VI040

Distribution Construction Standard

Indoor Substation – Ground Level Specification for Customer

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1. Supporting Documents – Substation Standard Construction Drawings

CitiPower/Powercor substation standard construction drawings for the various types of indoor substations are listed in Section D – Appendices of this specification document.

2. Scope

2.1. By taking into consideration each of those factors in the substation location and design, the customer is likely to address many of the key concerns that have been encountered by residents who occupy areas around the vicinity of the substation.

2.2. The content of this specification document is applicable to the requirements of a "Ground Level" indoor substation, and will assist a CitiPower/Powercor customer in the planning of a development that will require a ground-level indoor substation to be established on the property in order to meet the electricity supply requirements.

2.3. The ground-level indoor substation may be partly or completely within the customer's building or in a separate building on the property.

2.4. The construction of a substation is principally governed by the requirements of the "Electricity Safety (Networks Assets) Regulations 2009", other statutory authority requirements and the Building Code of Australia.

2.5. Information on the supply contract, supply and financial arrangements, site leases and registered easements is to be obtained from CitiPower/Powercor.

2.6. Timely advice will assist CitiPower/Powercor to organise the following so that supply can be provided by the required date.

- Outlining the substation and underground cable requirements.
- Assessing the impact of the development on the distribution system.
- Planning any associated work.

2.7. The building of the substation and compliance to the specification is the customer's responsibility.

2.8. The customer is responsible to provide the substation room which includes the following but not be limited to:

- The required floor area and design to install the electrical assets.
- The appropriate levels of ventilation, water tightness and fire proofing.
- The required access for both personnel and equipment into the substation room, and also to the substation room inside the building.
- The installation of a wall-mounted low voltage distribution switchboard to provide light and power to the substation room.
- The provision of a lease survey for the substation room.

2.9. Once the CitiPower/Powercor assets have been installed in the substation room, the following requirements shall be observed:

- The aspects of the substation room as mentioned in the above Sub-Clause 2.8 shall be continuously maintained by the customer.

  Note: Customer is responsible to provide continuous maintenance for all works initially carried out by the customer including but not be limited to: walls, ceiling, floors, doors, ventilation, monorail, EMF shielding, fire shutters, etc.
- There will be no access to the substation room to unauthorized personnel due to the danger associated with approaching live electrical apparatus except by appropriate arrangement with CitiPower/Powercor.

3. Requirements

3.1. This specification sets out CitiPower/Powercor's requirements for the design, construction, operation and maintenance requirements to assist architects, consulting engineers, property developers and property owners to establish a ground-level indoor substation on a customer's property.

3.2. The requirements are detailed into the following four sections:

Section	Section Topic	Brief Description
A	Substation Location	Understanding impacts that the substation has on its surrounding areas.
B	Construction Details	Substation design and construction to ensure access, operation and maintenance are not compromised.
C	Customer Connection	Detailing requirements and works that the customer must complete prior to substation handover to CitiPower/Powercor.
D	Appendices	Additional information and substation standard construction drawings to support and clarify the specification requirements.

3.3. For more information concerning any of the requirements for an indoor substation, please contact the CitiPower/Powercor representative.

4. Definitions

Terms	Description
Customer	The person or body requires electricity to be made available.
"Lock-In" Building Drawings	Drawings from customer providing design and construction details for the substation building and related work.
CitiPower/Powercor Representative	The officer nominated by CitiPower/Powercor responsible for various stages of project, including negotiating the supply arrangement, coordinating the design of the substation, coordinating of all the works associated with the substation construction and equipping of the substation.
Point of Supply	As defined in the Service and Installation Rules, the point of supply is the point: • At which responsibility for the conveyance of electricity within the property passes from CitiPower/Powercor to the customer. • The location of which is nominated in the supply contract between CitiPower/Powercor and the customer.

Wiring Rules	Standard AS/NZS 3000 Electrical Installation (known as the Australian/New Zealand Wiring Rules).
Dead	As defined in the VESI Green Book, "DEAD" – Isolated and at Earthed Potential.
Substation	The ground-level indoor substation to which this specification applies.
Transformer	An apparatus with 2 windings to transform a high voltage system to a low voltage system at the same frequency for the purpose of transmitting electrical power.

5. Australian & IEC Standards, Rules and Regulations

Unless stated otherwise, the substation shall be designed, constructed and tested in accordance with the current issue (including amendments) of the following Australian & IEC Standards, Rules and Regulations.

Standard	Title
AS ISO 1000	The International System of Units (SI) and its Application.
AS/NZS 1100	Technical Drawings – Parts 1 to 5.
AS/NZS 1102	Graphical Symbols for Electro-Technical Documentation – Parts 1 to 12.
AS/NZS 1170	Structural Design Actions – Parts 0, 1 to 4.
AS 1319	Safety Signs for Occupational Environment.
AS 1324	Air Filters for use in General Ventilation and Air Conditioning – Parts 1 & 2.
AS 1418	Cranes, Hoists and Winches – Parts 1 to 19.
AS 1530.4	Method for Fire Tests on Building Materials, Components and Structures – Fire Resistance Test of Elements of Construction.
AS/NZS 1554	Structural Steel Welding – Parts 1 to 7.
AS/NZS 1580	Paints and Related Materials – Methods of Testing – All Parts.
AS 1824	Insulation Coordination – Parts 1 & 2.
AS/NZS 1866	Aluminium and Aluminium Alloys – Extruded Rod, Bar, Solid and Hollow Shapes.
AS 1905.1	Components for the Protection of Openings in Fire-Resistant Walls – Fire Resistant Door Sets.
AS 1940	The Storage and Handling of Flammable and Combustible Liquids.
AS/NZS 2053	Conduits and Fittings for Electrical Installations – Parts 1 to 8.
AS 2067	Substations & High Voltage Installation Exceed 1kV AC.
AS 2293.1	Emergency Escape Lighting and Exit Signs for Buildings.
AS/NZS 2310	Glossary of Paint and Painting Terms.
AS 2550	Cranes, Hoists and Winches – Safe Use – All Parts.
AS 2700	Color Standard for General Purpose.
AS/NZS 3000	Electrical Installation (known as the Australian/New Zealand Wiring Rules).
AS/NZS 3008.1.1	Electrical Installations – Selection of Cables – Cables for Alternating Voltages up to and including 0.6/1kV – Typical Australian Installation Conditions.
AS/NZS 3190	Approval and Test Specification – Residual Current Devices (Current Operated Earth Leakage Devices).
AS 3600	Concrete Structures.
AS/NZS 3678	Structural Steel – Hot Rolled Plates, Floor Plates and Slabs.

Standard	Title
AS/NZS 3679	Structural Steel - Hot Rolled Bars and Sections and Welded I Sections (Parts 1 & 2).
AS 4254	Ductwork for Air-Handling Systems in Buildings (Parts 1 & 2).
AS/NZS 4600	Cold-Formed Steel Structures.
AS/NZS 4680	Hot-Dip Galvanized (Zinc) Coatings on Fabricated Ferrous Articles.
AS/NZS ISO 9001	Quality Management Systems – Requirements.
AS/NZS ISO 31000	Risk Management – Principles and Guidelines.
IEC 61914	Cable Cleats for Electrical Installations
BCA	Building Code of Australia.
SIR	Victorian Electricity Distributors Service Installation Rules.
S.R. No. 164/2009	Electricity Safety (Network Assets) Regulations 2009.

6. Compliance, Referenced Documents, Standards & Codes

6.1. The Australian & IEC Standards, Rules and Regulations as mentioned above shall be read in conjunction with this Specification. When an Australian & IEC Standards, rule or regulation is superseded by an approved revision, the latest revision shall apply.

6.2. The Australian & IEC Standards, Rules and Regulations as mentioned above set forth the minimum requirements which may be exceeded by the customers.

6.3. In addition to those mentioned Australian & IEC Standards, Rules and Regulations, the customer shall comply with all the applicable Federal, State and local laws, codes, regulations, status and ordinances pertaining to the construction of the substation as described in this specification.

6.4. CitiPower/Powercor shall have the option in incorporating requirements or changes resulting from changes in the codes, standards and regulations between the date the supply contract is signed and the date the customer initiates design works. It shall be the customer's responsibility to notify CitiPower/Powercor of any changes and the effect on the design of substation construction as a result of these changes.

6.5. In the event of any apparent conflict amongst the Australian & IEC Standards, Rules, Regulations, codes, and/or this Distribution Construction Standard Specification, the customer shall refer such conflict to CitiPower/Powercor in writing for clarification and resolution.

6.6. If any other Australian and IEC Standards apply to the substation works, then the customer must provide in their proposal full details of any aspects in which the requirements are less stringent than those nominated in the Australian and IEC Standards.

6.7. Where no appropriate Australian, International or other National Standards exists, then substation works shall comply with recognized standards of good practice. A copy of such standards in English shall be submitted.

7. Section A – Substation Location

7.1. Site Location Decision

7.1.1. The decision on where a substation is to be located within a building shall take into consideration some very important issues such as:

- Understanding the possible impact on areas adjacent to, above and below the substation.
- Personnel and equipment access to the substation.
- The surrounding environment.

7.1.2. To assist with the decision, close liaison with CitiPower/Powercor representative is strongly recommended when selecting a site within the property for installation of a ground-level substation.

A number of factors outlined in Clauses 7.2 and 7.3 shall be taken into consideration before proceeding with detailed works.

7.1.3. Careful planning and consultation with CitiPower/Powercor at an early stage of customer development will benefit both customer and future occupiers that require electricity at the customer's developed premises.

7.2. Substation Location

7.2.1. CitiPower/Powercor prefers ground-level indoor substations to be located with direct access and natural ventilation from the street.

7.2.2. The location shall comply with Standard AS 2067 – Appendix C – Figure C5 to the requirements on fire risk zones to adjacent buildings.

7.2.3. Substation rooms located below the flood level will not be accepted.

7.3. Site Selection Criteria

There are a number of key factors to consider when selecting the substation site, including the usage of the surrounding areas when dealing with the following:

7.3.1. Electric and Magnetic Fields (EMF)

7.3.1.1. Electric and magnetic fields (EMF) exist wherever electricity is used.

Electric fields are produced by the system voltage and magnetic fields are by the flow of electricity (current) in a conductor.

Magnetic Fields are measured in units of milligauss (mG) and the field strength reduces rapidly with increasing distance from the source.

7.3.1.2. Electric fields are generally contained within the substation by the use of appropriately insulated or metal-enclosed switchgear.

Magnetic fields from equipment and cables within a substation are unlikely to be contained by the substation enclosure, unless special precautions such as shielding are installed by the customer.

7.3.1.3. Sensitive computer and electronic equipment have been found to be susceptible to magnetic field levels as low as 5mG.

7.3.1.4. CitiPower/Powercor is not aware of any conclusive scientific evidence that proves a causal link between low level power frequency EMF and harm to human health. However in 2001, the International Agency for Research on Cancer (IARC), a part of the World Health Organisation, has classified EMF as a "possible carcinogen".

7.3.1.5. The Energy Networks Association (ENA) is the national voice for members of the electricity supply industry in Australia.

Detailed information on EMF, including research on the health effects from exposure to these fields, can be obtained from the ENA via their website www.ena.asn.au or from the Australian Radiation Protection and Nuclear Safety Agency via their web-site www.arpansa.gov.au.

7.3.1.6. The ENA recommends that its members act prudently when they design and operate their electricity generation, transmission and distribution systems.

Prudence embraces a range of actions which it is sensible to take having regard to the current state of scientific research into the subject.

CitiPower/Powercor has adopted the policy of prudent avoidance.

7.3.1.7. The customer's location choice for CitiPower/Powercor's substation and its proximity to people and equipment are critical issues in relation to observing the principles of prudent avoidance.

7.3.1.8. If there are any concerns regarding the EMF matter, customer is encouraged to discuss with CitiPower/Powercor representative at the initial negotiation and design stage.

Electro-magnetic field mitigation is difficult and generally very expensive once the indoor substation has been constructed.

Loads containing high harmonic content increase the difficulty in minimising EMF.

7.3.2. EMF Prudent Avoidance – Substation Design

7.3.2.1. Customer can assist to observe the principles of prudent avoidance by providing a substation enclosure of sufficient size and appropriate shape for the construction of CitiPower/Powercor's standard substation.

7.3.2.2. CitiPower/Powercor's standard substation design focuses the sources of electromagnetic fields towards the middle of the substation.

In limiting EMF, size and shape of the substation are the critical factors. Careful consideration must be taken with how and where the substation, mains cabling and other associated electrical plant are installed.

7.3.2.3. CitiPower/Powercor standard substation designs can be obtained from CitiPower/Powercor representative.

Any deviations to the CitiPower/Powercor standard substation design will require approval from CitiPower/Powercor representative, and will incur extra costs to be borne by the customer.

7.3.3. EMF Prudent Avoidance – Substation Location

7.3.3.1. Customer can also assist to observe the principles of prudent avoidance in its allocation of space for the substation.

7.3.3.2. In particular to limit interference to computer equipment, customer is to allocate an area within the building that is clear from electronic equipment for a distance of 10 metres in any direction from the substation.

The clear area is recommended as standard substation designs do not generally limit the magnetic fields to levels as low as 5mG. Modern electronic equipment such as personal computers has been found to be susceptible to these low levels.

7.3.3.3. If the customer cannot provide the clear area, EMF interference may be reduced by installing appropriate shielding to the substation.

Such shielding installation shall be checked and agreed by CitiPower/Powercor on whether its installation would have an adverse impact on the operation of CitiPower/Powercor's substation.

In addition, the cost for the shielding design, installation and effectiveness will be the responsibility of the customer.

7.3.3.4. Any computer modelling, calculation and analysis of EMF emission for shielding purposes shall be the responsibility of the customer, and shall be based on 100% utilisation of the substation ultimate capacity.

7.3.3.5. Customer must comply with the electromagnetic shielding requirements as contained in the Appendices of this specification.

7.3.4. Substation Lease

7.3.4.1. Both CitiPower and Powercor networks shall require a lease and easements of the area of the land where the indoor substation and electricity cables are located.

7.3.4.2. A copy of the CitiPower or Powercor current standard lease is available from your CitiPower/Powercor representative.

7.3.4.3. When a supply offer is made to a customer, the offer shall include the relevant lease document to be signed by the land owner.

7.3.4.4. The standard lease from both CitiPower and Powercor networks contains the following clause that require:

- The land-owners to indemnify CitiPower/Powercor for losses arising out of any damage to property or business caused or contributed by electromagnetic (EMF) interference or other emanation from the property.

The land-owners shall be aware and cautious of the possible interference that EMF emanating from electricity assets that may cause to sensitive computer equipment.

Changes in the location for the sensitive computer equipment may reduce or eliminate the EMF interference as the strength of the EMF reduces dramatically with increasing distance from the source.

7.3.5. Substation Leased Area

The minimum substation leased areas required for CitiPower and Powercor indoor ground level substations without the cable easement areas are detailed below.

CitiPower/Powercor substation standard construction drawings for the respective types of indoor ground level substations are listed in the appendices of this specification.

Substation	Room Size (mm)		Substation Location	Substation Ventilation	LV Board Type	Sub/Stn Standard Constr. Drawings
1 x 500kVA	W	3,000	Facing the street to open air	Natural (louvered metal doors)	Wall mount fuse strips	VI040 - Appendix 2
	L	7,000				
	H	3,000				
1 x 2000kVA	W	4,800	Facing the street to open air	Natural (louvered metal doors)	Stand alone modular board	VI040 - Appendix 3
	L	8,500				
	H	3,500				
1 x 2000kVA	W	4,800	Inside a building	Fan forced ducted to outside air	Stand alone modular board	VI040 - Appendix 4
	L	8,500				
	H	3,500				
2 x 2000kVA	W	9,800	Inside a building	Fan forced ducted to outside air	Stand alone modular board	VI040 - Appendix 5
	L	9,000				
	H	3,500				
3 x 2000kVA	W	9,800	Inside a building	Fan forced ducted to outside air	Stand alone modular board	VI040 - Appendix 6
	L	13,000				
	H	3,500				
1 x 500kVA	W	3,000	Inside a building	Fan forced ducted to outside air	Wall mount fuse strips	VI040 - Appendix 7
	L	7,000				
	H	3,000				
2 x 2000kVA	W	9,800	Facing the street to open air	Natural (louvered metal doors)	Stand alone modular board	VI040 - Appendix 8
	L	9,000				
	H	3,500				

7.3.6. Additional High Voltage Reticulation Costs

When the distance between the property boundary and the substation enclosure is greater than 5 metres, CitiPower/Powercor will impose a charge for additional high voltage mains.

7.3.7. Access Requirements

7.3.7.1. CitiPower/Powercor personnel require unhindered access to the substation and associated mains at all times from the date of handover.

7.3.7.2. Customer shall provide access details such as keys and key codes etc prior to connection of supply, and shall inform CitiPower/Powercor in the event the access details are altered thereafter the supply connection.

7.3.7.3. Vehicle and equipment access to the substation shall be available to CitiPower/Powercor at all times to address faults in the substation.

7.3.7.4. With the transformer being the largest and the heaviest item in the substation, the following minimum requirements shall be implemented for transformer accessibility and manoeuvring.

- A double door access directly at the ground level from the street to enable the transformer to be placed outside the substation by crane, winched and slid into final position inside the substation.
- Pulling eyes inside the substation for winch application.
- A 6.2 metre turning circle at the front of the substation for the mobile crane to navigate around corners.
- A carriageway easement of 5,000mm (h) x 4,000mm (w) at the front of the substation for the transformer movement from the street to the substation location.
- Where there is no concrete foot path, driveway or building foundation available to support the load, a 2,450mm x 2,500mm concrete landing pad shall be designed and constructed to handle equipment weight of 8,000kg.

7.3.8. Hazardous Locations

CitiPower/Powercor's substation access routes must not be within an area which is classified as a Hazardous Area as specified in the Standard AS 3000 - Australian/New Zealand Wiring Rules.

7.3.9. Fire Segregation

Where a substation is located within a building, a 2 hour fire rated enclosure and a Fire Retention Level (FRL) of not less than 120/120/120 to the requirements of the Building Code of Australia must be provided.

Fire risk zones for substations shall be in accordance with Standard AS 2067.

7.3.10. Noise

7.3.10.1. The Environmental Protection Authority (EPA), local councils and other authorities will have jurisdiction to ensure that noise originating from any premises is not the cause of reasonable complaint.

7.3.10.2. Transformers emit a constant low pitched hum at 100HZ fundamental noise frequency.

7.3.10.3. Special precautions in siting and/or construction may be necessary, particularly in locating ventilation panels and fans so as to limit noise emission if existing or prospective residential development is within the vicinity of the substation.

7.3.10.4. The maximum air bound noise emitted by either oil or dry type transformers shall be to the "Sound Power Level" as listed below.

These levels are in accordance with the "Sound Power Standard Limit" specified in Figure ZA1 of the Standard AS 60076.10 – Power Transformers – Determination of Sound Levels.

Transformer Size (kVA)	Sound Power Level (dBA)
500	61.5
750	64
1000	66
1500	68
2000	70

7.3.10.5. The above-mentioned sound power levels may exceed the limits as defined in the State Environment Protection Policy N–1 (SEPP N–1, Control of Noise from Commerce, Industry and Trade).

7.3.10.6. Customer is responsible for the design and construction of the substation to ensure that noise does not exceed the limits as defined in SEPP N–1 and shall not be a source of complaint.

7.3.10.7. Consideration shall be given to the use of surrounding areas which will have impact on the permissible noise level.

Measures such as installation of baffle walls or noise attenuating devices can be utilized on the proviso that such measures do not interfere with the maintenance or operation of the substation.

7.3.10.8. Ventilation fans are a source of noise and need to be silenced by attenuator attachments and baffles.

Ventilation fans installed in the substation must not exceed the sound power level of 39 dBA when measured outdoors nominally 6 metres from the substation ventilation inlets and outlets to ensure compliance to SEPP N–1 requirements.

The attenuator attachment can protrude substantially within the substation. Consequently the dimensions of the substation may need to be increased to compensate for this protrusion.

Size and position of fans within the substation must be acceptable to CitiPower/Powercor.

7.3.11. Foundation Requirements

7.3.11.1. The substation must be constructed on a stable foundation which bears on soil or another part of a building.

7.3.11.2. Where the foundation bears on soil, the soil must be clear of any obstruction or rubble which may interfere with the installation of the earthing electrode system through the substation floor.

7.3.11.3. Cable trenches are required to be constructed into the floor of the substation and can affect the clear head room of any floor below the substation.

7.3.12. Avoidance of Services and Encroachments

7.3.12.1. The substation enclosure must be free of encroachments into the required floor and cable trench or cable pit areas.

7.3.12.2. Columns, beams, footpads and walls may occupy certain areas specifically shown on the substation plans on the proviso that they do not interfere with the location of consumer mains, conduits, trenches or pits, ventilation ducts and substation equipment.

7.3.12.3. The location of the substation shall not allow services such as drains, sewers, piping and wiring to pass through the following:

- Substation space.
- Access passageways.
- Ventilation ducts.
- Substation walls.
- Substation floors.
- Substation ceiling.

7.3.12.4. The space next to all substation access doors and ventilation ducts must be kept clear at all times.

7.3.13. Water Tightness

7.3.13.1. The enclosure housing the substation equipment shall be water tight to protect all equipment within the substation which may be subject to risk of damage from exposure to water or dampness.

7.3.13.2. CitiPower/Powercor will not accept handover of the substation enclosure or install equipment if there is water or water leakage within the substation.

7.3.13.3. Detailed requirements on “Waterproofing” are set out in Section B of this specification.

7.3.14. Area Drainage

7.3.14.1. The area in which the substation is to be located must be risk free of flooding and storm water damage.

7.3.14.2. Any drains provided for storm water discharge must be maintained in working order by the customer.

7.3.15. Ventilation

7.3.15.1. Natural Ventilation

- Substations require ventilation to dissipate heat losses from the electrical equipment.
- Natural air flow directly to the outside of the building is preferred.

  This requirement generally incorporates weather and vermin proof louvered ventilators.

  Air inlets and outlets must be arranged to achieve an even distribution of air flow over the transformers.

7.3.15.2. Forced Ventilation

- Substations within buildings where natural ventilation is not practical shall be designed with forced air cooling controlled by a thermostat.
- The forced ventilation system shall be designed to achieve an even distribution of air flow over the transformers.
- Exhaust air from the substation shall be ducted independently and vented directly to the outside air.
- Shutters included in all ventilators shall be 2-hour fire-rated.
- All the ventilation ducts and louvre panels within the substation shall have the same fire rating as the substation enclosure.
- All ventilation fans must be the internal mounted type. External mounted type exhaust fans are not acceptable.
- The provision and installation of the cooling system is the responsibility of the customer.

  Drawings showing the mechanical ventilation within the indoor substation must be submitted to CitiPower/Powercor for approval.

  This is to ensure there is no encroachment between the customer's ducts, fans etc. and CitiPower/Powercor's electrical equipment.

7.3.16. Access Door Protection from Vehicles

7.3.16.1. The customer must ensure that equipment and personnel access doors shall be protected from damage by vehicles.

7.3.16.2. The protection may be in the form of bollards, which can be removable and consisting of 150mm diameter concrete–filled steel water pipes set in concrete to a depth of 600 mm, and with 1200mm above the pavement.

7.3.16.3. Alternatives that will provide equivalent protection, such as 230mm high kerb, will also be considered.

Where the location is such that there is a risk of vehicles backing up to the kerb, there must be not less than 1500 mm of clearance between the kerb and the part of the substation requiring protection.

7.3.17. Future Site Development

Substation locations which restrict future development of the site should be avoided.

Relocation of the substation equipment and electrical cables will be extremely costly to the owner of the premises.

In addition future site development shall not encroach onto the agreed access way to the indoor substation.

8. Section B – Construction Details

8.1. General Construction Requirements

The construction requirements incorporated in the CitiPower/Powercor substation standard construction drawings for substations are designed and constructed to comply with the relevant clauses of the Electricity Safety (Network Assets) Regulations 2009 and Building Code of Australia.

These requirements are summarized below:

- Protection of vulnerable portions of the customer's premises from damage which may occur in the event of failure of an oil–filled transformer.

  The walls, ceilings and any ventilation ducts must have an adequate degree of strength and a fire-rating of at least 2 hours where they are the means of separation from the interior of a building.
- The use of 'spray on' materials to achieve the fire rating shall not be permitted within the substation.
- The use of 'spray on' materials to achieve water tightness shall not be permitted within the substation.
- Protection of substation equipment and mains from fire and water sources originating outside the substation.
- High reliability in the precautions taken to ensure dry wall and floor conditions.
- 110% oil containment to the requirements stipulated in the Environment Protection Authority (EPA) and Standard AS 1940.
- High reliability in the drainage precautions.
- Suitability of the floor to support heavy equipment.
- Suitability of walls and ceilings to support equipment requiring heavy–duty fixings.
- Suitability of the floor, walls, ceiling and roof materials, joints and construction methods to provide a reliable water tight construction.
- Suitable proofing of the substation against the entry of vermin, vandal and unauthorized personnel.
- Safe access and exit for CitiPower/Powercor personnel in the event of an emergency.

8.2. Walls and Ceilings

Irrespective of whether the substation is within or external to the building, the construction requirements and principal materials for the walls and ceilings must comply with the 2 hour fire rating criteria as specified in the Electricity Safety (Network Asset) Regulations 2009 and Building Code of Australia, and to the following requirements.

8.2.1. The substation enclosure walls shall be of concrete or brick construction.

8.2.2. The substation ceiling shall be of concrete construction.

8.2.3. The substation wall footings must be suitable for supporting the roof, walls, cable trenches or cable pits and floor.

8.2.4. General requirements for walls and roofs are:

- Walls must have sufficient structural strength to support the weight of any equipment mounted on it without collapsing, and shall be designed and constructed to support a maximum 4 point load of 500kg.
- Roof must have sufficient structural strength, and shall be designed and constructed to withstand 200kg load at any point.

8.2.5. Acceptable principal materials are:

- Double clay brick:

  Minimum of 230mm thickness and with inner leaf of solid pressed type – half bond, cement mortar.

- Solid dense concrete block in accordance with the building regulations:

  Minimum of 150mm thickness for a single leaf construction, or
  Minimum of 230mm thickness for cavity construction,

- Precast high density reinforced concrete panels:

  Minimum of 125mm thickness and a minimum 25mm cover over the reinforcing grid. The reinforcing grid shall have a maximum of 200mm centres in each direction.

  If the cover over the reinforcing is less than the minimum 25 mm, the minimum thickness of the panel shall be 150mm.

- Cast in situ reinforced concrete:

  Minimum of 150mm thickness.

All principal materials shall be new and shall comply with the appropriate Australian Standards.

8.2.6. For concrete slab construction, the gaps between adjacent slabs and between slabs and ceiling must not exceed 25mm.

Gaps shall be filled and sealed with approved fire resistant materials.

Slabs shall be secured to each other and to all corners, floor and ceiling intersection points.

8.2.7. If the wall incorporates a steel section structural column, the steel must have a minimum cover of 50mm thickness of solid clay brick or concrete blocks, or 38mm thickness of cast in situ reinforced concrete.

8.2.8. For walls exposed to weather or below the ground level, a cavity construction shall be used with the level of the lowest point of the cavity below the floor level.

Walls shall be water-proofed to ensure dry walls and floor conditions.

8.2.9. At the openings in the cavity walls for doors, ventilators, cables and services, the cavity openings shall be sealed all the way around with a minimum 3mm thick galvanized mild steel plate to restore the 2 hour fire rating.

8.2.10. Hollow and lightweight concrete blocks or perforated bricks can be used on the internal wall of the substation on the condition that they are concrete filled.

8.2.11. The finish of the internal walls must be clean and smooth and must be painted with two coats of white acrylic paint applied to the paint manufacturer's specification.

8.3. Floors

8.3.1. The substation floor including chases, water–proofing membranes, steps, thresholds, undercuts, trenches, pits, pockets and recesses shall be formed in the positions and to the details shown in the CitiPower/Powercor substation standard construction drawings and specification.

8.3.2. The standard construction assumes that the substation floor sits on a suitable stable base.

Alternatively, a suspended slab construction to CitiPower/Powercor standard construction drawings may be used on the condition that the conduits are encased in concrete and the construction is suitable to carry the equipment loadings.

Structural computations for both standard and alternative options must be carried out by a qualified and practicing structural engineer. One copy of the structural drawings shall be submitted to CitiPower/Powercor representative for approval.

8.3.3. The substation floor must be suitable for carrying a transformer load of 8,000kg on 4 points.

Refer to CitiPower/Powercor substation standard construction drawing for the number of transformers in close proximity.

8.3.4. The floor must have a level steel-trowel finish to the following tolerances, unless otherwise specified on the CitiPower/Powercor substation standard construction drawings:

- ± 2.0 mm over any 1500 mm diameter circle and,
- ± 4.0 mm over the entire floor.

8.4. Transformer Landing Area

8.4.1. A transformer landing area shall be provided in all cases with the exception where the substation front is directly on to a public access way or road. In this exception case, a specially designed crossover may be required.

8.4.2. The transformer landing area shall be constructed with reinforced concrete and must have the same load bearing characteristics as the substation floor.

8.4.3. The minimum size of the landing area shall be 2500 (W) x 2450 (L) mm, and shall be located immediately in front of the transformer access doors.

8.4.4. The landing area shall be level and shall be at the same relative level as the substation floor to allow equipment to be rolled into the substation directly from the landing area.

8.5. Trenches & Trench Covers

8.5.1. Trenches are applicable for substations up to 500kVA capacity.

8.5.2. The trench wall must be able to support transformer loads applied to the substation floor within 300 mm of the cable trench.

8.5.3. Trenches must be watertight and must not be connected to the outside drainage system.

8.5.4. Grid type covers manufactured from galvanized steel, aluminium or other approved material must be provided and installed on all trenches as specified on CitiPower/Powercor substation standard construction drawings.

Covers must be suitably constructed to support pedestrian traffic.

Covers must be suitable for supporting equipment masses mounted or moved on it, as specified on CitiPower/Powercor substation standard construction drawings.

8.5.5. The trench cover when laid across the trench shall be flush with the surrounding floor level.

The minimum rebate width required to support the trench cover shall be in accordance with the supplier's recommendation.

The trench cover shall fit snugly into the rebate so that there is negligible sideways movement.

8.5.6. Trench covers must be divided into sections of maximum 1 metre length. Each trench cover shall not weigh more than 20kg.

8.5.7. Solid chequer plate type covers are not acceptable.

8.6. Waterproofing

The substation must be constructed using reliable waterproofing materials and construction methods, and site drainage to protect the substation equipment against exposure to dampness and water throughout the life of the substation.

All ground level substations shall include but not be limited to the following means of protection against water ingress:

- Use of site drainage.
- Use of waterproof construction materials and methods.

8.6.1. Site Drainage

8.6.1.1. The site shall be effectively drained to keep the area outside the substation freely drained and dry.

8.6.1.2. The siting of the substation with its floor level below the level of the building storm water sump/pump system will not be accepted.

8.6.1.3. Storm water drainage systems shall be designed and provided to industry best–practice standards.

8.6.1.4. Water drainage medium shall be provided at the back of all walls and connected to storm water or sump/pump system.

8.6.1.5. Site drainage shall be maintained in working order by the customer.

8.6.2. Use of Waterproof Construction – Materials

At all stages of the substation construction, waterproof durable materials shall be used. Examples include, but shall not be limited to:

- Tanking of bunded roof slabs over substations (including in–situ testing).
- Full grouting and sealing of any ground anchorages exposed within the substation.
- Cable duct penetration through walls.
- Bolts, fixings and internal steelwork – hot dipped galvanized or approved equivalent to provide long term durability of the substation for the following applications:
  - Cast penetration tube in the wall at the time of wall construction including flange and hydro-seal cast into the wall.
  - Where holes are drilled into the wall after construction, seal inside and outside of wall with injected epoxy waterproofing sealant.
  - Seal the inside of the cable duct between the cable duct and the cable conduit with waterproofing compound.

8.6.3. Use of Waterproof Construction – Methods

8.6.3.1. Industry best practice construction methods shall be used at all times to ensure the substation is waterproof. Examples include but shall not be limited to:

- Roof slab – provide minimum falls, tank, and drain low points to storm water.
- Brick or block walls – provide damp proof courses.

8.6.3.2. All necessary horizontal and vertical damp courses must be provided and the substation room shall have dry wall, floor and ceiling conditions before acceptance for installation of substation equipment.

8.6.3.3. The waterproofing of the room, the entrance and exit passageways must not be impaired by the drilling for and the fixing of expansion bolts to the walls, floors or ceilings.

8.6.3.4. CitiPower/Powercor shall seal all cable conduits.

8.6.4. Door Bunding Details

8.6.4.1. Bunding shall comply with the requirements stipulated in the Environment Protection Authority (EPA) and Standard AS 1940.

8.6.4.2. The substation door bund shall be manufactured from galvanized steel channel and sealed with a waterproof sealant to ensure that water is prevented from entering the substation and transformer oil is prevented from escaping from the substation. The construction is shown in the CitiPower/Powercor substation standard construction drawings.

8.7. Ventilation

8.7.1. General

8.7.1.1. Substation ventilation requires special attention to dissipate heat losses from electrical equipment.

Wherever possible, natural air flow to the outside of the building shall be used.

Where natural ventilation is not practicable, forced ventilation shall be used.

Forced ventilation by means of fans must be designed, supplied and installed by the customer to CitiPower/Powercor's requirements.

8.7.1.2. In either case, the ventilation must be designed to maintain a maximum temperature rise of 15°C above the ambient temperature inside the substation when transformers are operating at nameplate rating.

Air inlets and outlets must be arranged to achieve an even distribution of air flow over the transformers.

The maximum temperature inside the substation shall not exceed 40°C.

Note:
Heat losses dissipating from each distribution transformer up to 2MVA are approximately 25kW.

8.7.1.3. Substantial separation is required between inlet and outlet openings for effective cross-flow.

8.7.1.4. Inlet and outlet openings should preferably be clear of pedestrian areas and must be located to prevent entry of noxious gases such as vehicle exhausts, oil heater fuel exhausts, refrigeration plant gas discharge valves, pollutants such as smoke, soot, dust, ash etc.

8.7.1.5. Air being removed from the substation must be directly and independently ducted to the outside air.

8.7.2. Natural Ventilation

8.7.2.1. Natural ventilation is the preferred method to ventilate the substation.

8.7.2.2. The position of the vents must be directly to the outside air.

8.7.2.3. To achieve effective natural ventilation, the customer shall install vermin and weather proof louvered vents on the substation wall. The vents shall be of a design specification as shown in the CitiPower/Powercor substation standard construction drawings.

8.7.2.4. The areas outside the louvered vents must not be subjected to fire risk, and all louvered vents other than doors vents must be fitted with fire shutters.

8.7.2.5. Fire damper installation will not be required on wall penetrations for ventilation ducts if the fire risk zone on the outside area of the vent opening

is a minimum 2.0 metres radius from the vent as illustrated in the CitiPower/Powercor Drg. No. SCD04/01/1.

8.7.2.6. Weatherproof roof vents may also be specified where the roof of the substation is external.

It is important for where roof vent are installed, that the roof vents are fixed securely to the rod purloins.

8.7.3. Forced Ventilation

8.7.3.1. Natural ventilation will not be suitable where the substation is totally enclosed within the building. The suitable alternative is to install fan forced ventilation within the substation.

8.7.3.2. The forced ventilation system shall be designed such that an even distribution of air shall flow over the transformers.

8.7.3.3. CitiPower/Powercor representative will specify the location of the ventilating duct openings and the air flow required.

8.7.3.4. The forced ventilation system comprising fans, ducting, inlet and outlet vents, control devices and fan control wiring shall be designed, supplied and installed by the customer.

Air flow through the ventilation will be checked by CitiPower/Powercor representative before final approval is given.

8.7.3.5. In all circumstances, the fans must be installed inside the substation and all control wiring shall be contained within the substation.

8.7.3.6. Fans can be installed at roof level to extract air out of the substation or installed at floor level to supply air into the substation. Fans installed at roof level are the preferred arrangement.

8.7.3.7. To comply with the State Environment Protection Policy N-1 (SEPP N-1) on noise limits when located close to residential premises, fans installed in the substations must not exceed the sound power level of 39dBA when measured outdoors nominally 6 metres from the substation ventilation inlets and outlets.

8.7.3.8. The outlet ventilation shall be discharged independently and directly to open air.

8.7.3.9. All vents shall be fitted with fire shutters.

8.7.3.10. Fire dampers shall be installed on wall penetrations where ventilation ducts enter or leave the substation.

8.7.3.11. Substation ventilation ducts must not contain other services, give access to other portions of the building or form part of the ventilation system for the building.

8.8. Fire Containment & Prevention

CitiPower/Powercor's substation is designed to contain any products of a fire within the substation enclosure.

Self-containment has the added advantage of also being self-smothering to ensure no spread of fire to other parts of the building.

8.8.1. General

8.8.1.1. All construction materials used in the substation room including walls, ceilings, floors, doors and vents must be constructed from non–combustible materials.

8.8.1.2. Any wall, ceiling or floor shared with or adjoining another part of the building must be treated as a fire wall as defined in the Electrical Safety (Network Asset) Regulations 2009 and Building Code of Australia, and shall have a minimum 2 hour fire rating to effectively segregate the substation from the rest of the building.

8.8.1.3. It is essential that a minimum 2 hour fire rating be maintained for any wall penetration for cables or other services.

The sealing of the penetration must be completed strictly in accordance with the manufacturer's instructions and shall be inspected and approved by CitiPower/Powercor representative.

8.8.2. Fire Detection and Alarm Settings

8.8.2.1. CitiPower/Powercor does not have a requirement to fit fire detection or alarm system within the substation.

However if the customer has a requirement to fit such fire detection or alarm system, the customer shall seek the written agreement of CitiPower/Powercor.

CitiPower/Powercor will stipulate the location of such fire detection or alarm system within the substation to ensure that the integrity of the substation installation is maintained.

8.8.2.2. The customer must ensure that the design and construction of the fire detection or alarm system is with unrestricted access for inspection and maintenance.

8.8.2.3. The customer shall be responsible for the maintenance and ongoing testing of the installed fire detection or alarm system.

In addition, the 2 hour fire rating of the substation shall not be compromised by the installation of a fire detection or alarm system.

8.8.2.4. Depending on the location of the fire detection or alarm system, it may be necessary to have a shutdown of the substation for inspection and maintenance. Such requirements will incur an ongoing charge to the customer from CitiPower/Powercor for providing the required substation shutdown.

8.8.3. Fire Fighting Systems

CitiPower/Powercor will not permit the installation of any type of fire fighting systems within the substation.

8.8.4. Sprinkle System

CitiPower/Powercor will not permit the installation of any type of sprinkler system inside the substation.

8.9. Oil Containment

8.9.1. Provision must be made within the substation to contain any oil spillage in the unlikely event of a transformer tank failure.

8.9.2. The oil containment within the substation shall be designed to contain oil spillage equal to 110% of the oil volume in the installed transformer to the requirements stipulated in the Environment Protection Authority (EPA) and Standard AS 1940.

8.9.3. The substation foundation floor shall be designed with a gentle slope to facilitate the flow of oil spillage to the designated oil containment.

8.9.4. Bunding requirements are not applicable to dry type transformer installations.

8.10. Locks, Padbolts and Equipment and Personnel Access Doors

Information on the following requirements is included in the CitiPower/Powercor substation standard construction drawings.

- Locks and padbolts for access route to the substation enclosure.
- Equipment and personnel access doors for substation totally enclosed within building.
- Equipment and personnel access doors for substation facing street level.

8.11. Access Requirements

Unless access to the substation is directly from a public street, the following requirements shall be met by the customer.

8.11.1. Personnel Access

8.11.1.1. A permanent all–weather pedestrian access route of at least 1.2m width to the substation entrances.

This pedestrian access route must be available and kept clear at all times of day and night for CitiPower/Powercor personnel.

It is not acceptable for the access route to be through areas which are hazardous, for example due to the use of a guard dog, or for storage and car park bays to be located in front of substation access doors.

CitiPower/Powercor may require suitable notices to be erected to this effect.

8.11.1.2. The customer is required to ensure that each substation access doorway offers a way out to an open area suitable for escape in an emergency.

8.11.1.3. CitiPower/Powercor will supply and attach without charge a CitiPower/Powercor padlock to any gates involved in gaining access to the substation sites.

The CitiPower/Powercor padlock may be used in conjunction with a locking bar or chain and a padlock supplied by the customer to provide access to both parties using different keying systems.

An equivalent locking system using night–latch/mortise type locks supplied and installed by the customer will be acceptable.

8.11.2. Heavy Equipment Access

8.11.2.1. A mobile crane and a heavy duty truck are generally utilized to move transformers in and out of the substation.

8.11.2.2. A manoeuvring area adjacent to the substation is required for loading or unloading the transformer from the truck.

This area shall be of reinforced concrete construction and shall be sufficient to accommodate the truck and a mobile crane. Grassed areas are not acceptable.

8.11.2.3. If the substation is on the property boundary facing the street, the minimum headroom within the manoeuvring area required for the crane jib is 5 metres.

8.11.2.4. Where the substation is set well within the property boundary, a vehicular access route (driveway) is required between the public road and the substation doors.

8.11.2.5. Construction requirements for the driveway to the substation shall be as follows:

- Reinforced concrete construction to withstand a 2-point front axle group loading of 21 tonnes.
- Width for straight route is 4 metres.
- Width for bend route is 6.2 metres.
- Head height shall not be less than 5 metres.
- Sloping shall not be more than 1:16.
- Area of not less than 2500 (w) x 2450 (l) mm in front of the substation doors shall be flat.

8.11.2.6. In the event of damage to the paved surface of a right–of–way, it is the responsibility of the owner of the premises to re-instate the paved surface.

8.12. Monorail Lifting Beam & Geared Girder Trolley

8.12.1. For lifting heavy equipment within the substation such as low and high voltage switching equipment, the customer shall supply and permanently install a monorail lifting beam and geared girder trolley to suit a maximum equipment mass of 2,000kg. Such lifting equipment shall not be used for lifting distribution transformers.

8.12.2. The location of the monorail lifting beam shall be as shown in the CitiPower/Powercor substation standard construction drawings.

8.12.3. Assembly and installation including commissioning of the monorail shall be the customer's responsibility. Commissioning test reports and certification shall be supplied to CitiPower/Power representative prior to the handover of the substation enclosure.

8.13. Anchors and Pulling Eyes

8.13.1. Anchors and/or pulling eyes shall be provided by the customer in the floor, walls or ceiling in the positions shown in the CitiPower/Powercor substation standard design drawings, and shall be installed to achieve the working load specified.

8.13.2. For a substation with single cable trench and single transformer, two pulling eyes will normally be required – one for the cables and one for the transformer.

However, further pulling eyes may be required for more complex substations with multiple cable trenches or multiple transformers, or where access to install cables or transformers is restricted.

8.13.3. All anchors and pulling eyes shall be clearly and permanently stamped to indicate their safe working loads.

8.13.4. The construction, types, cast-in requirements and location of the pulling eye requirements shall be as shown in the CitiPower/Powercor substation standard construction drawings.

8.14. Incoming High Voltage Supply

8.14.1. The incoming high voltage supply between CitiPower/Powercor's high voltage distribution system and the indoor substation shall be via underground cables.

8.14.2. Customer shall install conduits from the property boundary to the substation to allow CitiPower/Powercor to install the incoming high voltage cables.

8.14.3. The minimum depth of the conduits at the property boundary shall not be less than 600mm and shall be clear from all other services on the roadway.

If the conduits to the substation are more than 1,000mm deep to avoid other assets in the street, then the substation may have to be relocated during the negotiation stage.

8.15. Cable Easements

8.15.1. The cable easement width required for CitiPower/Powercor cables is normally 1.5m.

8.15.2. No additional structures shall be installed or levels shall be altered within the cable easement without the express written permission of CitiPower/Powercor.

8.15.3. Permission will be given for various services to cross the cable easement on the condition that CitiPower/Powercor representative is satisfied that CitiPower/Powercor cables will not be affected.

8.15.4. Building over the cable easement may be permitted provided that the customer complies with CitiPower/Powercor's requirements which will be given in writing in response to the customer's written application to CitiPower/Powercor.

8.15.5. Where the finished surface over the cable will make future excavation of the cables impracticable or undesirable, it is generally necessary to extend the cable conduits from the substation to an accessible position.

In any area which is to be sealed or covered by future buildings, the cables shall be enclosed in conduits.

8.15.6. Customer is required to make all arrangements for all the trenching and the supply and installation of conduits necessary for CitiPower/Powercor to install CitiPower/Powercor cables on the customer's property.

8.15.7. On completion of CitiPower/Powercor work, the customer is required to make arrangement to reinstate the finished surfaces on the customer's property.

8.15.8. A typical cable trench requirement for indoor substation is shown in the respective CitiPower/Powercor substation standard construction drawings.

8.16. Cable Supports - Conduits

8.16.1. General

8.16.1.1. All electrical conduits and cable enclosures between the substation and the property boundary shall be provided by the customer as specified on the CitiPower/Powercor substation standard construction drawings for CitiPower/Powercor to install HV and LV cables to the substation.

8.16.1.2. The location of the substation shall be such that the length of conduits or other cable enclosures is as short as possible.

8.16.1.3. Conduits and other cable enclosures shall run in a horizontal straight line from the substation to the property boundary.

Where the substation cannot be located at street level or there are obstructions on the customer's property which necessitate bends in the cable run, the details of these bends shall be discussed with and approved by CitiPower/Powercor's representative.

Any conduit bends shall have a minimum radius of 2,000 mm.

All conduits shall be installed free of obstructions or any material that may hinder or damage the cables during the cable pulling.

8.16.1.4. The number, size, type and location of conduits, pits, cable trays etc. to be installed in the substation are detailed in the respective CitiPower/Powercor substation standard construction drawings.

8.16.2. Buried Conduit

Following are CitiPower/Powercor approved methods for supporting or enclosing HV and LV cables to substations.

8.16.2.1. Heavy duty orange colour un-plasticised Polyvinyl Chloride (H.D. Electrical U.P.V.C. conduits of solid wall construction to Standard AS2053) must be approved by CitiPower/Powercor prior to installation into the ground.

Conduits of the sandwich or corrugated construction will not be accepted.

8.16.2.2. The conduits shall be installed at not less than 600 mm below the finished ground level.

Conduits may be buried at the specified depth with appropriate bedding without any further mechanical protection.

8.16.2.3. Cable pits may be required external to the substation where a change in direction or level occurs in the conduit run.

Removable covers of the Gatic type construction or approved equivalent shall be provided with the cable pits.

8.16.2.4. The conduit installation must comply with the relevant fire protection regulations.

Where HV cable easements are accessible to the public, the conduits must be labelled with "CitiPower/Powercor Cables" in permanent black lettering every 4 metres along the conduit length.

8.16.3. Approval

8.16.3.1. The design of the conduit route and formation shall be included on the "lock–in" building construction drawings and shall be approved by CitiPower/Powercor before construction commences.

8.16.3.2. Any subsequent alteration to the approved design during construction shall be resubmitted for approval by CitiPower/Powercor.

8.16.3.3. When conduit installation is complete, the customer shall arrange inspection by CitiPower/Powercor prior to backfilling or concrete pouring.

8.16.4. Conduit Installations

8.16.4.1. All conduits shall be laid and jointed to the conduit manufacturer's instructions.

8.16.4.2. All conduit joints shall be made using approved solvent glue and shall be waterproof.

8.16.4.3. Conduit entries through walls and floors shall be sealed against the entry of water.

8.16.4.4. Conduits in excess of 25 metres in length shall be provided with a 3mm diameter polypropylene draw-string.

8.16.4.5. Suitable pulling eyes shall be installed in the locations specified in the respective CitiPower/Powercor substation standard construction drawings to enable cable installation.

8.16.4.6. The ends of conduits shall be suitably plugged by the customer to prevent the ingress of dirt or moisture prior to cable installation by CitiPower/Powercor.

8.16.4.7. CitiPower/Powercor will inspect conduit location and installation before backfilling.

8.17. Standard Design Procedure

8.17.1. Having completed the negotiation process between the customer representative and CitiPower/Powercor representative and agreeing on the substation capacity and layout, and the suitability of the site and the access arrangements, the customer's representative will be provided with copies of CitiPower/Powercor standard substation building requirement drawings.

8.17.2. The customer must provide drawings in **AutoCAD** format for the proposed site, planned conduit route through the property and the substation location.

Along with a floor plan, relevant sections through the substation showing all relative levels (RL), beams, columns, footpads and any other structures within or outside the substation shall be shown.

8.17.3. Ventilation details that are submitted must show size and location of all vents, ducts and fans.

From this information, CitiPower/Powercor will issue its substation standard design drawing showing the building requirements, easements and light & power layout.

8.17.4. The CitiPower/Powercor substation standard construction drawings issued to the customer are for reference only and are not for building construction.

8.17.5. The customer representative is then required to prepare "Lock–In" building drawings for the builder's guidance.

Three (3) copies of these "Lock-In" drawings shall be provided to CitiPower/Powercor representative for reference before construction of the substation commences.

8.17.6. The "Lock–In" drawings shall include but not be limited to the following requirements:

- The location of the substation in relation to adjoining construction and to the street.

  If not on the street alignment, the information should include the access route, type of road surface, relative levels of the roadway, any overhead obstruction and details of levels external to the substation.
- Drainage arrangements in the vicinity of the substation.
- The location of the customer's main switch room and the route of the cables, busbars or bus-ways from the point of supply to the main switchboard.
- Details of cable pits and conduits provided by the customer to enable CitiPower/Powercor to install HV and LV cables between the substation and the property boundary.
- Any variations from CitiPower/Powercor substation standard construction drawings.

  These must be either alternative forms of building construction or specifically negotiated modifications that have been approved by CitiPower/Powercor representative.
- Detailed information that will be needed for any other features such as ventilation ducts, water stopping membranes etc. shall be conveyed to the builder to carry out the building work required.
- The permanent means of access for CitiPower/Powercor staff and equipment.

8.18. Special Design Procedure

8.18.1. In general, a standard design which is suitable for the substation equipment to be installed shall be used.

However, where the standard design is not suitable, CitiPower/Powercor will prepare special design drawings.

Following the issue of these drawings by CitiPower/Powercor, the customer must prepare a set of "Lock–In" drawings as mentioned in the above sub-clauses 8.17.5 and 8.17.6.

8.18.2. Customer shall be aware that the use of a special design may add considerably to the period normally taken from acceptance of the supply agreement to the supply being available, and it will also incur a special design fee.

8.19. Agreements, Approvals and Construction

8.19.1. On receipt of three copies of the "Lock–In" drawings of the substation, CitiPower/Powercor representative will advise the customer representative in writing that the building details, location and access requirements are satisfactory, and that the customer can proceed with the construction of the substation.

This advice is given on the understanding that it does not commit CitiPower/Powercor in any way.

8.19.2. Immediately before beginning construction in the substation area, the builder should contact CitiPower/Powercor representative.

The builder must provide at least forty-eight (48) hours notice for CitiPower/Powercor representative to arrange visits to inspect the substation building work and installation of conduits on the customer's property.

This service is provided on the understanding that CitiPower/Powercor does not accept any responsibility for failure to meet the stated requirements.

8.19.3. The importance of close liaison is stressed because failure to fully comply with the requirements can result in expense to the customer in rectifying errors and may affect the program for providing supply.

In this regard, before the acceptance of the substation enclosure for equipping, it must be complete in all respects including suitable access for the delivery of heavy equipment and safe personnel access.

8.20. Inspections

8.20.1. On receipt of forty–eight (48) hours' notice, CitiPower/Powercor representative will check the set out of conduits, cable trenches, cable trays and cable pits etc. before backfilling or concreting is commenced.

It is the responsibility of the builder to contact CitiPower/Powercor representative to make arrangements for this inspection.

8.20.2. After the conduits have been laid and where considered necessary, the builder will be required to draw a proving mandrel through the conduits under the supervision of CitiPower/Powercor representative.

Suitable exposure of the conduits for the inspection shall be the builder's responsibility.

Any conduit that does not provide free passage shall be rectified by the builder at own expense.

9. Section C – Customer Connection

9.1. Customers Electrical Installation – Supply

The customer electrical installation must comply with the requirements of the Electricity Safety (Installations) Regulations 2009, the Standard AS 3000 Wiring Rules, the Service and Installation Rules and associated publications.

9.2. Fault Levels

9.2.1. In accordance with the Standard AS 3000 Wiring Rules, the inspecting authority may require the wiring of an installation to be of a suitable size and construction, and that control and protective gear be suitably rated so that the installation will perform satisfactorily under fault conditions.

9.2.2. The short circuit current which may occur in a customer installation supplied from a substation is relatively high and makes it necessary to design and select switchboards, cabling or bus-work and protection and control equipment of adequate fault rating.

9.2.3. As a guide, the maximum prospective fault current at the point of supply would be as follows:

Substation Capacity	Maximum Fault Current Level
1000kVA	30kA for 1 second
2000kVA	50kA for 1 second

For customers with substations of 2000kVA capacity and with the following interconnection, then the prospective maximum fault current level at the customer installations would be as follows:

Type of Service	Customer Fault Level
No Cogeneration	50kA for 1 second
With Cogeneration	50kA for 3 seconds

9.3. Selection of Main Protection Devices

9.3.1. The customer's main protective devices (circuit breakers or fuses) must be selected, installed and coordinated so that in the event of a fault on the customer installation, they will interrupt the fault current such that CitiPower/Powercor protective devices do not operate.

9.3.2. Details of the customer protection devices and their characteristics shall be supplied to CitiPower/Powercor representative so that co-ordination with CitiPower/Powercor protective devices can be checked and agreed.

9.4. Point of Supply

9.4.1. The point of supply will be the specified low voltage terminals of the CitiPower/Powercor LV distribution switchboard.

9.4.2. The location of the point of supply will be specified in the drawings provided by CitiPower/Powercor in the supply contract.

9.5. Customer's Mains

9.5.1. General Requirements

9.5.1.1. A 3 phase, 4 conductor, 50 Hz, 415/240V (CitiPower) or 433/250V (Powercor) supply within normal commercial limits shall be provided from the substation via a customer's mains for which the customer is responsible.

The size and form of the customer's mains shall be in accordance with the requirements stipulated in Standards AS 3000 and AS 3008.1.1.

9.5.1.2. The customer's mains including selection of cable sizes and type, metering and earthing must be installed in accordance with the Installation Regulations, Wiring Rules, the Service and Installation Rules and any additional conditions required by CitiPower/Powercor representative and CitiPower/Powercor's installations inspector.

The customer is responsible for supply and installation of the consumer mains.

9.5.1.3. The customer's Registered Electrical Contractor (REC) will be responsible for the installation and termination of the customer mains within the substation enclosure to the CitiPower/Powercor switchboard under "dead" conditions and under the supervision of CitiPower/Powercor.

CitiPower/Powercor shall at all other times connect supply to the CitiPower/Powercor switchboard.

The manner and route of the cables will be confirmed by CitiPower/Powercor.

9.5.1.4. No interconnection will be allowed between multiple services unless the interconnection is fitted with approved locking and is under the sole control of CitiPower/Powercor.

9.5.1.5. No load transfer will be permitted between multiple services unless the arrangement has been submitted to and approved by CitiPower/Powercor.

9.5.1.6. Standby or emergency generators shall be interlocked to prevent running in parallel with or feeding into CitiPower/Powercor distribution system.

9.5.2. Installation

9.5.2.1. Acceptable forms of customer mains are either busbars or plastic insulated and sheathed cables to the requirements of the appropriate Australian Standards.

9.5.2.2. Customer cables must be affixed to metal trays via cable cleats, provided that these trays are electrically isolated from trays outside the substation.

9.5.2.3. Cable cleats shall be manufactured from non-magnetic materials such as aluminium or stainless steel, and shall be type tested to comply with Standard IEC 61914.

9.5.2.4. Where cables or busbars enter the substation enclosure via a floor, wall or ceiling opening, it is a mandatory requirement that the opening be sealed with an approved sealing system that will have a fire rating of at least 2 hours.

For bare busbars, the section through the opening is to be sheathed with an insulating material, for example, heat shrinkable polyolefin sleeve.

9.5.2.5. The customer shall notify CitiPower/Powercor representative of the type of cables and arrangement before the commencement of cable procurement and installation.

9.5.2.6. CitiPower/Powercor shall advise the customer representative the means of connection and arrangements at the point of supply.

9.6. Lighting and Power within Substation Enclosure

9.6.1. Temporary Installation – During Construction Stage

Prior to handover of the substation enclosure, the enclosure shall contain suitable temporary lights and power supplied from the customer installation to allow for the safe installation of substation equipment by CitiPower/Powercor.

9.6.2. Permanent Installation

9.6.2.1. As shown in the respective CitiPower/Powercor substation standard construction drawings, the customer shall supply and install the following equipment within the substation enclosure.

- A light and power board.
- Mains supply.
- Necessary light fittings.
- Power outlets.
- All the necessary wiring.

9.6.2.2. Where specified in the respective CitiPower/Powercor substation standard construction drawings, equipment such as exhaust fans, pumps, controls and associated wiring shall be provided and installed in the substation by the customer.

9.6.2.3. All wiring works shall be undertaken against a "Certificate of Electrical Safety for Prescribed Work". Such certificate shall be provided to CitiPower/Powercor representative by the customer during substation handover.

9.6.2.4. The Registered Electrical Contractor (REC) is responsible for terminating customer mains and the light and power mains to the CitiPower/Powercor substation low voltage distribution board under "dead" conditions.

9.7. Provision of Permanent Supply

Permanent supply to the customer will only be provided when the following items have been completed to the satisfaction of CitiPower/Powercor representative:

- The permanent lights and power requirements of the substation enclosure have been completed by the customer.
- The temporary lights and power of the indoor substation enclosure have been disconnected and removed.
- The temporary supply to the site has been arranged to be disconnected within 5 days from the date permanent supply is to be provided.
- Any other outstanding items for the satisfactory completion of the substation enclosure to the requirements of this specification document including execution of the lease documents by the responsible parties.

9.8. Substation Compliance Certification

9.8.1. EMF Shielding

Prior to handover of the substation enclosure, the customer shall provide certification of EMF shielding to specification requirements.

9.8.2. Fire Rating

Prior to handover of the substation enclosure, the customer shall provide certification of 2 hour fire rating on all fire shutters and doors.

9.8.3. Steelwork

Prior to handover of the substation enclosure, the customer shall provide certification of structural adequacy for any structural steelwork inside the substation enclosure for both raised platform and pit type substations.

9.8.4. Monorail

Prior to handover of the substation enclosure, the customer shall provide design certification, commission reports for the monorail and trolley and manuals.

9.8.5. Ventilation

9.8.5.1. Prior to handover of the substation enclosure, the customer shall provide certification that the required change of airflow every two minutes is met based on the heat emitted by the transformer/s and the specific room size.

9.8.5.2. Any revised ventilation ducts, fan locations, vents and fire shutters information and calculations shall be given to CitiPower/Powercor for in principle approval prior to handover of the substation.

9.8.6. Fans

Prior to handover of the substation enclosure and upon commissioning and certification of the mechanical fans, the customer shall provide a commission report on the mechanical fans.

9.8.7. Noise

Prior to handover of the substation enclosure, the customer shall provide certification that the sound power level complies with SEPP N-1 requirements.

9.8.8. Civil Works

Prior to handover of the substation enclosure, the customer shall provide a Victorian Electrical Distribution Networks (VEDN) accredited audit report and conduit fields notes.

9.8.9. Certificate of Electrical Safety

Prior to handover of the substation enclosure, the customer shall provide a Certificate of Electrical Safety – Non Prescribed for the light and power installation and changeover switch inside the substation enclosure.

10. Section D – Appendices

10.1. Appendix 1 – Electromagnetic Shielding Requirements

10.1.1. Any proposed electromagnetic shielding shall be subject to CitiPower/Powercor's prior agreement.

The customer must provide CitiPower/Powercor with details of the proposed shielding, including plans that clearly show but not be limited to the following:

- Area and the extent of shielding.
- Type of shielding.
- Mounting method for the shielding.

10.1.2. Shielding is preferable to be installed external to the newly construction substation, however shielding installed internal to the substation is acceptable provided there is a minimum physical separation of 20mm between the shield and any anchoring to the wall and ceiling.

10.1.3. Where an existing substation required installation of shielding material and installation is not possible on the exterior, shielding may be permitted inside the substation subject to CitiPower/Powercor agreement.

10.1.4. All works required to install, maintain and/or modify shielding shall be the responsibility of the customer, and the customer shall bear the cost of such works.

10.1.5. Where CitiPower/Powercor requires the customer to rectify a defect on the installed shielding, the customer must rectify the defect at the customer's cost within a timely manner.

10.1.6. The customer's design of any proposed electromagnetic shielding shall consider the ultimate potential electromagnetic field strengths that may be generated from within the substation and the corresponding required level of attenuation to be achieved outside the chamber.

10.1.7. The customer shall select the shielding material accordingly with the appropriate consideration of suitable support and fixing methods.

The shielding design shall also consider and accommodate expansion and contraction of the shielding material due to temperature variations.

10.1.8. Shielding installed within a substation will be considered to be part of the substation enclosure. Accordingly, the building owner shall own and be responsible for the maintenance of electromagnetic shielding during the life of the substation.

10.1.9. All electromagnetic shielding installed within a CitiPower/Powercor's substation shall comply with but not to be limited to the following requirements:

- Constructed entirely with non–flammable materials.
- Solid construction and securely fixed in place with suitable fixing methods
- Shielding material fixed to the wall shall be covered with a non conductive white cladding to a minimum height of 2.4 metres. Materials that do not allow proper fixing of fixtures, such as plasterboard, are not acceptable as cladding.

- Any shielding above the specified 2.4 metres minimum height (including shielding on the ceiling) is to have similar cladding as previously specified, and painted white or otherwise finished in a color as specified by CitiPower/Powercor.
- The cladding and shielding materials shall be suitable for fixing of wiring and lighting fittings that are required by CitiPower/Powercor.
- Fixed to the recessed floor of the substation with a suitable layer of concrete to ensure that weight and loading limits are not exceeded.

10.1.10. All electromagnetic shielding installed within an CitiPower/Powercor substation shall **not**:

- Impede personnel access to and egress from the substation.
- Impede substation equipment access to and removal from the substation.
- Impede operation of substation equipment and/or fittings.
- Impede maintenance of substation equipment and/or fittings.
- Impede or obscure general lighting, emergency lights or exit lights within the substation.
- Impede ventilation of or airflow within the substation.
- Impede or obscure signage within the substation.
- Have sharp or protruding edges that may be considered by CitiPower/Powercor to be hazardous.
- Be earthed.
- Be covered with vinyl.

10.1.11. CitiPower/Powercor requires that the customer maintain a net amount of freely available space within the indoor substation in accordance with any shielding proposal agreed to by CitiPower/Powercor.

10.1.12. Please refer to Clause 7.3.4 on “Substation Lease” regarding the land-owner’s indemnification of CitiPower/Powercor under CitiPower/Powercor’s standard Lease, for losses arising out of any damage to property or any business caused or contributed to by EMF interference or other emanation.

10.2. Appendix 2 – 1 x 500kVA Natural Ventilation Substation Standard Construction Drawings

CitiPower/Powercor substation standard construction drawings applicable to the 1 x 500kVA natural ventilation substation.

Drawing #	Sheet #	Drawing Description
SCD04/01/1/A	1 of 11	1 x 500kVA Standard Arrangement Compact Distribution Substation – Natural Ventilation – Substation Facing the Street.
SCD04/01/2/A	2of 11	1 x 500kVA Standard Arrangement Compact Distribution Substation – Natural Ventilation – Substation Notes.
SCD04/01/3/A	3 of 11	1 x 500kVA Standard Arrangement Compact Distribution Substation – Natural Ventilation – Building Requirements.
SCD04/01/4/A	4 of 11	1 x 500kVA Standard Arrangement Compact Distribution Substation – Natural Ventilation – Building Requirements.
SCD04/01/5/A	5 of 11	1 x 500kVA Standard Arrangement Compact Distribution Substation – Natural Ventilation – Vented Door Details.
SCD04/01/6	6 of 11	1 x 500kVA Standard Arrangement Compact Distribution Substation – Natural Ventilation – Louvre Details.
SCD04/01/7/A	7 of 11	1 x 500kVA Standard Arrangement Compact Distribution Substation – Natural Ventilation – Light and Power Layout Notes.
SCD04/01/8/A	8 of 11	1 x 500kVA Standard Arrangement Compact Distribution Substation – Natural Ventilation – Plan Light & Power.
SCD04/01/9/B	9 of 11	1 x 500kVA Standard Arrangement Compact Distribution Substation – Natural Ventilation – Cable Pit Covers & Equip. Supp. Details.
SCD04/01/10 & 11	10/11 of 11	1 x 500kVA Standard Arrangement Compact Distribution Substation – Natural Ventilation – Conduit & Cable Water Sealing System.

Note: These drawings can be accessed from the following folder in the Document Management System drawing portal by the CitiPower/Powercor representative.

- \Documents\Published PDF Drawings\Standards\04 - Standard Construction Drawings\SCD04 - Distribution Substations\

10.3. Appendix 3 – 1 x 2000kVA Natural Ventilation Substation Standard Construction Drawings

CitiPower/Powercor substation standard construction drawings applicable to the 1 x 2000kVA natural ventilation substation.

Drawing #	Sheet #	Drawing Description
SCD04/02/1/A	1 of 11	1 x 2000kVA Standard Arrangement Ground Distribution Substation – Natural Ventilation – General Arrangement.
SCD04/02/2/A	2 of 11	1 x 2000kVA Standard Arrangement Ground Distribution Substation – Natural Ventilation – Substation Notes.
SCD04/02/3/B	3 of 11	1 x 2000kVA Standard Arrangement Ground Distribution Substation – Natural Ventilation – Building Requirements.
SCD04/02/4/B	4 of 11	1 x 2000kVA Standard Arrangement Ground Distribution Substation – Natural Ventilation – Building Requirements.
SCD04/02/5/A	5 of 11	1 x 2000kVA Standard Arrangement Ground Distribution Substation – Natural Ventilation – Vented Door Details.
SCD04/02/6/A	6 of 11	1 x 2000kVA Standard Arrangement Ground Distribution Substation – Natural Ventilation – Above Door Louvre Details.
SCD04/02/7/A	7 of 11	1 x 2000kVA Standard Arrangement Ground Distribution Substation – Natural Ventilation – Light & Power Layout Notes.
SCD04/02/8/A	8 of 11	1 x 2000kVA Standard Arrangement Ground Distribution Substation – Natural Ventilation – Plan Light & Power.
SCD04/02/9/B	9 of 11	1 x 2000kVA Standard Arrangement Ground Distribution Substation – Natural Ventilation – Cable Pit Covers & Equipment Support.
SCD04/02/10 & 11	10/11 of 11	1 x 2000kVA Standard Arrangement Ground Distribution Substation – Natural Ventilation – Conduit & Cable Water Sealing System.

Note: These drawings can be accessed from the following folder in the Document Management System drawing portal by the CitiPower/Powercor representative.

- \Documents\Published PDF Drawings\Standards\04 - Standard Construction Drawings\SCD04 - Distribution Substations\

10.4. Appendix 4 – 1 x 2000kVA Fan Forced Ventilation Substation Standard Construction Drawings

CitiPower/Powercor substation standard construction drawings applicable to the 1 x 2000kVA fan forced ventilation substation.

Drawing #	Sheet #	Drawing Description
SCD04/03/1/A	1 of 10	1 x 2000kVA Standard Arrangement Ground Distribution Substation – Fan Forced Ventilation – General Arrangement.
SCD04/03/2/A	2 of 10	1 x 2000kVA Standard Arrangement Ground Distribution Substation – Fan Forced Ventilation – Substation Notes.
SCD04/03/3/B	3 of 10	1 x 2000kVA Standard Arrangement Ground Distribution Substation – Fan Forced Ventilation – Building Requirements.
SCD04/03/4/B	4 of 10	1 x 2000kVA Standard Arrangement Ground Distribution Substation – Fan Forced Ventilation – Building Requirements.
SCD04/03/5/A	5 of 10	1 x 2000kVA Standard Arrangement Ground Distribution Substation – Fan Forced Ventilation – Ventilation Details.
SCD04/03/6/A	6 of 10	1 x 2000kVA Standard Arrangement Ground Distribution Substation – Fan Forced Ventilation – Light & Power Layout Notes
SCD04/03/7/A	7 of 10	1 x 2000kVA Standard Arrangement Ground Distribution Substation – Fan Forced Ventilation – Plan Light & Power.
SCD04/03/8/B	8 of 10	1 x 2000kVA Standard Arrangement Ground Distribution Substation – Fan Forced Ventilation – Cable Pit Covers & Equipment Support.
SC04/03/9 & 10	9/10 of 10	1 x 2000kVA Standard Arrangement Ground Distribution Substation – Fan Forced Ventilation – Conduit & Cable Water Sealing System.

Note: These drawings can be accessed from the following folder in the Document Management System drawing portal by the CitiPower/Powercor representative.

- \Documents\Published PDF Drawings\Standards\04 - Standard Construction Drawings\SCD04 - Distribution Substations\

10.5. Appendix 5 – 2 x 2000kVA Fan Forced Ventilation Substation Standard Construction Drawings

CitiPower/Powercor substation standard construction drawings applicable to the 2 x 2000kVA fan forced ventilation substation.

Drawing #	Sheet #	Drawing Description
SCD04/04/1/A	1 of 10	2 x 2000kVA Standard Arrangement Ground Distribution Substation – Fan Forced Ventilation – Substation Facing the Street.
SCD04/04/2/A	2 of 10	2 x 2000kVA Standard Arrangement Ground Distribution Substation – Fan Forced Ventilation – Substation Notes.
SCD04/04/3/B	3 of 10	2 x 2000kVA Standard Arrangement Ground Distribution Substation – Fan Forced Ventilation – Building Requirements.
SCD04/04/4/B	4 of 10	2 x 2000kVA Standard Arrangement Ground Distribution Substation – Fan Forced Ventilation – Building Requirements.
SCD04/04/5/A	5 of 10	2 x 2000kVA Standard Arrangement Ground Distribution Substation – Fan Forced Ventilation – Ventilation Details.
SCD04/04/6/A	6 of 10	2 x 2000kVA Standard Arrangement Ground Distribution Substation – Fan Forced Ventilation – Light & Power Layout Notes.
SCD04/04/7/B	7 of 10	2 x 2000kVA Standard Arrangement Ground Distribution Substation – Fan Forced Ventilation – Plan Light & Power.
SCD04/04/8/B	8 of 10	2 x 2000kVA Standard Arrangement Ground Distribution Substation – Fan Forced Ventilation – Cable Pit Covers & Equipment Support.
SCD04/04/9&10	9/10 of 10	2 x 2000kVA Standard Arrangement Ground Distribution Substation – Fan Forced Ventilation – Conduit & Cable Water Sealing System

Note: These drawings can be accessed from the following folder in the Document Management System drawing portal by the CitiPower/Powercor representative.

- \Documents\Published PDF Drawings\Standards\04 - Standard Construction Drawings\SCD04 - Distribution Substations\

10.6. Appendix 6 – 3 x 2000kVA Fan Forced Ventilation Substation Standard Construction Drawings

CitiPower/Powercor substation standard construction drawings applicable to the 3 x 2000kVA fan forced ventilation substation.

Drawing #	Sheet #	Drawing Description
SCD04/05/1/A	1 of 11	3 x 2000kVA Standard Arrangement Ground Distribution Substation – Fan Forced Ventilation – General Arrangement.
SCD04/05/2/A	2 of 11	3 x 2000kVA Standard Arrangement Ground Distribution Substation – Fan Forced Ventilation – Substation Notes.
SCD04/05/3/B	3 of 11	3 x 2000kVA Standard Arrangement Ground Distribution Substation – Fan Forced Ventilation – Building Requirements.
SCD04/05/4/B	4 of 11	3 x 2000kVA Standard Arrangement Ground Distribution Substation – Fan Forced Ventilation – Building Requirements.
SCD04/05/5/A	5 of 11	3 x 2000kVA Standard Arrangement Ground Distribution Substation – Fan Forced Ventilation – Ventilation Details.
SCD04/05/6/A	6 of 11	3 x 2000kVA Standard Arrangement Ground Distribution Substation – Fan Forced Ventilation – Light & Power Layout Notes.
SCD04/05/7/A	7 of 11	3 x 2000kVA Standard Arrangement Ground Distribution Substation – Fan Forced Ventilation – Plan Light & Power.
SCD04/05/8/B	8 of 11	3 x 2000kVA Standard Arrangement Ground Distribution Substation – Fan Forced Ventilation – Cable Pit Covers & Equipment Support.
SCD04/05/9/A	9 of 11	3 x 2000kVA Standard Arrangement Ground Distribution Substation – Fan Forced Ventilation – Cable Pit Covers & Equipment Support.
SCD04/05/10 & 11	10/11 of 11	3 x 2000kVA Standard Arrangement Ground Distribution Substation – Fan Forced Ventilation – Conduit & Cable Water Sealing System

Note: These drawings can be accessed from the following folder in the Document Management System drawing portal by the CitiPower/Powercor representative.

- \Documents\Published PDF Drawings\Standards\04 - Standard Construction Drawings\SCD04 - Distribution Substations\

10.7. Appendix 7 – 1 x 500kVA Fan Forced Ventilation Standard Construction Drawings

CitiPower/Powercor substation standard construction drawings applicable to the 1 x 500kVA fan forced ventilation substation.

Drawing #	Sheet #	Drawing Description
SCD04/06/1/A	1 of 10	1 x 500kVA Standard Arrangement Compact Distribution Substation – Fan Forced Ventilation – Substation Facing the Street.
SCD04/06/2/A	2 of 10	1 x 500kVA Standard Arrangement Compact Distribution Substation – Fan Forced Ventilation – Substation Notes.
SCD04/06/3/A	3 of 10	1 x 500kVA Standard Arrangement Compact Distribution Substation – Fan Forced Ventilation – Building Requirements.
SCD04/06/4/A	4 of 10	1 x 500kVA Standard Arrangement Compact Distribution Substation – Fan Forced Ventilation – Building Requirements.
SCD04/06/5/A	5 of 10	1 x 500kVA Standard Arrangement Compact Distribution Substation – Fan Forced Ventilation – Ventilation Details.
SCD04/06/6/B	6 of 10	1 x 500kVA Standard Arrangement Compact Distribution Substation – Fan Forced Ventilation – Light & Power Layout Notes.
SCD04/06/7/A	7 of 10	1 x 500kVA Standard Arrangement Compact Distribution Substation – Fan Forced Ventilation – Plan Light & Power.
SCD04/06/8/A	8 of 10	1 x 500kVA Standard Arrangement Compact Distribution Substation – Fan Forced Ventilation – Trench Covers & Equipment Support Details.
SCD04/06/9&10	9/10 of 10	1 x 500kVA Standard Arrangement Compact Distribution Substation – Fan Forced Ventilation – Conduit & Cable Water Sealing System.

Note: These drawings can be accessed from the following folder in the Document Management System drawing portal by the CitiPower/Powercor representative.

- \Documents\Published PDF Drawings\Standards\04 - Standard Construction Drawings\SCD04 - Distribution Substations\

10.8. Appendix 8 – 2 x 2000kVA Natural Ventilation Standard Construction Drawings

CitiPower/Powercor substation standard construction drawings applicable to the 2 x 2000kVA natural ventilation substation.

Drawing #	Sheet #	Drawing Description
SCD04/07/1/A	1 of 12	2 x 2000kVA Standard Arrangement Ground Distribution Substation – Natural Ventilation – General Arrangement.
SCD04/07/2/A	2 of 12	2 x 2000kVA Standard Arrangement Ground Distribution Substation – Natural Ventilation – Substation Notes.
SCD04/07/3/B	3 of 12	2 x 2000kVA Standard Arrangement Ground Distribution Substation – Natural Ventilation – Building Requirements.
SCD04/07/4/B	4 of 12	2 x 2000kVA Standard Arrangement Ground Distribution Substation – Natural Ventilation – Building Requirements.
SCD04/07/5/A	5 of 12	2 x 2000kVA Standard Arrangement Ground Distribution Substation – Natural Ventilation – Vented Door Details (Double).
SCD04/07/6/A	6 of 12	2 x 2000kVA Standard Arrangement Ground Distribution Substation – Natural Ventilation – Vented Door Details (Single).
SCD04/07/7/A	7 of 12	2 x 2000kVA Standard Arrangement Ground Distribution Substation – Natural Ventilation – Above Door Louvre Details.
SCD04/07/8/A	8 of 12	2 x 2000kVA Standard Arrangement Ground Distribution Substation – Natural Ventilation – Light & Power Layout Notes.
SCD04/07/9/A	9 of 12	2 x 2000kVA Standard Arrangement Ground Distribution Substation – Fan Forced Ventilation – Plan Light & Power.
SCD04/07/10/B	10 of 12	2 x 2000kVA Standard Arrangement Ground Distribution Substation – Fan Forced Ventilation – Cable Pit Covers & Equipment Support.
SCD04/07/11 & 12	11/12 of 12	2 x 2000kVA Standard Arrangement Ground Distribution Substation – Fan Forced Ventilation – Conduit & Cable Water Sealing System

Note: These drawings can be accessed from the following folder in the Document Management System drawing portal by the CitiPower/Powercor representative.

- \Documents\Published PDF Drawings\Standards\04 - Standard Construction Drawings\SCD04 - Distribution Substations\