Network Standard

NETWORK	Document No : NW000-S0012 Amendment No : 7 Approved By : Manager – T & DME Approval Date : 17/07/2019

Minor Amendment approved on 17/04/24

NW000-S0012 **NS172 DESIGN REQUIREMENTS FOR CABLE PITS, VAULTS AND BAYS**

ISSUE

For issue to all Ausgrid and Accredited Service Providers' staff involved with the design and construction of power cable pits, vaults and bays, and is for reference by field, technical and engineering staff.

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Where this standard is issued as a controlled document replacing an earlier edition, remove and destroy the superseded document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

KEY POINTS OF THIS STANDARD

Scope and Risks Addressed

This Network Standard describes the minimum design requirements for cable pits, vaults and bays for use with power cables and pilots.

- ☐ For communications pits, refer to NS204. Communications Pits – Specifications and Installation Guidelines.
- ☐ This standard does not cover construction requirements or other issues relating to construction activities.
- ☐ For works involving significant modifications to existing pits, joint vaults, or joint bays, the modified design shall comply with the requirements of this Network Standard to the extent that is reasonably practicable.
- ☐ All materials used must be free from Asbestos.
- ☐ Confined space training and procedures apply.

Where to for more information?

Sections 1 - 5

Design

The following major design requirements are included:

- ☐ Design options
- ☐ Design loads
- ☐ Dimensions
- ☐ Access
- ☐ Confined space issues
- ☐ Items to be included in underground enclosures:
- ☐ Access covers
- ☐ Ladder
- ☐ Pulling eyes
- ☐ Cable supports
- ☐ Embedded earthing
- ☐ Drawings

Where to for more information?

Section 6

Tools and Forms

Not applicable

Identification, Signage, Inspection, and Certification

This standard also includes requirements in relation to:

- ☐ Pit identification and signage
- ☐ Inspections during construction
- ☐ Certification of designers and pit design
- ☐ Requirements for Certificate of Practical Completion following final inspection.

Where to for more information?

Section 7 - 10

Tools and Forms

Not applicable

Network Standard
NS172
Design Requirements for Cable Pits, Vaults and Bays

Contents

1.0 PURPOSE

This Network Standard describes the minimum design requirements for cable pits, joint vaults and joint bays for use with power cables and pilots.

For pits exclusively for use with optical fibre pilot cables, refer to NS204.2.1 Communications Pits - Specifications and Installation Guidelines.

2.0 SCOPE

This Network Standard describes the minimum design requirements for new pits, joint vaults and joint bays for use with power cables and pilots. It does not cover construction requirements, authority approvals, safety or environmental requirements relating to construction. Normal industry practices apply in addition to any Ausgrid design requirements detailed herein.

This Network Standard does not cover 33kV joint bays that comprise of a natural ground or concrete working floor only, without the use of concrete side walls to form the bay.

For works involving significant modifications to existing pits, joint vaults or joint bays that would have been originally constructed to a previous standard, the modified design shall comply with the requirements of this Network Standard to the extent that is reasonably practicable.

3.0 RELATED DOCUMENTS

3.1 General

All work covered in this document shall conform to all relevant Legislation, Standards, Codes of Practice and Network Standards. Current Network Standards are available on Ausgrid's Internet site at www.ausgrid.com.au.

3.2 Ausgrid documents

- Company Form (Governance) - Network Technical Document Endorsement and Approval
- Company Procedure (Governance) - Network Technical Document Endorsement and Approval
- Company Procedure (Network) – Network Standards Compliance
- Company Procedure (Network) - Production / Review of Engineering Technical Documents
- Electrical Safety Rules
- Electricity Network Safety Management System Manual
- NEG-SM04.24.06 Inspection and Test Quality Procedure
- NS100 Field Recording of Network Assets
- NS104 Specification for Electrical Network Project Design Plans
- NS130 Laying of Underground Cables up to and including 11 kV
- NS148 Overhead Line Support, Street Light Column, Pit and Pillar Labelling
- NS149 Drawings for Chamber Type Substations, Control Points, Cable Risers and Ductlines
- NS156 Working Near or Around Underground Cables
- NS168 Design and Construction of 33kV, 66kV and 132kV Underground Cables
- NS174 Environmental Procedures
- NS181 Approval of Materials and Equipment and Network Standard Variations
- NS203 Telecommunications Network Master Policy Document
- NS204Communications Pits - Specifications and Installation
- NS212 Integrated Support Requirements for Ausgrid Network Assets
- NS260 Sub-Transmission Feeder Earthing

Refer to NS104 Specification for Electrical Network Project Design Plans for a more comprehensive list of available Network Standards.

3.3 Other standards and documents

- ENA Doc 001-2019 National Electricity Network Safety Code
- AS/NZS 1170 Structural design actions
- AS/NZS 1891.4 Industrial fall-arrest systems and devices - Selection, use and maintenance
- AS 1100 series – Technical drawing
- AS 1319 Safety signs for the occupational environment
- AS 1657 Fixed platforms, walkways, stairways and ladders – Design, construction and installation
- AS 2865 Confined Spaces
- AS 3600 Concrete Structures
- AS 3610 Formwork for concrete
- AS 3850.1 Prefabricated concrete elements, Part 1: General requirements
- AS 3996 Access covers and grates
- AS 4586 Slip resistance classification of new pedestrian surface materials
- AS 5100 Bridge Design Set
- SafeWork NSW Code of Practice Confined Spaces

3.4 Acts and regulations

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

4.0 DEFINITIONS

Refer to NS001 Glossary of Terms.

5.0 ASBESTOS

All materials and equipment used for construction of Ausgrid's assets are to be free from Asbestos and or Asbestos related products.

Suppliers are expected to comply with Work Health and Safety Act 2011 (WHS) together with the WHS Regulation 2017 and confirm in writing that all products supplied to Ausgrid contain no Asbestos related materials.

6.0 DESIGN REQUIREMENTS

6.1 General

The underground enclosure for cables shall be designed to all the relevant Australian Standards including those listed in Section 3.0 References.

6.2 Design options

Acceptable design options for underground enclosures are:

a. Pre-cast reinforced concrete.

b. Constructed in-situ reinforced concrete blockwork.
c. Cast in-situ reinforced concrete.
d. Brickwork.

For pre-cast reinforced concrete 11kV pits, refer to standard drawing 249060 for typical indicative pit details.

The geographical location shall be considered when determining the design option to be used, as indicated below.

Brickwork underground enclosures shall only be used in areas of rock and where the area around the enclosure is backfilled with a sand/cement mix.

In tidal areas or where an underground enclosure is below the water table:

- Only pre-cast or cast in-situ reinforced concrete shall be used.
- Suitable 50MPa reinforced concrete shall be used.
- Hydrophilic water stops shall be used to seal construction joints.
- An additive shall be used in the concrete to give it non-absorptive properties - products such as Xypex or 3CC (by Cementaid) or an approved equivalent are acceptable and shall be used in accordance with the manufacturer's recommendations.
- Suitable hydraulic seals shall be used for all conduit entries into a pit or joint vault. This should seal both the inside and outside (embedded) conduit surfaces to restrict the ingress of water.

In Acid Sulfate Soils (ASS):

- Only pre-cast or cast in-situ reinforced concrete shall be used.
- Suitable 50MPa reinforced concrete using Sulfate Resisting (SR) cement shall be used.
- Soil disposal shall be to an approved disposal facility.

Alternative design options and materials for underground enclosures may be approved by Ausgrid, provided that the following risk factors are considered and adequately mitigated:

- Design life and durability impacts at the geographical location.
- Fire resistance for a credible internal fire (not applicable to joint bays).
- Internal prop or cross-bracing requirements where a roof slab or internal backfill material (for joint bays) may need to be removed in future.
- Conduit penetration constraints, eg minimum distance from wall/floor edges, maximum allowable % of wall area.
- Ladders/step-bolts attachment method & potential for corrosion (not applicable to joint bays).
- Pulling eye constraints, eg limited load rating.
- Wall attachment constraints.
- Design standards.
- Need & cost for original supplier design input for future modifications.
- Water ingress and control options (not applicable to joint bays).
- End of life - recycling or abandonment in-situ.

6.3 Design loads

The underground enclosure and access covers (if applicable) shall be designed for a service life of 50 years. If specified by Ausgrid the service life of the underground enclosure shall be increased to 100 years at specific locations, and the corresponding durability requirements will be increased to comply with AS 5100.

The underground enclosure and any temporary road cover for use during construction shall be designed to carry the design loads in Table 1:

Table 1 – Design loads

Location	Design loads
Road	Loads and load factors required by AS5100 (dead load, superimposed dead load, soil/groundwater load etc), including SM1600 and HLP320 road traffic loads.
Footpath	As road design loads above, but with no dynamic load allowance applied.

The underground enclosure shall also be designed for any special conditions unique to its location such as:

- Crane loads,
- Loading from neighbouring building foundations,
- Design for support of other services in or near the underground enclosure for both construction and final situations to meet the relevant Authority requirements,
- Buoyancy forces if there is the potential for a high water table, or where the underground enclosure is in a tidal area.

The ground adjacent to any pit and joint vault accesses shall be capable of withstanding construction and service loads applied by vehicles and any cranes required for lifting. Sufficient space to position and operate a crane shall be provided where required.

All walls and floors that include pulling eyes shall be designed to cater for the rated working load of the pulling eyes at any location on the wall or floor.

The underground enclosure design drawings shall include suitable notation on the following construction related aspects:

- Shoring requirements - evidence of inspection and design of shoring by an approved geotechnical engineer shall be provided by the Contractor to the Compliance Officer.
- Concrete curing requirements.
- Concrete strength and age requirements before backfilling around the underground enclosure and before traffic may be carried on adjacent ground.

6.4 Underground enclosure dimensions

6.4.1 General

The final size of the underground enclosure is to be approved by the Project Officer.

It is recognised that other underground services are often present and that these will often govern the final size and shape of the underground enclosure.

6.4.2 Minimum size

The minimum internal plan dimensions for underground enclosures shall be as per Table 2.

Table 2 – Minimum Underground Enclosure Size

Underground Enclosure Type	Size
Joint vaults and joint bays	Refer to Clause 6.5
11kV pits where cable bends need to be accommodated within the pit	5m x 4m
11kV narrow pits where no significant cable bending is needed	5.7m x 2m
LV pits	2m x 2m

A pit or joint vault that uses a fixed roof shall have minimum 2m internal height, wherever this is reasonably practicable. Lower internal heights shall be assessed in accordance with Table 3.

The depth of underground enclosures having a fully removable roof (including multi-part covers, precast concrete roof lids etc.) may be less than 2m. The depth of these underground enclosures shall be minimised but is to be compatible with the depth of the cables entering the structure.

6.4.3 Cable working constraints

In addition to the minimum sizes specified in Table 2, underground enclosures shall cater for the following cable working constraints to allow for the nominal minimum internal cable bending radii during installation and for adequate working space in HV pits:

Figure 1 shows cable entry details where cable bends need to be accommodated within the underground enclosure (not applicable to joint bays or 11kV narrow pits).

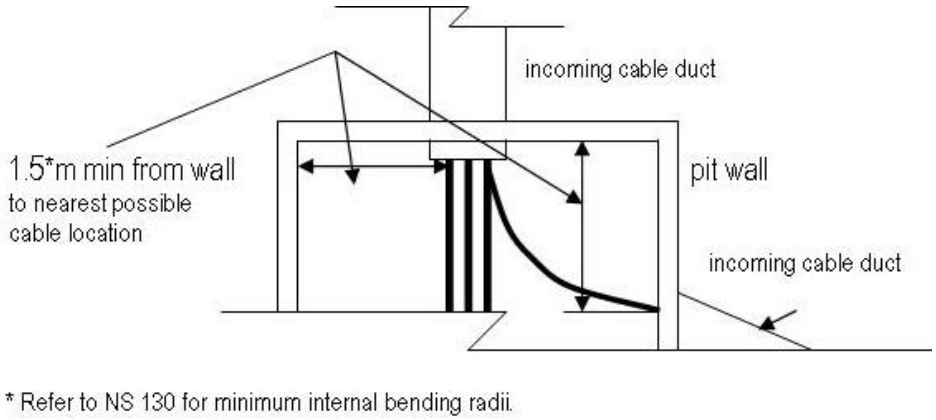

Figure 1 - Plan of Cable Entry

Figure 2 shows details of the underground enclosure indicating the minimum height of the conduit above the floor of the enclosure.

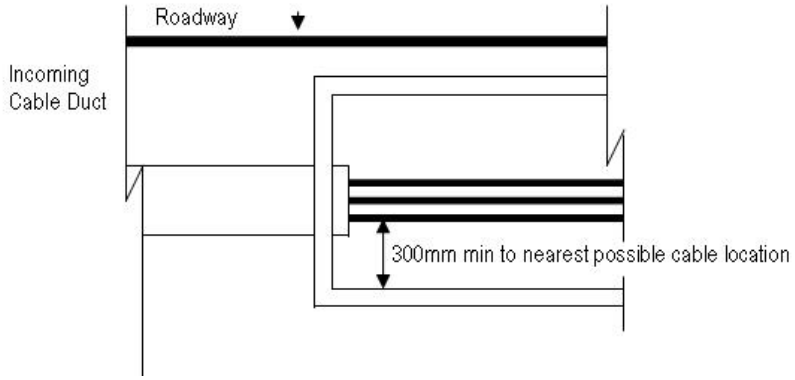

Figure 2 - Section through an Underground Enclosure

Reference should be made to Ausgrid approved jointing instructions for information on cable joint space requirements. Where cable joints are made in an underground enclosure, the length of straight cable required to assemble the joint shall also be considered, this shall include the parking of the joint components during the joint assembly process.

The location of the cables and joints should be positioned such that it does not hinder personnel accessing the underground enclosure or place the exposed cable joint or cable at risk of damage. Placing any pressure or load on exposed cable joint and or cable is not permitted. This includes stepping onto or using the cable joint or cable for support whilst accessing or working within the underground enclosure.

6.4.4 Columns

Columns can interfere with cable pulling and jointing, and therefore shall be avoided where possible. The use of roof beams or thicker roof slabs is preferred.

Where the use of columns is unavoidable, the location of the column within the underground enclosure is to be approved by the Project Officer.

6.4.5 Access and egress

For pits and joint vaults, an absolute minimum of two accesses shall be provided.

Additional accesses may be needed to comply with the criteria below:

- All accesses shall be suitable for personnel entry, egress, ventilation and cable pulling.
- All accesses shall be 900mm x 900mm size.
- Accesses shall be located in corners of the pit or joint vault where possible.
- Accesses shall be located away from cable alignments and ductline entries.
- Where the pit or joint vault is located such that it crosses opposing lanes of traffic, the structure shall have two accesses in each lane so that safe access (two accesses open) is possible by closing one traffic direction only.
- If the pit or joint vault is effectively divided into sections by walls, cable banks or split levels, every section of the pit or joint vault shall have a minimum of two accesses.
- The distance from anywhere in the pit or joint vault to the nearest ladder base shall be 3m maximum, wherever this is reasonably practicable. Longer egress distances shall be assessed in accordance with Table 3.

- The ground adjacent to each access shall have a minimum of 600mm clear space to allow for positioning of portable fall-arrest rescue davit systems.
- Access covers shall be located and oriented so they open into an area free of obstructions.

Note that these requirements will normally result in a requirement for four accesses for pits and joint vaults larger than approximately 4m x 4m.

Access points for personnel or other purposes are not required for joint bays.

6.4.6 Multi-part accesses

Multi-part accesses may be used for LV pits with the following limitations:

- Footpath locations only.
- Minimum clear opening of 900mm.
- Only to be used for pits of 2.2m x 2.2m and smaller.

Access covers with the following arrangements of covers are acceptable:

- 2 x 2 multi-part.
- 1 x 3 trench covers.

There shall be adequate space to allow removal and temporary storage of the covers and for pedestrian traffic around the pit, i.e. a minimum available footpath width of 1200mm on one side of the opening with the covers removed.

The support beam for a multi-part access cover shall be corrosion resistant. For non-corrosive environments, the support beam may be made from galvanised steel with a minimum galvanising rate of 600g/m². In corrosive environments 316 grade stainless steel is required.

6.4.7 Egress distance vs internal height

Table 3 provides a matrix of design limits for pits and joint vaults. The Table balances likely combinations of egress distances and internal heights for pits and joint vaults, and indicates the degree of acceptability for different design solutions:

Table 3 – Egress Distance vs Internal Height

Egress distance	*Internal head height* <1600mm	≥1600mm	≥1800mm	≥2000mm
≤3m	Unacceptable	Marginal. May be acceptable. Special assessment required.	Accepted occasionally. Recommend consideration on a site by site basis.	Ideal.
≤4m	Unacceptable	Very marginal. Unlikely to be acceptable. Special assessment required.	Examples are available. Recommend consideration on a site by site basis.	Accepted occasionally. Recommend consideration on a site by site basis.
≤5m	Unacceptable	Unacceptable	Marginal. May be acceptable. Special assessment required.	Examples are available. Recommend consideration on a site by site basis.
>5m	Unacceptable	Unacceptable	Unacceptable	Unacceptable

Design solutions indicated as "Ideal" shall be adopted where reasonably practicable.

Design solutions indicated as "Accepted occasionally" and "Examples are available" may be approved by Ausgrid only where:

- Site constraints prevent the "Ideal" solution, and;
- There are no future Ausgrid plans to increase the number of feeders that will pass through the pit or joint vault, and;
- Internal cable congestion is not excessive, and;
- Egress distance is as short as is reasonably practicable.

Design solutions indicated as "Marginal" or "Very Marginal" may be potentially acceptable, subject to detailed site-specific risk assessment, life-cycle cost analysis and Ausgrid approval.

Design solutions indicated as "Unacceptable" will not be accepted by Ausgrid.

6.4.8 Restricted access

Restricted entry/egress design solutions may be acceptable for pit and joint vault modifications that involve unavoidable site constraints such as existing cables/ductlines that prevent normal entry and egress via ladder. In these situations, the following requirements shall apply:

- An absolute minimum of two unrestricted accesses shall be provided, and;
- Restricted entry/egress accesses shall be noted on pit and joint vault signage, design drawings and in Ausgrid's GIS system, and;
- A risk assessment shall be carried out, and;
- Mitigation measures for emergency entry/egress (eg step irons) shall be considered.

6.5 Joint Vault and Joint Bay Dimensions

Joint vault and joint bay dimensions are determined by the number of cables, the voltage, and specific jointing requirements. Refer to NS168 for further details.

6.6 Confined space requirements

All pits and joint vaults will normally be considered a confined space.

Pit and joint vault designers shall be trained as per the requirements of the SafeWork NSW Confined Spaces Code of Practice.

In addition to any other requirements, the design of pits and joint vaults will take into consideration the following:

- Risk assessment procedures.
- Risk control measures.
- Access & egress.
- Emergency procedures.
- Selection, use, fitting and maintenance of safety equipment.

The design of pits and joint vaults shall aim to minimise the Complexity level (Levels 1-5) as described in Ausgrid's Confined Space Policy.

The designer shall supply the required Space Characteristics (in Resting State) criteria as defined in Ausgrid's Confined Space Field Sheet - Risk Assessment & Data Collection. These parameters will be used in the Confined Spaces register to determine training, rescue & working arrangements for future activities in the enclosure.

Joint bays will not normally be considered a confined space. All work in these types of structures is typically undertaken without the roof, concrete lids, or steel plates in place.

6.7 Standard items

6.7.1 General

The following standard features are required for all pits and joint vaults:

- Access covers.
- Standard Ausgrid ladders (Drawings 49813 or 157908).
- Retractable handrails (Drawing 120488).
- Pulling eyes (Drawing 63678).

In addition, the following features are required for some underground enclosures:

- Drainage sump (300mm x 300mm x 300mm deep) with hinged cover (Gatic 331S33L hinged grate and frame or equivalent) adjacent to the base of certain access ladders, required for all pits and joint vaults apart from pre-cast reinforced concrete structures.
- Falls in the base slab towards the sumps to provide drainage, required for all pits and joint vaults apart from pre-cast reinforced concrete structures.
- Temporary road plate and beam system, if needed for covering the underground enclosure during construction.
- Cable supports are required for HV narrow pits and joint vaults.
- Embedded earthing, where required for 33kV, 66kV & 132kV joint vaults and joint bays.

The design drawings shall indicate the features provided in the underground enclosure, and the drawing title shall include the size of the structure.

Ausgrid standard drawings may be obtained from the Ausgrid website.

6.7.2 Access covers

Pit and joint vault access covers shall comply with AS 3996. As a minimum, Class D watertight units are required for roads and Class C watertight units are required for footpath situations. Access covers are not applicable for use in joint bays.

Covers shall be tested in accordance with AS 3996 and test certificates made available on application. In addition, covers shall be required to sustain a modified type test without fracture, using the ultimate limit state design load as follows:

a) The test load shall be applied, without shock, five times, sustaining the test load and zero load alternately for minimum periods of 30 seconds.
b) Any resultant permanent set measured along the unit's long axis shall, after removal of the test load, be not greater than 0.8% of the clear opening span.
c) Test certificates shall be made available on application.

If the proposed covers do not comply with these test requirements the next higher load classification may be used (ie Class E or D respectively), subject to Ausgrid approval.

Covers shall be made from ductile iron as per AS 3996 2.2(b) with concrete infill for roads and concrete or paver infill for footpath situations, unless approved otherwise by the Project Officer. For Class D or E covers, the cast metal ribbing shall extend to the top surface of the concrete or paver infill.

Concrete infill covers should preferably be filled with concrete by the cover manufacturer rather than filled on site, to reduce the risk of quality problems. Covers in road carriageways shall include black pigment in the concrete (with similar light reflective characteristics to the road top coat) to match the road surface.

Covers that accommodate paver infill are acceptable provided the edge of the frame and the cover are each a minimum of 5mm thick with the cast elements extending to the surface of the paving. Covers for use with pavers are to have a 60mm set down to match the pavers. Covers that utilise separate edge plates attached to the cast lid to enclose infill paving and as the interface between the cover and the frame, are not acceptable.

The cover shall not present a trip hazard or a hazard to bicycles or motor bikes. Surfaces of smooth steel that may become slippery are not acceptable. The life of the access cover shall be considered including its corrosion performance and its wear under traffic loads.

Access cover lifting keyholes shall be provided as per AS 3996 3.2.2.6. The lifting keyhole dimensions in AS 3996 Figure 3.1 and the 35mm (+5, -0mm) distance from the edge of a cover to the centre of a lifting keyhole shall be mandatory rather than "preferred".

For security, standard purpose-made keys or lifting devices shall be used to ensure access to the pit or joint vault is limited. The covers shall be designed so that the following keys may be used to open them:

a) Long handle Gatic type key (Ausgrid stockcode 216).
b) Short handle Gatic type key (Ausgrid stockcode 232).

The following requirements shall apply to access covers and frames;

- The underside of access covers shall be flat bottomed to allow for safe removal using a roller.
- Permanent marking to AS 3996 1.6 shall not be provided, as this could pose a slip/trip hazard and would become detached with time.
- Covers in road carriageways shall be installed to be opened in the direction of the traffic lane (ie not across the lanes) and shall open in the opposite direction to the flow of traffic.
- The design of the access cover, frame and roof slab shall allow for reasonable ease of modification to provide for future possible changes in road/footpath levels. The roof slab shall have a minimum cover depth of 200mm in footpaths, and 450mm in the roadway.
- Covers and frames shall be installed in accordance with the manufacturer’s installation instructions.

6.7.3 Ladders

Vertical twin-stile rung-type ladders shall be provided in accordance with AS 1657. This ladder type provides good lifting access, maximises internal clearances, and is compatible with Ausgrid's normal fall arrest system.

Vertical single-stile ladders shall not be allowed due to general unsuitability for confined space usage.

Ausgrid drawing 49813 details the standard vertical ladder and drawing 120488 details the retractable handrails.

Note: These designs are only appropriate for pits and joint vaults of 1800mm minimum depth. For shallower structures, access complying with AS 1657 shall be provided.

Permanent ladders are not required for use in joint bays.

6.7.4 Pulling eyes

The Project Officer shall approve the proposed pulling eye locations prior to the construction of the underground enclosure.

Galvanised pulling eyes are required in the walls or floor of the underground enclosure, these shall be Type A, C or D (preferred) as shown in drawing 63678 with a minimum Safe Working Load of 50kN. Type D anchors shall meet the "lifting insert" requirements of AS3850.1.

For selected straight through LV pits, a reduced pulling eye rating of 15kN Safe Working Load may be acceptable, subject to a risk assessment and Ausgrid approval.

The exact location of pulling eyes is to be determined when the locations of the incoming cable ducts are known. Pulling eyes are to be positioned such that they are in line with the cable ducts wherever possible.

Figure 3 is indicative of typical pulling eye locations. Where a duct line has more than one conduit, multiple pulling eyes may be required.

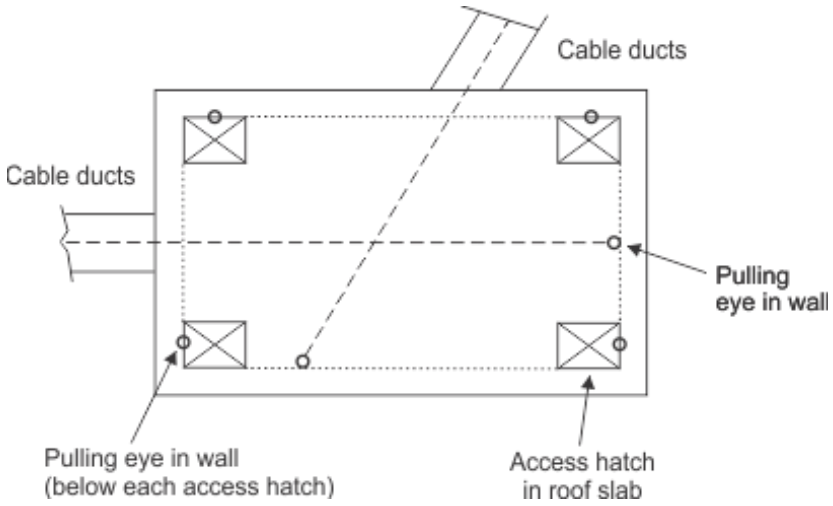

Figure 3 - Typical pulling eye locations

6.7.5 Cable supports

Designs for HV narrow pits and joint vaults shall include provision to support the planned number of cables via the use of cable support brackets along the side walls of the structure. The support brackets (or provision for future brackets) shall be designed to permit the installation of a straight-through joint for each feeder.

For pits and joint vaults, cable support brackets shall be designed to support the heaviest size of power cable likely to be installed in the pit or joint vault. Provision for copper pilot or optical fibre cables shall also be provided, with any optical pilots arranged in accordance with the relevant requirements of NS203 and NS204.

For joint bays, the proposed use of wall mounted cable support brackets with permanent backfill shall be subject to review and approval by Ausgrid. The design options include:

1. **Option 1** – The installation of removable precast concrete roof panels on the joint bay walls to support all external loads.
2. **Option 2** – The detailed design of the cable support brackets to support both power cable and applied external loads, including the minimum requirements below:
    - Additional loading due to the backfill material placed over the cables.
    - Imposed construction loading and road traffic loading.
    - The level of compaction required for the permanent backfill (selected sand) around the cables.
    - The method of preventing migration (loss) of backfill material from the joint bay.
    - A Structural Engineer's report covering the loading and design of the cable support brackets for review by Ausgrid.

For joint bays, the buried cable support brackets and associated fixings shall use 316 stainless steel.

6.7.6 Embedded earthing

For 33kV, 66kV and 132kV cable joint vaults and joint bays, the requirements for embedded earthing shall be in accordance with NS168 and NS260.

Where embedded earthing is required the Project Officer will provide detailed earthing drawings showing the required construction, welding and connection details.

6.8 Design drawings

Ausgrid requires copies of any drawing produced in relation to the construction of any underground enclosure that is to be included as part of Ausgrid's network assets. Refer also to NS149.

Structural drawings of the proposed underground enclosure, certified by a Structural Engineer, are to be submitted to the Project Officer for approval.

The structural drawings shall detail all stages of construction and shall consider the loading and reinforcement requirements for each stage. For joint bays, this shall include traffic or other loads while the joint bay is open, and also when backfilled, including details of temporary concrete lids, steel plates and any props or beams as required or used. Where relevant, the joint bay roof panels, permanent backfill (selected sand), level of compaction, sealing, TSB "cap" and other details, as required by NS168, shall be clearly shown on the drawings.

Construction shall not commence without an approved drawing. The drawing shall include all necessary provisions from this Standard and shall be fully dimensioned.

The structural drawings are to be presented to the Project Officer as full sized or electronic form drawings. All drawings are to be placed on drawing sheets, in sizes A0, A1, A2, A3, A4 or B1 only, in accordance with ISO-A and ISO-B standard.

Each sheet shall utilise a drawing border and drawings are to comply with the latest edition of the AS 1100 series. Electronic drawings are to be compatible with the latest release of AutoCAD or Microstation software.

The Project Officer will advise on which of these systems will be acceptable for the project.

The title block of each sheet shall contain the following information:

- The underground enclosure number and description, so that the Project Officer can readily identify where the underground enclosure design is to be used.
- The geographic location of the underground enclosure.
- The size of the underground enclosure.
- The material used: pre-cast, blockwork etc.

- The drawing number and the amendment or revision or issue number assigned by the designer.
- The date of original design and subsequent amendments, revisions or issues.
- The printed name and signature of the responsible accredited designer.

The drawing sheets shall also have provision for:

- The addition of Ausgrid's drawing number. This number will be added by Ausgrid once the underground enclosure design or variation to the design is accepted by the Project Officer. A blank rectangular space of 90mm wide x 50mm high is to be left immediately above the title block for the addition of this number.
- An amendment or revision or issue table.

The drawings must not bear Ausgrid's name or logo if an accredited designer other than Ausgrid has undertaken the design.

The structural underground enclosure drawings shall be fully dimensioned and contain cross-references to other drawings in the project. All dimensions shall be to clear and finished sizes and sufficient details shall be present to fully define the underground enclosures to be constructed in accordance with the design. Drawings made over grid or modular base lines without sufficient dimensions are not satisfactory.

The drawings shall provide all construction details and shall also document the design loads and design life.

7.0 IDENTIFICATION AND SIGNAGE

7.1 Summary

Signage requirements are summarised in Table 4 below:

Table 4 – Signage Requirements

Sign	Classification	Location
Underground enclosure identification	Information	One sign per underground enclosure, located at the access that is likely to be the most commonly used.
Fall arrest (for pits and joint vaults)	Mandatory	At every access, for pits and joint vaults where fall arrest procedures are to be employed.
Confined space (for pits and joint vaults)	Danger	At every access.
Webbing (for pits and joint vaults)	Danger	Directly under every access. Sizes and stock codes are as follows; • 700 Round - 186383 • 900 x 900 - 186384 • 900 x 600 - 186385 • 750 x 750 - 186386 • Fasteners - 186381, 186382
Sump trip hazard	Warning	Sign on nearest wall at 1m height.
Load capacity of pulling eyes	Information	Wall-mounted pulling eyes - sign adjacent to each Type A & C pulling eye. No signs are required for Type D since foot anchors are stamped with their load rating as per AS3850.1. Floor-mounted pulling eyes - sign on nearest wall at 1m height for each Type A & C pulling eye. No signs are required for Type D since foot anchors are stamped with their load rating as per AS3850.1.

Internal props notice (where required)	Information	One or more signs on removable roof lids or near top of walls indicating the internal prop locations. Signs shall indicate the prop load rating, location and when they are required. For example, 5 tonne props at 2.5m spacing when structure is not backfilled and if traffic loads are within 2.5m.

Signs that are classified as mandatory, danger and warning signs shall meet the requirements of AS1319. The confined space danger sign and webbing danger sign shall also meet the requirements of AS2865.

All signage shall be corrosion resistant and shall be fixed with corrosion resistant fasteners.

The underground enclosure identification sign shall include design information including underground enclosure number, drawing number, design company and construction year. The identification sign shall be made from 3mm thick aluminium plate and shall have smoothed and rounded edges and corners. Underground enclosures are to be numbered in accordance with the requirements of NS148. On completion, the number of the drawing that was used to construct the underground enclosure and survey information of the underground enclosures location is to be given to the Project Officer who will forward details to the GIS section.

Webbing danger signs and installation instructions shall be provided by the Project Officer.

7.2 Typical signs

Figure 4 – fall arrest sign

Figure 5 – confined space sign

Figure 6 –Webbing sign, as installed

Figure 7 – sump trip hazard sign

8.0 INSPECTIONS

8.1 General

To ensure the underground enclosure meets all Ausgrid requirements and relevant design criteria, Ausgrid shall be given the opportunity to perform inspections as described in this section.

In addition, during construction the Certifying Engineer shall carry out all inspections deemed necessary in order to provide the required certification.

Drawings indicating Ausgrid approval shall be used for construction and shall be made available to the Compliance Officer.

8.2 Ground conditions

During the excavation of the underground enclosure, the Certifying Engineer is to inspect the excavation to ensure the ground conditions are suitable for the proposed design. Where there are deviations from the design assumptions, amended drawings to allow for the deviations shall be produced and submitted for Ausgrid approval.

Where Acid Sulfate Soils (ASS) are present, the underground enclosure design must allow for these conditions. As the impact of ASS will affect the design of the underground enclosure, the contractor is responsible for identifying soil types. The Project Officer shall be supplied with test certificates relating to soil types prior to acceptance of the design.

8.3 Reinforcement inspections

Inspection and Test Plans are required to be submitted by the contractor to verify that the construction has been carried out in accordance with the specification.

A Professional Structural Engineer who is approved by the Project Officer will carry out inspections of reinforcement. In addition, the Compliance Officer will inspect the reinforcement and shall be given a minimum of 24 hour notice of any opportunity for inspection.

In all cases, the Professional Structural Engineer is required to certify that all reinforcement has been installed in accordance with the approved specific underground enclosure structural design.

Where embedded earthing has been installed the Compliance Officer may inspect the welding, the connection points and carry out an electrical continuity test from a number of points on the mesh to the connection points to verify that the construction has been carried out in accordance with the specification.

8.4 Concrete pours

The Compliance Officer shall be given the opportunity to witness all concrete pours and where appropriate make comments or reject the work if it does not comply with relevant standards.

8.5 Final inspection

The Compliance Officer will inspect the completed underground enclosure prior to the issue of the Certificate of Practical Completion.

The required ladders, sump grates, pulling eyes and signage etc, are to be installed and any material such as formwork and the like to be removed from the site.

9.0 CERTIFICATION

The following documentation shall be provided:

a. Structural Certificate certifying the design and construction of the underground enclosure to the relevant Australian Standards, signed by a Professional Structural Engineer. The Professional Structural Engineer shall be eligible for registration with the Institution of Engineers (Australia) under classification NPER3.

b. Certificate certifying that the WHS and Confined Space aspects of the design of the underground enclosure are fit for purpose.

c. Evidence of the Certifying Engineer's professional indemnity insurance cover.

d. Details of the training and experience, including WHS & Confined Spaces, of the designer and Certifier shall be included with the certificate.

e. Safety In Design report.

f. Confined Space Field Sheet - Risk Assessment & Data Collection.

10.0 COMPLETION

The Compliance Officer will issue a Certificate of Practical Completion when the requirements of Sections 7.0 to 9.0 have been met.

11.0 RECORDKEEPING

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

Table 5 – 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. 2014/21250/273)	Unlimited
Working documents (emails, memos, impact assessment reports, etc.)	Records management system Work Folder for Network Standards (HPRM ref. 2014/21250/273)	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.

12.0 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.

13.0 DOCUMENT CONTROL

Content Coordinator : Head of Network Strategy & Future Grid

Distribution Coordinator : Manager – Network Standards & Electrical Safety