Superseded by T HR EL 20007 ST v1.0, 26/11/2019

Engineering Standard
Electrical

EP 20 00 04 05 SP

CABLE PITS

Version 3.0

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Transport RailCorp NSW

Engineering Standard

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Document control

Version	Date	Summary of change
	June 2008	Last Technical Review
2.0	May 2010	Application of TMA 400 format
3.0	February 2012	• Contents of previous section on “Introduction” incorporated in “Scope and application”. Joint bays excluded from scope. • References updated. • Section on “Design requirements” renamed as “General”; list of requirements expanded; some provisions relocated to other sections. • Section on “Confined space” added. • Section on “Dimensions” added; this section includes provisions for previous sections (deleted in this version) on “Space for persons working” and “Future maintainability”. • Requirement for spare ducts expressed as a percentage of total ducts per circuit instead of a table (section 6). • Section on “Access steps” renamed as “Access ladders”; reference to AS 1657. • Section on fall arrest system added • Section on “Design documentation” added. • Order of sections re-arranged. • Minor editorial changes.

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1 Scope and application

This document sets out the requirements for the design and construction of cable pits for high voltage and 1500V dc cables.

The requirements of this document apply to all new cable pits, including those at substations.

Where approved by the RailCorp nominated engineering authority, joints in underground cables may be provided in joint bays rather than cable pits. These joint bays are generally back filled with clean sand or other suitable material after the joints have been made. Access covers are not provided for joint bays. This document is not applicable to joint bays.

For more information about conducting safety risk management assessments when assessing requirements to be considered when designing and constructing cable pits, see RailCorp Safety Management System Element 6: Risk Management.

2 References

2.1 Australian and international standards

AS 1657:1992	*Fixed platforms, walkways, stairways and ladders – Design, construction and installation*
AS/NZS 1891.4:2009	*Industrial fall-arrest systems and devices Part 4: Selection, use and maintenance*
AS 2865:2009	*Confined spaces*
AS 3996:2006	*Access covers and grates*
AS 4799:2000	*Installation of underground utility services and pipelines within railway boundaries*

2.2 RailCorp documents

EP 20 00 00 03 SP	*Above ground cable installation systems*
EP 20 00 03 01 SP	*HV and 1500V dc cables – Joints and terminations*
EP 20 00 04 02 SP	*Underground installation configurations for high voltage and 1500 Vdc cables*
EP 20 10 00 02 SP	*High voltage cable*
EPD 0013	*Technical reviews*
EPE 0002	*Mains Installation (OHW, HV Aerial Lines, HV and 1500V Cables) – Design Competencies and Authorities*
ESC 540	*Service installations within the rail corridor*
ESM 102	*Communication Outdoor Cabling Standard*
SMS-06-FM-0038	*Confined Space Identification and Assessment Checklist*
SMS-06-GD-0035	*Confined Spaces*
SMS-06-PR-0240	*Working at Heights*
SMS-06-SW-0254	*Physical Restraint Systems (Anchorages)*
SPG 0705	*Construction of Cable Routes and Signalling Civil Works*
TMD 0001	*CAD and Drafting Manual*

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2.3 RailCorp drawings

EL 0024639 *Underground cables – Under track crossing arrangement*

2.4 Other references

NSW Occupational Health and Safety Regulation 2001

3 General

Cable pits are generally provided for:

- Cable joints
- Pulling of cables during installation

The requirements for cable pits are determined from the following considerations:

- Gradient and depth of the duct line
- Changes in route direction
- Maximum allowable pulling tension of the cable
- Minimum bending radii of cables
- Maximum length of cable on a drum
- Joints in cable
- De-rating of cables
- Protection of all cables in the same pit
- Construction and maintenance of the cable installation
- Cross bonding requirements, if any
- Provision for future cable installations
- Requirements of the Occupational Health and Safety Act and Regulation
- Water table levels
- Drainage arrangements
- Presence of other services in the vicinity, eg Signalling and Communication cable routes
- Vehicular and pedestrian traffic at the cable pit location
- Proximity to tracks

The internal surfaces of cable pits shall be smooth, chemically inert and as far as practical impervious to water.

4 Location

The location of cable pits shall comply with the requirements of *ESC 540* and *AS 4799*.

Cable pits shall not be located within three metres from the nearest rail of any track.

The design of cable pits shall be coordinated with that of the drainage system, as well as other services such as Signalling and Communication cable routes. Cable pits shall be designed and located such that access to other RailCorp infrastructure will not be impeded, unless prior agreement by the relevant maintainer has been obtained.

The standard RailCorp cable construction as set out in *EP 20 10 00 02 SP* is such that the cables are not suitable for immersion in water for extensive time periods. Cable pits shall therefore be designed so that the cables are at a level that is well above the water table. Information on relevant water table levels shall be provided by the Designer at or before the Preliminary Design Review.

Cable pits shall be located to allow for safe access of persons and plant to the pits for construction and maintenance of the cables in the pit.

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5 Confined space

As far as practical cable pits shall be designed so that they are not confined spaces. Refer to the NSW Occupational Health and Safety Regulation, *AS 2865, SMS-06-GD-0035* and *SMS-06-FM-0038* for the definition and identification of confined spaces. Where it is not practical to do so, the design and installation of the cable pit shall comply with the relevant requirements applicable to confined spaces. Hazards involved in working in a confined space should be minimised at the design stage and during the initial installation of equipment.

6 Cable entries and ducts

Cable entries or ducts entering the pit shall be in the form of a bellmouth, smooth and free of sharp edges to prevent damage to the cable during installation and subsequent operation of the cable.

Cable entries into circular pits shall be positioned to be tangential to the pit as shown in Appendix A.

Cable entries into rectangular pits shall be positioned to the side of the pit as shown in Appendix A.

Where ducts or ground line troughing enters a cable pit, the ducts or ground line troughing shall be encased in concrete for a distance of 300 mm from the pit to hold the ducts or ground line troughing securely in position.

The height of cable entries and ducts shall be such that the cable is at least 300mm above the floor of the pit at the entry.

Spare cable entries or ducts shall be provided for future use. The minimum number of spare entries or ducts for HV and 1500V dc cables shall be 30% of the total for each circuit. Where there are project specific requirements for additional spare cable entries or ducts that are not associated with any specific circuit, and unless otherwise specified, such cable entries or ducts shall be of the same size as the largest one provided for the pit.

Spare cable entries and ducts shall be provided at or above the same level as those housing cables.

Cable entries or ducts shall be sealed to prevent the ingress of soil, water and dangerous gases into the pit.

7 Dimensions

The pit shall be of sufficient size to provide a safe work and rescue environment under the Occupational Health and Safety Act for the activities to be performed in the pit.

The dimensions of a cable pit shall be suitable for the planned installation as well as designed future construction and maintenance activities. These should include, but not limited to

- Minimum bending radii consideration, including those for possible future cable installation utilising the spare ducts
- Space requirements for installation and maintenance of cable joints
- Allowance for future cable joints for repairs to the cable installation, if required by the maintenance strategy for future cable faults.

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8 Provision of support for cables and joints

The principles set out in document *EP 20 00 00 03 SP* shall generally apply to the support of cables within cable pits. Cables and joints within the pit shall be properly and securely supported by suitable cable cleats / clamps and permanent racking. Timber supports shall not be used.

9 Pulling eyes

Pulling eyes shall be provided as close as possible to the pulling alignment of the cable in all pits constructed for the purpose of pulling in cables. Pulling eyes shall be located as shown in Appendix A and shall:

- be suitably located opposite the cable entries or ducts in the pit wall to assist with the installation of cables
- have a safe working load not less than three (3) times the maximum allowable pulling tension of the cables to be installed

The safe working load of each pulling eye shall be clearly and permanently labelled on or adjacent to the pulling eye.

10 Access ladders

Access ladders complying with *AS 1657* shall be provided for entry to and egress from the pit. Clearance requirements around the access ladder shall comply with the requirements of *AS 1657*. Future cable installations utilising the spare cable entries and ducts shall be considered in determining the clearance requirements.

11 Fall arrest system

Where a fall arrest system is required during entry and egress, anchorage points suitable for attachment of two persons and complying with *AS/NZS 1891.4* and *SMS-06-SW-0254* shall be provided.

12 Pit covers and access covers

Removable covers shall be provided for all cable pits.

Cable pit covers and access covers shall be flush with the surrounding finished surface on platforms, access roads or other areas subject to pedestrian or road traffic. At other locations the top of the cable pit shall be 300 mm above the surrounding ground level to prevent the ingress of water and silt. Refer to section 4 for the requirements for cable pit locations,

Cable pit access covers may, in some instances, also be the cable pit covers. However on large cable pits it will be necessary to install access covers within the cable pit cover as the cable pit cover will be too large and heavy to be moved without cranes or other lifting equipment.

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Cable pit access covers shall:

- comply with *AS 3996*
- be removable without the need for lifting appliances such as cranes etc
- be of sufficient mechanical strength for the environment in which they are installed and loading conditions to which they may be subjected
- be designed to resist the ingress of water
- be vermin proof
- require the use of specialised tools, keys or locking systems to gain access to the cable pit

Cable pit covers and access covers located at trafficable areas within the rail corridor shall be designed for road vehicle loads in accordance with *ESC 540*.

13 Drainage

Adequate drainage shall be provided to discharge water from the pit. The arrangement shall be coordinated and integrated with the drainage system in the area. The drain shall be vermin proof.

Where it is impractical to provide drainage, the pit shall be provided with a sump suitable for the placement of a sump pump. The floor of the cable pit shall be suitably graded towards the sump. The minimum depth of the sump pit shall be 300mm.

14 Ventilation

The pit shall be designed to:

- avoid the build up of any contaminants or combustible atmospheres;
- facilitate the use of portable ventilating equipment by providing adequate access and ventilating openings in the pit cover

When the entire top area of the pit is not covered by cable pit access covers, two access openings shall be provided at diagonally opposite ends of the pit as shown in Figure 1 for safe access and ventilating purposes.

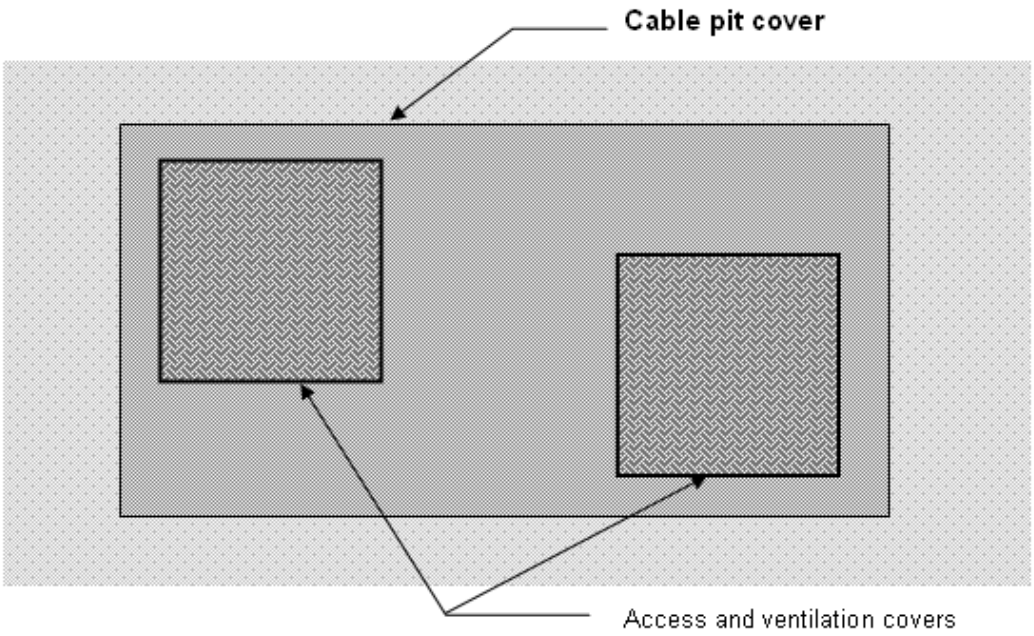

Figure 1 - Cable pit cover provided with access and ventilation openings.

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15 Identification of cables

All cables entering and exiting a pit shall be positively identified by corrosion resistant tags with the cable's owner, voltage and designated feeder number clearly shown by engraving or embossing. The tags shall be securely attached to the relevant cable with a corrosion resistant securing system.

All high voltage cables within shared pits shall be suitably identified as high voltage cable in a permanent manner, i.e. by binding the cable with a suitable plastic warning tape in accordance with the requirements of *SPG 0705*.

16 Other services in high voltage cable pits

Communication cables and high voltage and 1500V dc cables shall not be in the same pit. Refer to *ESM 102* for separation requirements between Communication cables and high voltage and 1500V dc cable pits.

The installation of low voltage and signalling cables with high voltage cables should be avoided. However, if it is necessary to locate all services in the same pit, the high voltage cable(s) shall be grouped and identified as specified in Section 15. Signalling or low voltage cables shall be physically separated by a continuous rigid barrier.

High voltage cable joints shall not be located in cable pits with signalling services, low voltage cables or other utility services.

Other services shall not be installed in high voltage and 1500V dc cable pits unless prior approval has been granted by the RailCorp Nominated Engineering Authority.

For the purpose of this section pilot wire and DTS fibre optic cables associated with a high voltage feeder are considered as part of the high voltage cables.

17 Signage

Suitable signs shall be installed in a prominent position where applicable:

- Confined space signage in accordance with *AS 2865*
- Fall arrest system anchorage points signage in accordance with *AS/NZS 1891.4*
- Safe working load of each pulling eye
- Warning sign for the presence of gas cables in the pit
- "Danger High Voltage" warning sign

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18 Design documentation

18.1 For Construction drawings

Design drawings for Electrical aspects of cable pits shall comply with *TMD 0001* Sections 1, 2 and 4, and include details of the following:

- Geographical location of the pit
- Drainage arrangements
- Plans and sections showing relevant dimensions
- Arrangement of cable entries and ducts, including duct sizes and identifications of cables in each duct
- Arrangement for segregation of services
- Arrangements for support of cables and joints
- Cable runs through the pit with bending radius for each cable
- Provision for access and egress
- Pulling eyes
- Anchorage for fall arrest systems, if applicable
- Signage

Structural design of cable pits shall be documented separately in another set of drawings complying with *TMD 0001* Sections 1, 2 and 3.

18.2 Other design documents

The Designer shall provide the following documents to support the design as shown on the For Construction drawings:

- Relevant water table levels at the cable pits (see section 4)
- Proposed maintenance strategy demonstrating the adequacy of the cable pit locations and dimensions for repairing future cable faults (see section 7)

The Designer shall provide other documents and calculations to support the design drawings as required by the RailCorp nominated engineering authority.

18.3 As built drawings

A full set of drawings, as listed in section 18.1 and showing the as-built configuration of the cable pit(s), shall be provided for acceptance by the RailCorp Nominated Engineering Authorities within 4 weeks of commissioning of any of the cables in the pit.

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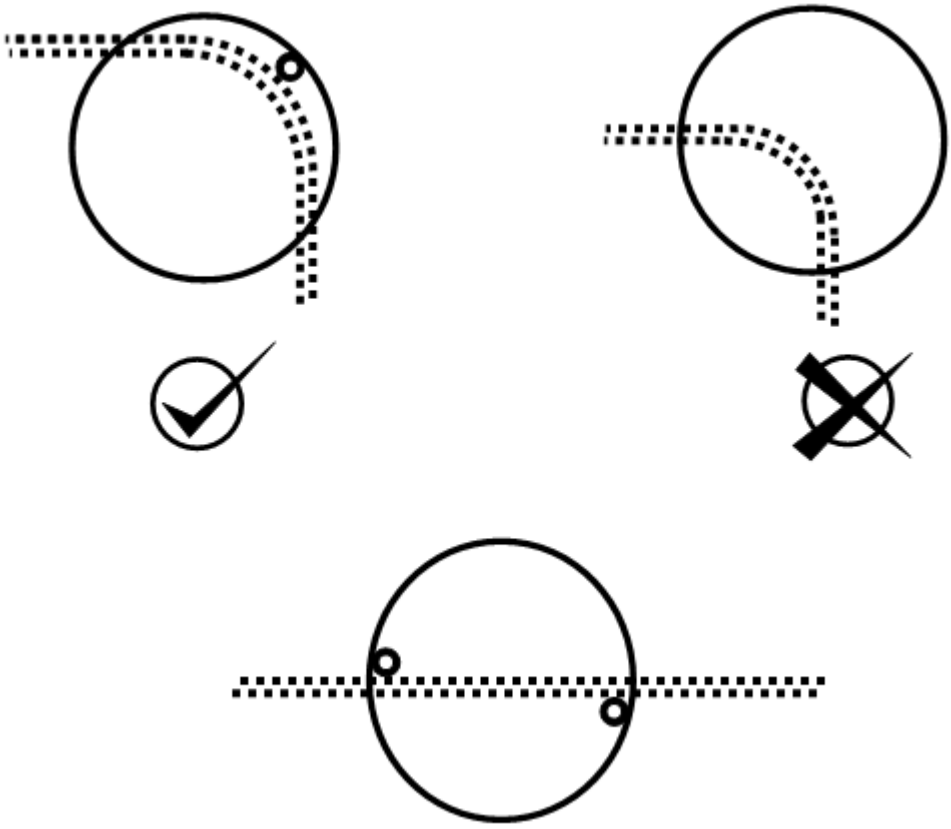
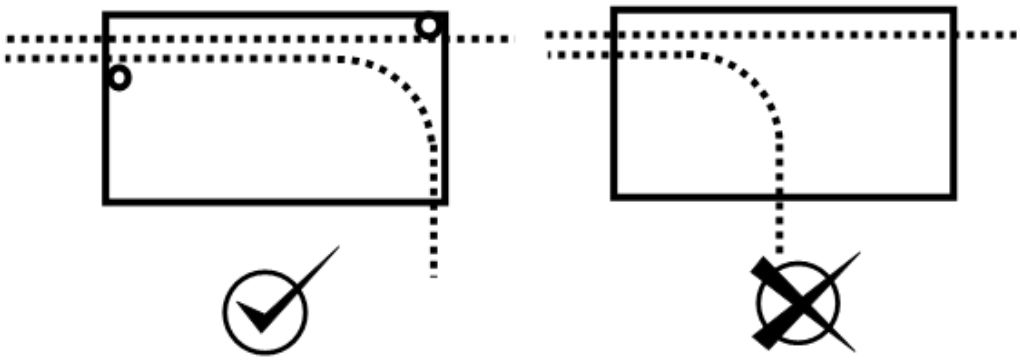
Appendix A Cable Layout Configuration in Pits

Circular Pits



Acceptable but not preferred. Rectangular pit is the preferred arrangement

Pulling eyes shall be installed opposite the cable entry and exit positions as indicated on the diagram by the symbol "**o**"

Rectangular Pits