss of time.

5.13.2 Free issue items

Where work is carried out by a contractor, items provided by Endeavour Energy will be listed in the project as *free issue*, and the contractor can use these items in the project.

If a contractor wishes to supply any of the items on the *free issue* list, the contractor shall indicate this in their tender as a separate option, and be aware that all equipment supplied shall comply fully with all of the requirements of Endeavour Energy's specifications. Before approval for use is given, the Network Substations Manager, Primary Systems needs to be satisfied that the nominated alternative item(s) meet all of the requirements. The contractor can supply this equipment only after receiving written approval from the Network Substations Manager, Primary Systems.

5.13.3 Major equipment tests

All major equipment supplied shall be fully type tested before tendering for projects, and those type tests shall be included in the tender specification. Additional testing requirements may be included in the tender specification.

Two copies of all type, routine and special reports for the tests stated in the equipment specifications and the associated standards, are to be provided with tenders.

All tests shall be carried out by a testing authority holding appropriate accreditation:

- By NATA Australia; or,
- By an accreditation authority recognised by NATA Australia.

Tests from other testing authorities may be accepted at the discretion of the Manager Primary Systems.

All type test reports shall be accompanied by copies of the accreditation certificate/s issued to the testing laboratory. The accreditation certificate/s shall be valid for the relevant test/s and for the duration of the tests.

Type tests shall be less than five years old. Type tests beyond this limit may be acceptable at the discretion of Endeavour Energy's Manager Primary Systems if sufficient information can be provided to show that the manufacturing process, raw materials, design and quality control processes have not significantly changed since the original test date.

All documentation submitted such as reports, tests, testing procedures/policies and calibration certificates written in any language other than English shall not be accepted by Endeavour Energy unless the reports are translated into English by a sworn translator.

5.13.4 Equipment drawings

Drawings shall include dimensions showing overall sizes, weight and general construction. Where necessary, terminal arrangement, numbering, mounting details and equipment such as control cables, relays, switches and lighting, shall be clearly shown.

Drawings of all equipment shall be in accordance with Substation Design Instruction SDI 515 - Drawings.

5.13.5 Environment

All equipment shall be suitable for the environment in which it will operate. Cubicles and similar enclosures shall be adequately ventilated to restrict dust and condensation, and where necessary, anti-condensation heaters shall be fitted with thermostatic control.

Equipment shall be adequately protected against corrosion.

5.13.6 Insulation co-ordination

The design of plant and equipment shall provide insulation co-ordination between different items of plant, such as transformers, surge arresters, and transmission lines, and between different components within a particular item of equipment in accordance with Substation Design Instruction SDI 520 - Lightning protection and insulation coordination.

5.13.7 Interchangeable items or parts

Similar items or parts shall be interchangeable, as far as possible, without the need to modify the equipment with the use of items such as tools.

5.13.8 Maintainability

All systems shall be designed to allow them to be maintained under normal switching arrangements. All necessary tools and equipment, operation and maintenance manuals required for this purpose shall be provided by the contractor. All special tools shall be supplied by the contractor in two sets.

5.13.9 Maintenance manuals

Maintenance manuals shall be supplied in accordance with Substation Design Instruction SDI 534 - Manuals, test reports and photographs.

5.13.10 Spare parts

Documentation and guarantees shall be provided to allow spare parts for equipment to be supplied in a project throughout the expected life of the asset which is typically a minimum of 40 years unless indicated otherwise in the equipment specification.

All manufacturers recommended spare parts required for operation and maintenance of the plant and equipment over the next five years shall be supplied as part of the works.

The Senior Engineer Transmission Substation Equipment shall provide the Network Substations Manager, Primary Systems with a list of recommended major spares (such as bushings) and minor consumable spares (such as contacts, coils, limit switches, micro switches, motor brushes and motors) for all equipment that has not been previously ordered by Endeavour Energy.

The list shall contain the manufacturers' part numbers, costs and other necessary ordering information, including the suppliers' details and expected lead times.

5.13.11 Warranty

The contractor shall provide a minimum five year warranty on all materials and work standards from the date of delivery unless indicated otherwise in the specification.

6.0 AUTHORITIES AND RESPONSIBILITIES

Chief Engineer has the authority and responsibility for approving this instruction.

Manager Primary Systems has the authority and responsibility for making recommendations to the Chief Engineer in respect to this instruction.

Network Substations Manager, Primary Systems has the authority and responsibility for keeping the content of this instruction up to date.

Senior Engineer Transmission Substation Equipment has the authority and responsibility for:

- checking that the relevant requirements of this instruction are included in the specification prepared for project work, or purchasing and installation of equipment;
- consulting the Network Substations Manager, Primary Systems during major equipment evaluation; and
- providing the Network Substations Manager, Primary Systems with a list of recommended major spares and minor consumable spares for all major equipment that has not been previously ordered by Endeavour Energy.

Endeavour Energy employees and/or contractors have the authority and responsibility for:

- meeting the requirements of this instruction;
- working in accordance with local and statutory requirements; and
- working in accordance with Endeavour Energy's Electrical Safety Rules and systems when conducting works associated with this instruction.

Project Managers have the authority and responsibility for:

- meeting the requirements of this instruction within their area of responsibility;
- overseeing that Endeavour Energy employees and/or contractors engaged to perform the work have appropriate qualifications and experience; and
- overseeing that data is entered into Ellipse in accordance with Substation Maintenance Instruction SMI 119 - Transmission and zone substation data entry, asset structure and details, and associated drawings are entered in the company document management system.

7.0 DOCUMENT CONTROL

Documentation content coordinator: Network Substations Manager, Primary Systems

Documentation process coordinator: Standards Process Coordinator

