

Network Standard

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NW000-S0080 NS149 DRAWINGS FOR CHAMBER TYPE SUBSTATIONS, CONTROL POINTS, CABLE RISERS AND DUCTLINES



ISSUE

For issue to all Accredited Service Providers' employees involved with the preparation of design drawings for Chamber type Substations, Control Points, Cable Risers and Ductlines forming part of Ausgrid's network, and Ausgrid staff who are involved with the approval of the above mentioned drawings. All external communication associated with a Contestable project is via the Ausgrid officer facilitating the Contestable project. Ausgrid maintains a copy of this and other Network Standards together with updates and amendments on www.ausgrid.com.au.

Where this standard is issued as a controlled document replacing an earlier edition, remove and destroy the superseded document.

DISCLAIMER

As Ausgrid's standards are subject to ongoing review, the information contained in this document may be amended by Ausgrid at any time. It is possible that conflict may exist between standard documents. In this event, the most recent standard shall prevail.

This document has been developed using information available from field and other sources and is suitable for most situations encountered in Ausgrid. Particular conditions, projects or localities may require special or different practices. It is the responsibility of the local manager, supervisor, assured quality contractor and the individuals involved to make sure that a safe system of work is employed and that statutory requirements are met.

Ausgrid disclaims any and all liability to any person or persons for any procedure, process or any other thing done or not done, as a result of this Standard.

All design work, and the associated supply of materials and equipment, must be undertaken in accordance with and consideration of relevant legislative and regulatory requirements, latest revision of Ausgrid's Network Standards and specifications and Australian Standards. Designs submitted shall be declared as fit for purpose. Where the designer wishes to include a variation to a network standard or an alternative material or equipment to that currently approved the designer must obtain authorisation from the Network Standard owner before incorporating a variation to a Network Standard in a design.

External designers including those authorised as Accredited Service Providers will seek approval through the approved process as outlined in NS181 Approval of Materials and Equipment and Network Standard Variations. Seeking approval will ensure Network Standards are appropriately updated and that a consistent interpretation of the legislative framework is employed.

Notes: 1. Compliance with this Network Standard does not automatically satisfy the requirements of a Designer Safety Report. The designer must comply with the provisions of the Workplace Health and Safety Regulation 2017 (NSW - Part 6.2 Duties of designer of structure and person who commissions construction work) which requires the designer to provide a written safety report to the person who commissioned the design. This report must be provided to Ausgrid in all instances, including where the design was commissioned by or on behalf of a person who proposes to connect premises to Ausgrid's network, and will form part of the Designer Safety Report which must also be presented to Ausgrid. Further information is provided in Network Standard (NS) 212 Integrated Support Requirements for Ausgrid Network Assets.

2. Where the procedural requirements of this document conflict with contestable project procedures, the contestable project procedures shall take precedent for the whole project or part thereof which is classified as contestable. Any external contact with Ausgrid for contestable works projects is to be made via the Ausgrid officer responsible for facilitating the contestable project. The Contestable Ausgrid officer will liaise with Ausgrid internal departments and specialists as necessary to fulfil the requirements of this standard. All other technical aspects of this document which are not procedural in nature shall apply to contestable works projects.

INTERPRETATION

In the event that any user of this Standard considers that any of its provisions is uncertain, ambiguous or otherwise in need of interpretation, the user should request Ausgrid to clarify the provision. Ausgrid's interpretation shall then apply as though it was included in the Standard, and is final and binding. No correspondence will be entered into with any person disputing the meaning of the provision published in the Standard or the accuracy of Ausgrid's interpretation.

KEYPOINTS

This standard has a summary of content labelled "KEYPOINTS FOR THIS STANDARD". The inclusion or omission of items in this summary does not signify any specific importance or criticality to the items described. It is meant to simply provide the reader with a quick assessment of some of the major issues addressed by the standard. To fully appreciate the content and the requirements of the standard it must be read in its entirety.

AMENDMENTS TO THIS STANDARD

Where there are changes to this standard from the previously approved version, any previous shading is removed and the newly affected paragraphs are shaded with a grey background. Where the document changes exceed 25% of the document content, any grey background in the document is to be removed and the following words should be shown below the title block on the right hand side of the page in bold and italic, for example, Supersedes – document details (for example, "Supersedes Document Type (Category) Document No. Amendment No.>").

Network Standard
NS149
Drawings for Chamber Type Substations,
Control Points, Cable Risers and Ductlines

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1.0 PURPOSE

This Network Standard specifies the minimum content of the design drawing package required by Ausgrid:

- to enable builders to construct substation chambers and associated control points, cable risers and ductlines, and;
- to enable Accredited Service Providers (ASPs) to undertake equipping of the chamber substation.

2.0 SCOPE

This Network Standard applies to the design of chamber type substations and associated control points, cable risers and ductlines by ASPs and their associated Architects, Structural Engineers, Project Managers and Builders.

This Network Standard does not apply to any other type of substation, nor to any control point, cable riser or ductline that is not associated with the design of a chamber type substation. This Network Standard does not apply to chamber type substations designed by Ausgrid.

3.0 REFERENCES

3.1 General

A list of other documents (standards, codes, acts, annexures, policies and other procedures etc) related to the document being prepared or updated. Internal documents that are referenced are those that are above or at peer level of the document in the document hierarchy.

3.2 Ausgrid documents

- Electrical Safety Rules
- Electricity Network Safety Management System Manual
- ES4 Service Provider Authorisation
- NS104 Network Project Design Plans
- NS109 Design Standards for Overhead Developments
- NS112 Design Standards for Commercial/Industrial Development
- NS113 Site Requirements and Construction Design Requirements for Chamber Substations
- NS114 Electrical Design and Construction Standards for Chamber Type Substations
- NS116 Design Standards for Distribution Earthing
- NS181 Approval of Materials and Equipment and Network Standard Variations
- NS195 High Voltage Customer Connections (HVCs)
- NS212 Integrated Support Requirements for Ausgrid Network Assets

3.3 Other standards and documents

- AS1100 Technical Drawing
- ENA Doc 001-2019 National Electricity Network Safety Code

3.4 Acts and regulations

- Electricity Supply (General) Regulation 2014 (NSW)
- Electricity Supply (Safety and Network Management) Regulation 2014
- Work Health and Safety Act 2011 and Regulation 2017

4.0 DEFINITIONS

Accredited Service Provider (ASP)	An individual or entity accredited by the NSW Department of Planning, Industry and Environment, in accordance with the Electricity Supply (Safety and Network Management) Regulation 2014 (NSW).
ASP/3	As defined in the current version of the NSW Department of Planning & Environment, Energy, Water and Portfolio Strategy Division - Accreditation of Providers of Contestable Services - Scheme Rules.
Authorised person	An authorised person can be either the ASP, as a sole trader or company and an ASP's employee or sub-contractor, who has personally been granted permission in writing by Ausgrid to carry out contestable work in Ausgrid's network area.
Contestable Project Coordinator (CPC)	The Ausgrid Contestable Project Coordinator responsible for facilitating the contestable project.
Contestable Work	Contestable Work is work such as the design, construction and installation of electricity works, which are required to connect a customer's installation to an electricity network. Customers are required to fund the cost of contestable work and they have the choice of selecting the ASP to carry out the work. The legislation relevant to contestable work is the NSW Electricity Supply (Safety and Network Management) Regulation 2014
Designer	An Ausgrid employee, contractor to Ausgrid or ASP/3 who is duly qualified to produce design plans.
Document control	Ausgrid employees who work with printed copies of document must check the document repository regularly to monitor version control. Documents are considered "UNCONTROLLED IF PRINTED", as indicated in the footer.
Network Standard	A document, including Network Planning Standards, that describes the Company's minimum requirements for planning, design, construction, maintenance, technical specification, environmental, property and metering activities on the distribution and transmission network. These documents are stored in the Network Category of the document repository and available externally on Ausgrid's website.
Review date	The review date displayed in the header of the document is the future date for review of a document. The default period is three years from the date of approval however a review may be mandated at any time where a need is identified. Potential needs for a review include changes in legislation, organisational changes, restructures, occurrence of an incident or changes in technology or work practice and/or identification of efficiency improvements.

5.0 DESIGN PACKAGE CONTENTS

There are two types of drawings that are required to be presented in the Design Package.

(a) Layout Drawings

These drawings are created by the ASP and are the design of the substation chamber, control point, cable riser, ductline and associated access chambers.

(b) Lock-in Drawings

Principal architectural Lock-in Drawing/s supported by Layout Drawings provided in the Design Package by the Architect, Structural Engineer, Builder, Project Manager and other building services designers.

This drawing finalises the design of the substation chamber, control point, cable riser, ductline and associated access chambers and services within the surrounding building.

6.0 CONTENT OF DRAWINGS

6.1 Layout drawings

6.1.1 General

These drawings are created by the ASP and detail the layout of equipment, pits, conduits and associated services of the substation, control point, cable riser, ductline and associated chambers. A drawing, or multiple drawings, is required for each of the drawing types described in this section. Each drawing shall show, in a clear manner, enough information for the builder and ASP to undertake their tasks.

For Layout Drawings, it is important to use a drawing scale which provides legible detail. Scales smaller than 1:50 are not acceptable.

6.1.2 Substation and Control Point

The layout of equipment drawing(s) for a substation or control point shall contain a fully dimensioned plan view which indicates the position of the equipment. Equipment shown on this plan should include transformers, HV switches, LV board, protection panels, batteries, battery chargers, chamber light and power distribution board and fire extinguishers. For substations in the Sydney CBD additional equipment such as ventilation fans and their control panels, SCADA equipment panels, signal marshalling box and pilot isolation box shall be included.

In all substations or control points where a CO₂ fire protection system is present, the position of the connection box is to be indicated on a plan view as well as the location of the CO₂ delivery pipe penetration into the chamber. In some control points a fan is required which should be shown on this plan view.

The dimensioning of this plan view should set out the positions of equipment, doors, hatches, ventilation ducts and openings and their associated louvres and fire dampers, busbar supplies and conduit entries through walls and the water service relative to the walls. Floor plates over pits and the location of any handrails should also be included on this view.

A plan view also sets out locations, sizes and depths of pits and floor chases, along with connecting conduits. Dimensioning shall clearly indicate positioning in relation to associated equipment and walls. Each conduit is to be numbered and dimensioned to its centre line and pit depths are to be indicated from the level of the finished floor. This view should also indicate step heights at the thresholds of doors and oil containment ramp heights and slopes, the height of any hob and the approximate position of the earth rods under the substation floor.

To avoid misinterpretation created by too much information on a single plan view, multiple plan views should be provided. For example, a plan view showing the layout of equipment and a second plan view showing the layout of pits, floor chases and conduits is an acceptable method of clearly conveying the necessary information.

Sections through the chambers should also be present. The position of the sections should be taken such that the maximum amount of information is depicted, and complicated areas are clarified.

Additional details and cross-referencing should be shown to further clarify complicated areas, and to supplement any Ausgrid standard drawing details that are used.

The Layout Drawing shall also contain a conduit schedule. The schedule should be in tabular form and contain the conduit number, size, minimum bending radius and usage. Conduit numbers are to be as per the numbers shown on the conduit plan.

A table indicating all reference drawings related to the building and the equipping of the substation or control point shall be included. Annexure A of NS114 Electrical Design and Construction Standards for Chamber Type Substations, provides a list of standard details drawings which Ausgrid has made available for use in the design of the substation chamber or control point. The CPC will assist in selection of the relevant drawings. Copying of Ausgrid reference drawings onto drawings in the Design Package is not acceptable.

Doors and door hardware details associated with the substation or control point should be placed in a table. The table should clearly describe each door size, type (louvred or three hour fire rated) and its associated lock, door closer and door handle. NS113 Site Requirements and Construction Design Requirements for Chamber Substations, contains general information on doors and door hardware requirements and should be used in compiling this table.

6.1.3 Cable risers

Design drawings for cable risers shall contain sufficient information to allow for construction and equipping. Fully dimensioned plan views of the cable riser and surrounding building at each floor the riser passes through should be included. However, it is acceptable to depict multiple floors on one plan view, if these floors are identical. The positions of pulling rings should also be included. Conduit entry points shall be shown and fully dimensioned, especially if special treatment is required to allow for cable bending radii. To fully depict the cable riser, sections should be included.

The set out of the cable clamps should be shown on an appropriately scaled plan view. It is not necessary to show the set-out at each identical floor, but additional cable clamps set-out plans will be required when floor plans change. The type and number of cable clamps required shall be indicated on the drawing. The CPC will provide cable size information so that the correct clamps can be selected. For a range of suitable cable clamps refer to NS114.

Doors and door hardware should be placed in a table. The table should clearly describe each door size, type (louvred or three hour fire rated) and its associated lock, door closer and door handle. NS113 contains general information on doors and door hardware requirements and should be used in compiling this table.

A table indicating all reference drawings related to the cable riser shall be included.

6.1.4 Ductlines

Ductline drawings are required to show the route and arrangement of the conduits, including relevant set out dimensions, concrete encasing and any cable marking plates. The locations of all pulling rings, cable turning rooms, pits and pit lids should be shown and fully dimensioned. Fully dimensioned plan and section views are required for pits and cable turning rooms. Conduit entry points into pits and cable turning rooms shall be shown and fully dimensioned, especially if special treatment is required to allow for cable bending radii.

The drawing shall also contain a conduit schedule. The schedule should be in tabular form and contain the conduit number, size, minimum bending radius and usage. A table indicating all drawings that relate to the ductline shall be present.

In situations where a short ductline or cable riser makes separate drawings uneconomical, it is acceptable to combine the substation, control point, cable riser and ductline drawings, providing the drawing does not contain too much information. The drawing scale should not vary.

6.1.5 Light and power

The light and power requirements of the substation, control point and associated personnel/equipment access chambers are to be shown on this drawing.

A plan view is to be provided which shows the position of the light fittings, switches, distribution board and power outlets for the battery charger. In chambers where SCADA equipment is present, the necessary power outlets and isolation switches should be shown as well as the emergency push buttons. If a ventilation fan is required, the position of the fan control panel and fan power terminals should be indicated.

Any appropriate elevations or sections should be included to create a clear indication of the position of above mentioned items.

In some situations, it may be necessary to provide light and power in cable risers and cable turning rooms. If this occurs the details can be added as separate plan and section views to the substation or control point light and power drawing.

6.1.6 Fire protection and ventilation

If it is necessary to have a CO₂ fire protection system present in the substation chamber, a drawing will be required which outlines the position and fixings of the pipework, nozzles and associated trip wire release valve. The drawing should indicate the height above the finished floor level of the CO₂ delivery pipework so that the required fall is achieved. The position of the drain plug shall be indicated. A statement of the empty volume of the chamber and CO₂ bottle capacity is to be presented on the drawing.

This drawing shall also indicate the position of the tripwire, fusible links, pulleys, fire dampers and their trip levers.

The type of fan mounting to be employed should also be indicated and if the fan requires special mounting arrangements, these shall be detailed on this drawing.

A table of the reference drawings to be used in the construction of the CO₂ and tripwire systems and fan mounting is required on this drawing.

6.1.7 Information plan

The Information Plan (see Annexure A for an example) is a drawing that indicates the location of the substation or control point in the building, location and method of access for personnel and equipment into the chamber and emergency equipment located in the chamber.

The Information Plan is to be sized to fit into the inside of the CO₂ connection box and is therefore to be provided within a frame of 280mm wide x 205mm high within a standard drawing sheet. Even if a CO₂ connection box is not installed this border size is still required. Multiple Information Plans for a large project may be drawn. This drawing does not have to be drawn to scale, however, if the information conveyed is too small to be legible, the CPC will request a larger scale.

The Information Plan shall contain the following information:

- A sub-title block which has the Ausgrid substation or control point number, the Ausgrid substation or control point name, the geographic location of the chamber and provision for the addition of the Ausgrid drawing number assigned to the Layout Drawing of the substation or control point. A blank rectangular space, 70mm wide x 20mm high is to be left below the sub-title block for the drawing number.
- A site plan is required which gives a clear indication of the position of the chamber on the site relative to surrounding access roads.
- A plan view showing the substation or control point layout and the position of fire extinguishers, water service and, if present, telephone, batteries, emergency push buttons and CO₂ connection box. The drawing is to clearly and simply show the personnel access such that there can be no doubt as to the method of access, i.e. door or hatch, and shall indicate the surrounds to the access ways from the street so that their positions are readily recognisable at all times. The transformer doors or hatch are to be treated in similar manner to the personnel access.

- The equipment and services mentioned above should be depicted on the plan view by symbols. Ausgrid drawing A4-120100 indicates the appropriate symbols and colours to be used. A legend of the symbols used is to be on the drawing.
- If oil filled equipment is present in the chamber, the drawing is to have a statement in bold print saying. **THIS SUBSTATION (OR CONTROL POINT) CONTAINS OIL.**

A typical Information Plan is attached in Annexure A.

6.2 Lock-in drawings

6.2.1 General

These drawings are created by the building design team and serve to finalise the substation, control point, cable riser, ductline and associated access chambers and services design, within the surrounding building.

The principal Lock-in Drawing/s is supported by the several Layout Drawings provided in the Design Package.

These drawings shall show, in a clear manner, enough information for the builder to provide accommodation for the substation, control point, cable riser, ductline and associated access chambers which is acceptable to both Ausgrid and the building design team.

6.2.2 Architectural

The architectural drawings shall show and detail the walls, ceiling and structural floor of the chambers, including all openings through the walls, ceiling and floor for items such as doors, conduits, busbars, ventilation ducts, personnel hatches and transformer hatch. The positions of openings shall align with those shown on the Layout Drawings. The type of wall material for the chambers shall be nominated.

The full length of ventilation ducts, their construction material and weatherproof louvre position shall be shown. The louvre position shall include the surrounding building usage with items such as other ventilation duct openings, windows and doors shown.

If a CO₂ connection box is required, its position and location of the delivery pipe is to be shown.

The Reduced Level (RL) of the finished floor level and structural floor level of the main and associated access chambers are to be indicated, with the height of any steps and ramps, including ramp slope, clearly identified. The clear headroom of the chamber and associated chambers shall be indicated.

The RL of the footpath in front of any access door is to be indicated.

There is no necessity to repeat the equipment, pit and conduit layout that is shown on the Layout Drawings. However, a note should be clearly displayed in the chamber area, which nominates the Layout Drawing number to be used for the internal construction.

The access path for personnel and equipment delivery including transformers shall be indicated on these drawings.

Any other building requirements such as dwarf walls and piers to support *bondek* type floor construction and concrete encasing of conduits should be indicated on these drawings. Repeating information shown on the Layout Drawings is acceptable.

6.2.3 Structural

The structural design drawings are to be certified by a qualified and practicing professional structural engineer. Proof of this certification is to be provided to the CPC. These structural designs are generally considered to be part of the construction drawings and may not always be required to be submitted as part of the Design Package sent to Ausgrid.

The CPC may request any relevant structural design drawings, including those which indicate pits depths and the position of wall, ceiling and floor openings, to be submitted as part of the Design Package.

Pits depth and the position of wall, ceiling and floor openings shall align with those shown on the Layout Drawings.

Note: Ausgrid will not check any drawing for structural adequacy. The designer is responsible for verifying structural adequacy. Ausgrid's acceptance of the drawings in the Design Package does not imply approval of structural adequacy.

6.2.4 Schedules

Project material schedules are generally not required to be part of the Design Package submitted to the CPC. However, if requested by Ausgrid, schedules will be required to be submitted.

All material schedules should correspond with the Layout Drawings and comply with Ausgrid's Network Standards.

6.2.5 Builder's sketches

Construction sketches showing variations from Layout Drawings and Ausgrid's Network Standards are to be formally submitted to the CPC for acceptance before construction commences. All requests regarding variations from Ausgrid's Network Standards are to be managed via the NS181 Approval of Materials and Equipment and Network Standard Variations process.

6.2.6 Fabrication drawings

These drawings, sometimes referred to as shop drawings, may be requested to be submitted to the CPC for acceptance before fabrication commences.

7.0 DRAWING APPROVAL

As per the requirements of NS104 Network Project Design Plans, the ASP shall provide the drawing package to the CPC before commencing construction of the substation chamber, control point, cable riser or ductline.

During the design or building of the substation chamber, control point, cable riser, ductline, any variations to the approved Design Package shall be submitted for review and acceptance by the CPC before construction of that portion commences.

Upon acceptance of the Design Package, the CPC will arrange for the appropriate drawings to be registered into the Ausgrid Document / Drawing Management System. Approved variation drawings and sketches will be similarly treated.

It should be noted that Ausgrid will determine which drawings will be entered into the Ausgrid Document / Drawing Management and may not enter all drawings into this System. It is the responsibility of the building owner to maintain a copy of all drawings.

7.1 Exemptions

All requests regarding variations from Ausgrid's Network Standards are to be managed via the NS181 Approval of Materials and Equipment and Network Standard Variations process.

8.0 RECORDKEEPING

The table below identifies the types of records relating to the process, their storage location and retention period.

Table 1 – Recordkeeping

Type of Record	Storage Location	Retention Period*
Approved copy of the Network Standard	Document repository Network sub process Standard – Company	Unlimited
Draft Copies of the Network Standard during amendment/creation	Records management system Work Folder for Network Standards (HPRM ref. 2014/21250/314	Unlimited
Working documents (emails, memos, impact assessment reports, etc.)	Records management system Work Folder for Network Standards (HPRM ref. 2014/21250/214	Unlimited

* The following retention periods are subject to change e.g. if the records are required for legal matters or legislative changes. Before disposal, retention periods should be checked and authorised by the Records Manager.

9.0 AUTHORITIES AND RESPONSIBILITIES

For this network standard the authorities and responsibilities of Ausgrid employees and managers in relation to content, management and document control of this network standard can be obtained from the Company Procedure (Network) – Production/Review of Network Standards. The responsibilities of persons for the design or construction work detailed in this network standard are identified throughout this standard in the context of the requirements to which they apply.

10.0 DOCUMENT CONTROL

Document Owner : Head of Asset Engineering Policy & Standards

Distribution Coordinator : Manager – Asset Engineering Standards

Annexure A – Sample Information Plan

