Substation Design Instruction

11/22kV single pole substation design and material requirements

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SDI 150 11/22kV single pole substation design and material requirements

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1.0 PURPOSE
To provide the minimum design requirements for single pole substations.

2.0 SCOPE
This document is to be used in conjunction with MCI 0005 – Overhead distribution construction standards manual. MCI 0005 contains all construction drawings and some design information directly related to the construction of substations and associated equipment.

The scope of this document is to provide sufficient detail to determine the type and most appropriate location for installation of all single pole substations.

For information on the earthing refer to MCI 0005 and SDI 100.

Unless otherwise specified, equipment shall be in accordance with the relevant current Australian Standards including all amendments at the time of supply. Those of particular reference are listed below in 3.0 References.

Where no appropriate Australian Standard exists, the equipment shall be in accordance with the relevant International Standard. Where no Australian or International Standard exists, the equipment shall comply with recognised standards of good practice.

Where this Specification conflicts with a Standard, this Specification will prevail.

If the equipment not complying with this Specification is to be supplied, detailed descriptions of the differences between the apparatus offered and this Specification's requirements shall be given.

The Standards must be followed. If you consider that the Standards do not cover a particular situation, or it is not practical to follow them, you must liaise with Distribution Engineering so that an approved solution can be developed. Any deviation from the Standards must be approved by Distribution Engineering.

3.0 REFERENCES
• Company policy 9.2.3 – Network property and easements
• Company policy 9.2.5 – Network asset design
• Company policy 9.6.1 – Network connection
• Company policy 9.6.3 – Industrial/commercial distribution design
• Company policy 9.6.4 – Non-urban distribution design
• Company policy 9.6.9 – Facility access (shared infrastructure)
• Company policy 9.7.1 – Network asset construction
• Company policy 9.8.3 – Network operations
• Electricity Supply Act 1995
• Electricity Supply (Safety and Network Management) Regulation 2002
• ENA National Electricity Network Safety Code (NENS 01-2006)
• ENA C(B)1-2006: Guidelines for design and maintenance of overhead distribution and transmission lines
• Integral Energy Network Management Plan 2006-2011
• Occupational Health and Safety Regulation, 2001
• Service and Installation Rules for NSW (2007)
• SPJ 4004 – Network connection contestable works general terms and conditions
• Environmental Management Standard EMS 0001 – Environmental due diligence and environmental management plans
• EMS 0002 – Pollution control
• EMS 0003 – Environmental impact statements
• EMS 0004 – Vegetation management
• EMS 0007 – Waste management
• EMS 0008 – Environmental incident response and management
• EMS 0011 – Environmental guidelines for level 2 ASP’s
• Mains Construction Instruction MCI 0005 – Overhead distribution construction standards manual
• MMI 0005 – Control and prevention of television and radio interference in 11kV-132kV overhead power lines
• MMI 0009 – Pole and asset identification
• Substation Design Instruction SDI 100 – Distribution earthing design, construct and test
• SDI 101 – Distribution substation general details and minimum requirements
• SDI 300 – Pole substation transformer specification
• SDI 304 – Pole substation drop out fuse specification
• SDI 305 – 11/22kV surge arrester specification
• SDI 311 – Distribution fuse specification
• Substation Maintenance Instruction SMI 112 – Distribution data entry – maintenance and defect prioritisation
• SMI 113 – Distribution data entry - asset structure and details
• WorkCover NSW documentation for the production of hazard assessment forms
• AS ISO 1000 The international system of units (SI) and its application
• AS 1033.1 High voltage fuses (for rated voltages exceeding 1000V) expulsion type
• AS 1100.1 Technical drawing – General principles - Part 7
• AS 1111 ISO metric hexagon bolts and screws
• AS 1112 ISO metric nuts
• AS 1148 Nomenclature of commercial timbers imported into Australia
• AS 1154 Insulator and conductor fittings for overhead power lines - Part 3
• AS 1194 Winding wires Parts 1 - 4
• AS 1214 Hot-dip galvanised coatings on threaded fasteners
• AS 1265 Bushings for alternating voltages above 1000V
• AS 1307 Surge arresters – Metal-oxide surge arresters without gaps for a.c. systems
• AS 1580 Paints and related materials – Method of test – Introduction and list of methods
• AS 1604 Specification for preservative treatment – Sawn and round timber
• AS 1605 Methods for sampling and analysing timber preservatives and preservative treated wood
• AS 1627 Metal finishing - Preparation and pretreatment of surfaces
• AS 1720.1 Timber structures - Design methods
• AS 1767 Insulating liquids – Specification for unused mineral insulating oils for transformers and switchgear
• AS 1824 Insulation co-ordination - Definitions, principles and rules - Parts 1 and 2
• AS 1931 High voltage test techniques – General definitions and test requirements Part 1
• AS 2067 Switchgear assemblies and auxiliary equipment for alternating voltage above 1kV
• AS 2082 Timber - Hardwood - Visually stress-graded for structural purposes
• AS 2209 Timber poles for overhead lines
• AS/NZS 2312 Guide to the protection of iron and steel against exterior atmospheric corrosion
4.0 DEFINITIONS AND ABBREVIATIONS

4.1 General definitions

For the purpose of this instruction the following general definitions apply:

ABC  Aerial bundled cable
ASP  Accredited Service Provider – a person authorised to work in the system, and includes authorised external contractors and Integral Energy staff.
CCT  Covered conductor thick
Contract  The agreement between Integral Energy and the contractor.
Contractor  The person bound to execute the work under the contract.
Customer  For the purpose of this instruction the person or persons that take electricity from the Integral Energy network.
DEM  Distribution Engineering Manager
Distribution network  The collection of assets (distribution lines, cables, substations and associated equipment) whose purpose is to distribute power from a zone substation to distribution substations, which feed the LV network.
DNSP  Distribution Network Service Provider
5.0 ACTIONS

5.1 General requirements

5.1.1 General

Only approved substation constructions shall be installed.

The method of providing supply will depend upon an assessment by Integral Energy based on the estimated maximum and diversified demand of the installation, and the existing or planned reticulation/distribution system in the area.

All work shall comply with SDI 101 and MCI 0005. The substation shall include everything necessary or usually supplied for the operation of the equipment, whether directly specified or not.

5.1.2 Electrical equipment

All equipment used in construction (including HV and LV equipment) shall be new and from Integral Energy’s approved component list.

All component parts shall be supplied and tested in accordance with the appropriate Australian Standard.
All equipment shall be enclosed to the extent that there is no safety hazard to operating personnel. The equipment shall be fully shrouded to prevent accidental shorts by human error, flying objects or by rodents.

5.1.3 Electrical connections

All connections shall be terminated using crimp lugs and stainless steel or hot dip galvanised bolts. Clamps or U-bolt type connections are not acceptable.

5.1.4 Sound levels

The complete substation may be installed in a residential area in close proximity to family residences. It is necessary to keep noise and radio interference to levels that at least comply with the relevant Australian Standard – lower level, and local council requirements.

5.1.5 Service conditions

All electrical equipment shall be suitable for use on Integral Energy’s 11kV and 22kV 3-phase 50Hz system, having the neutral point of the supply source effectively earthed. The highest system voltages are 12kV and 24kV RMS respectively. The service conditions are generally in accordance with the indoor standard requirements of clause 2.1 of AS 2650.

5.2 Substation approval

Integral Energy will have the final say on determining if a substation site and associated equipment and cabling is suitable. This may include, but not be limited by such items as design, construction, maintenance, appearance and access.

5.3 Provision of a site

The Electricity Supply Act 1995 (Section 28) states that where a customer requires a supply that in the opinion of the DNSP exceeds that which can be provided by a service line from its street mains, a site for a substation in the location and to the requirements of the DNSP (Integral Energy) shall be provided.

5.4 Easement or lease of premises

Integral Energy may require easements over those parts of the customer's property affected by the substation or cable access routes. It shall be the designer’s responsibility to obtain all necessary easements. In some instances, leases may be more appropriate, but will be at Integral Energy’s discretion.

5.5 Substations near hazards

Substations contain HV and LV electricity, oil, plastics, concrete and other materials. In some situations, a substation may be regarded as a hazardous source, or be susceptible to hazardous sources.

Therefore, substations near hazardous areas shall be dealt with strictly in accordance with Australian Standards and statutory requirements. The minimum distances to be maintained from hazardous locations are set out in AS 2430. Reference shall be made to AS 2430 and any relevant statutory authority in determining the siting of a substation when in hazardous locations.
5.6 Environmental considerations

Visual impact, noise and possible pollution problems shall be considered in the design.

In areas where the substation will be located in (and sometimes near) a water catchment zone it will be necessary to arrange for installation of a special transformer filled with environmentally friendly oil. This may require a longer lead time and specific instructions to the purchaser and construction companies to ensure the correct unit is installed.

5.7 Substation construction requirements

Full details of the substation construction requirements are contained in MCI 0005 and shall be referred to in producing any designs. Basic requirements covered in MCI 0005 are:

- Construction assemblies
- Substation fusing
- Pole sizes
- Joints and terminations
- Equipment/asset numbering
- Transformers produce a low frequency hum (max 74dBA at 300mm from tank), and also produce electrical and magnetic fields that may have an impact on people and equipment, such as computer monitors. This should be taken into account when locating substations.

5.8 Substation access

Full details of substation access requirements are contained in MCI 0005 and shall be referred to in producing any designs. Basic access requirements are:

- Substation will be located at the front property boundary with unrestricted, 24 hour a day access for people and vehicles to the substation directly from a public street. Driveways are not regarded as public street access. Some areas where the equipment shall not be installed are:
  a) Corners or tee intersections.
  b) Excessively sloping embankments that prevent normal access.
  c) On islands between roads.
- Substations shall be installed in locations that provide at least the minimum electrical clearances to all objects.
- Access through security areas is not acceptable, for example, guard dogs, restricted access and the like.
- Designs shall ensure that there is adequate room to install transformers and other equipment on and off the pole from the access road without being obstructed by other buildings or structures.
- Substations (including the easement) shall not be located in or under part of any building, without approval from Integral Energy’s engineer.
- Where access is available by a vehicle driveway directly to the substation, and the substation is located on the perimeter of the driveway, this may also be regarded as street level access at Integral Energy’s discretion.
- All secure access (for example, gates) shall use Integral Energy’s standard key.
- The design shall ensure that substation access areas shall be located so that they are safe at all times. This may mean that bollards or safety rails will need to be erected to protect staff while operating, working on the equipment, erecting ladders or carrying out maintenance.
Where a substation location is not immediately apparent from the street, a sign may need to be erected indicating the substation location, at Integral Energy’s discretion.

Typical delivery truck details are shown below.

Figure 1: Typical transformer truck height details

5.9 Segregation requirements from other structures

There are a number of restrictions to construction near substations. The following sections set out some of these individual requirements.

5.9.1 Equipment hazard/fire zone

Substations near hazardous areas shall be dealt with strictly in accordance with Australian Standards and statutory requirements. The minimum distances to be maintained from hazardous locations are set out in AS 2430. Reference shall be made to AS 2430 and any relevant statutory authority in determining the sitting of a substation when in hazardous locations.

As part of the design, a three (3) metre horizontal fire zone is to be allowed for around the substation to minimise the effects of a failure of any equipment.

Figure 2: Pole substation hazard/fire zone

Separation may be by means of adequate clearance or building components within the zone having a minimum FRL of 120/120/120.
5.9.2 **Earthing**

Special care must be taken to ensure that all designs supply adequate information to construction staff to allow the equipment to be earthed in accordance with the earthing section of MCI 0005 and SDI 100.

For example, all earthing designs shall include:

- Soil resistivity measurements.
- Determination as to being common or separately earthed.
- Number, length and location of all earthing electrodes and conductors.
- Expected/estimated final earthing value.
- Any special earthing requirements, for example, extra insulation or greater separation of earth conductors to avoid Telstra equipment, bodies of water and the like.

![Diagram of earthing requirements](image)

**Figure 3: Padmount substations – segregation requirements from other structures**

5.10 **Specific substations details**

Selection of a suitable single pole substation, for example, urban, coastal or rural, for the project shall be carried out in accordance with this instruction and MCI 0005.

5.10.1 **Pole size**

- Pole substation in the road alignment - 12.5m/12kN or bigger depending on mains.
- Pole substation not in the road alignment - 12.5m/8kN or bigger depending on mains plus a maximum transformer weight of 700kg and size of 63kVA.

If there is an unusual HV construction (for example, HV at 90° to LV) the designer shall choose a pole suitable to cater for the mains. This may require a taller pole to allow for the connection from the mains to the pole substation.

The maximum transformer mass for any substation is 2090kg.
5.10.2 Maximum demand indication
Maximum demand indication is required on all three (3) phase transformers.

5.10.3 Transformer HV barrier and possum guards
The installation of an earthed barrier on top of the transformer is required when the distance from the pole face to the HV bushing is less than 800mm (11kV) or 1100mm (22kV). This barrier must be installed in accordance with SDI 300.

HV transformer bushings and surge diverters shall be fitted with approved possum guards. Surge diverters will be supplied in accordance with SDI 305.

5.10.4 Substation numbering
It is the designer’s responsibility to ensure that all numbers are provided to the constructor so that they can be installed as set out in MCI 0005.

5.10.5 LV mains
The number of LV distributors at a substation is generally two (2) but three (3) can be used if a design variation is submitted for approval. Regardless of the number of distributors a maximum of two (2) 3 phase sets of supply fuses can be installed on any pole substation.

- A typical submission that would require approval may be the use of a wing arm located on the top and at the end of the two (2) LV crossarms of the urban design. This will allow a 90° long span open wire LV tee at the substation.

Figure 4: Typical wing arm assembly

- Another option may be the use of LV ABC attached to the pole. The use of LV ABC attached to the service box in arms of the urban design is not suitable.

5.10.6 Substation combinations
Substations may be assembled in various combinations. These combinations need to be suitable for the following, if required:

- Transformer sizes of 25, 63, 100, 200, 315, and 400 (all 3 phase), 25 and 50kVA (both single phase). Note: 400kVA is the maximum size.

- High voltage street mains constructions of open wire, aerial bundled conductor (ABC) or covered conductor thick (CCT).

- Low voltage street mains constructions of open wire or ABC. Rural substations allow the direct connection of services to the low voltage switchgear.
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- The primary voltage will be 11kV, 22kV or 12.7kV SWER. The secondary voltage will be 433V if three phase and 250V or 500V if single phase (refer to transformer technical details in SDI 300 for complete information).

- Coastal areas where salt pollution is a problem.

5.10.7 Underground to overhead cables on substations

Only one (1) LV mains or service cable underground to overhead connection is permitted on a single pole substation.

The cable cores shall remain grouped and be saddled to the pole so that the cable passes up between any LV crossarms. Then the cable can be split into individual cores and brought over the top of the LV crossarm and connected to the line side of the LV fuses.

The LV cable shall not obstruct the operation of the LV transformer links and fuses or the HV drop out fuses.

Note: HV underground cables can not be run up a substation pole under any circumstances.

5.10.8 Pole substation fuses

Refer to MCI 0005 for details on fuse sizes for various size transformers.

5.10.8.1 LV fusing

During design, when calculating the load to apply to fuses, the maximum continuous load should be limited to approximately 75% of the fuse nameplate rating.

LV fuses above 400 amps are not permitted. When an individual load greater than 350 amperes occurs, a LV circuit breaker will be required (refer Drawing no. 078960 in MCI0005).

A maximum of two (2) fused circuits for each phase are permitted on any pole substation.

5.10.8.2 MV fuses

In all 22kV areas, and on 11kV networks where the fault current exceeds 8kA, the HV fuses shall be of a boric acid drop out fuse type unless approval to the contrary is given by Integral Energy.

Also, where there is a problem achieving the correct levels of earthing resistance, and a 3.15A fuse is required, a boric acid drop out fuse may be used once approval is obtained from Distribution Engineering.

Fire chokes must not be fitted to drop out fuses. Where fire chokes exist on existing substations they shall be removed.

5.10.9 Transformer mounting

All new transformers must be mounted using 20mm grade A2 (304) class 70 stainless steel bolts through the pole (grade 316 nuts). All stainless bolts should have their threads lubricated with a nickel based solid lubricant (Molykote 1000 or similar). Units up to and including 63kVA must be pole bolt mounted. Units greater than 63kVA must be mounted on a transformer hanging bracket that uses the same mounting holes as the 63kVA pole bolt style. This detail is covered on Integral Energy Drawing no. 078956.
Older transformers may be fitted with *U-bolts* that wrap around the pole, and a hanging bracket. This arrangement can remain if it is not in the way of, or is suitable for the replacement transformer.

To aid in the mounting of transformers and equipment, a platform shall be used on all pole substations.

5.10.10 Maintenance/operating platform

A maintenance/operating platform is required on all substation constructions except the coastal design. The platform is required to allow field staff to carry out any manual handling of equipment (for example, transformer changes), operate LV and HV switchgear, and assist in applying earthing. Due to the different construction of the coastal design, it has been deemed not to be required.

5.10.11 Construction assemblies

It is the designer’s responsibility to indicate on the design drawings which type of substation shall be constructed at each location (for example, urban, coastal, rural, LV fuses or CB).

The table below shows the typical layout drawings for each substation construction type (refer to MCI 0005 for more details on construction, if required).

<table>
<thead>
<tr>
<th>Drawing detail</th>
<th>Type of substation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Open wire</td>
</tr>
<tr>
<td>General arrangement</td>
<td>249489</td>
</tr>
</tbody>
</table>

**Note:** Customer only substations shall only be installed in the customer’s property.

5.11 Substation selection and typical substation circuit diagrams

It is the designer’s responsibility to indicate on the design the type of substation, as listed below, that will be used at each site. Selection of the correct substation for a project should be in accordance with the following table and the expanded detail indicated for each construction type. Generally, an urban style substation should be considered the standard construction until approval is given by Integral Energy for another construction type to be used.

<table>
<thead>
<tr>
<th>Transf. size</th>
<th>Urban (standard)</th>
<th>Rural</th>
<th>Semi-rural</th>
<th>Single customer</th>
<th>Coastal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max current</td>
<td>Max 400kVA</td>
<td>&lt;= 63kVA</td>
<td>&lt;= 250kVA</td>
<td>Max 400kVA</td>
<td>Max 400kVA</td>
</tr>
<tr>
<td></td>
<td>556A/ph</td>
<td>200A/ph 1ph</td>
<td>348A/ph</td>
<td>556A/ph</td>
<td>556A/ph</td>
</tr>
<tr>
<td>Sub location</td>
<td>Street</td>
<td>Street</td>
<td>Street</td>
<td>Private</td>
<td>Street/private</td>
</tr>
<tr>
<td>Pole size min.</td>
<td>12.5m/12kN</td>
<td>12.5m/12kN</td>
<td>12.5m/12kN</td>
<td>12.5m/8kN</td>
<td>12.5m/12kN</td>
</tr>
<tr>
<td>LV mains</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>Both</td>
</tr>
<tr>
<td>LV fuse/CB options</td>
<td>Trf Isol. + 2 x 400A Open style fuse links</td>
<td>100A service (max 2 customers)</td>
<td>400A LV ABC</td>
<td>100A service, 400A LV ABC, LV ABC + CB</td>
<td>1 or 2 x 400A Open style fuse links, 100A service, 400A LV ABC, LV ABC + CB</td>
</tr>
</tbody>
</table>
The following sections show the typical layout for each of the substation configurations.

5.11.1 **Urban substation**

Urban substations are the preferred designed for most areas and applications such as:

- Large loads, generally greater than 63kVA.
- Multiple customers.
- Substation is located in the street alignment.
- LV crossarms are required.
- Open style LV fuses and links.
- Where an interconnected LV network is essential.
- 1000m² (¼ acre or less) land block size is a standard or will be the standard developed in that area.

This design allows for transformers up to 400kVA and can have fusing of various ratings up to 400A in both lines leaving the substation.

The substation is generally used in built up areas and provides greater flexibility in switching.

With the service box in arms it allows multiple services to be strung at wide angles and with suitable clearance from any HV. Also allows good road crossing clearances to be maintained.

5.11.2 **Rural substation**

Rural substations are generally designed to supply the following type of load:

- Light loads, no larger than 63kVA.
- Generally one (1) or two (2) individual customers supplied through pole mounted 100A barrel service fuses.
- Substation is located in the road reserve.
- Rural areas with large open blocks of land.
- No LV mains or network connection.

Where two (2) customers are required, a second separate service switch/fuse shall be connected to the transformer LV cable (min 95mm²) by way of a IPC mounted on the opposite side of the pole to the first switch fuse.

This is the preferred method of supply where customers are widely spaced and where LV backup is not economically possible, or voltage drop makes it technically unsuitable.
5.11.3 **Semi-rural substation**

Semi-rural substations are generally designed to supply the following type of load:

- Medium loads, no larger than 250kVA.
- More than two (2) customers fed from joint use LV mains.
- Insulated 400A LV ABC switch/fuse.
- Substation is located in the **road reserve**.
- Houses fused separately at each property.
- Large open blocks of land.
- Possible limited LV network backup/interconnection.
- Not likely to be developed to an urban design for more than five (5) years.
- Generally, the transformer will connect straight to the LV mains through a LV fuse switch.
- Typically, in new areas, the LV mains will be LV ABC with no LV crossarms.
5.11.4 Coastal substation

Coastal substations are designed to supply loads in areas of heavy salt pollution.

This design is to be used strictly within 2km of coastal or salt spray affected areas.

This design can be installed in the road reserve or on a customer’s property. Both individual and multiple customers can be supplied from this design.

This design is more suited to open wire LV fuse link construction but may be used with LV ABC where the salt pollution is less significant and single phase fuse/links are used.

Due to the reduced LV mains height, long spans away from the substation are not usually achievable. Clearances over driveway and the like are also reduced and need to be considered during design.

The coastal substation design can be used with the following LV options:

Option 1 – Maximum continuous loads up to 350 amps or 250kVA (400 amps peak - short time) for each phase using fuses. 100A service fuses to be used for single customers. 400A LV ABC switch/fuse for loads greater than 100A or multiple customers.

Option 2 – Twin LV fuse arrangement (up to 400A each). This is suitable for transformers up to 400kVA and allows isolation of each LV supply. If total load exceeds 250kVA the transformer LV cabling will need to be doubled in a closed loop to achieve full load rating.

Option 3 – Single customer with maximum continuous loads greater than 350 amps up to 550 amps per phase (400kVA) using a LV CB.

The 100A service fuse would be replaced with a 400A LV ABC switch fitted with links to achieve a 630A isolator.

A 1250A LV CB and neutral isolation/test link would be installed on the pole as set out in Drawing no. 78960.
Single customer substations are designed to supply the following type of load:

- Any loads, such as single phase 25kVA up to 400kVA three phase loads.
- One (1) customer only.
- Substation will be located in the customer’s property but not in the road reserve.
- No LV mains but a backup LV feed to the street may be installed, if required.
- Minimum 12.5m/8kN pole up to 63kVA. Loads greater than 63kVA a minimum 12.5/12kN pole size.
- Normal loads, but where a more stable quality of supply is required.

The basic rural substation design would be used, but with the following LV options:

**Option 1** – Maximum loads up to 100A for each phase use the standard service fuse.

**Option 2a** – Maximum continuous loads up to 350 amps or 250kVA (400 amps peak - short time) for each phase using fuses and an overhead service.

The 100A service switch/fuse would be replaced with a 400A ABC switch/fuse fitted with the appropriately rated DIN fuses for the load.

**Option 2b** – Same as for 2a, but with underground consumer’s main connection on the pole in a meter box.

**Option 3** – Maximum continuous loads greater than 350 amps up to 550 amps for each phase (400kVA) using a LV CB.

The 100A service fuse would be replaced with a 400A LV ABC switch fitted with links to achieve a 630A isolator.

A 1250A LV CB and neutral isolation/test link would be installed on the pole, as set out in Drawing no. 78960.
5.11.6 Single phase substations

Single-phase substations must be built to the rural pole substation design. The centre phase dropper cable, drop out fuse, surge arrester and associated hardware is to be omitted from the construction. The transformer must be limited in size to 50kVA.

5.11.7 SWER substations

SWER substations require that their earth grid is capable of continuously carrying load current in addition to providing safe protective earthing.

As with single phase substations, the SWER substations supply can generally be configured to supply 250V when the LV output windings are connected in parallel, and 500V when they are connected in series.
5.12 Major equipment specifications

The items that are deemed major equipment for the pole substation have the technical specification detailed in individual Substation Design Instructions. The items and the relevant Substation Design Instruction number are set out below:

- SDI 300 – Pole substation transformer specification
- SDI 304 – Pole substation drop out fuse specification
- SDI 305 – 11/22kV surge arrester specification

5.13 Minor equipment specification

The items that are deemed to be minor equipment are those items that are shown in the material lists on the substation construction drawings, but are not set out in detail in the Major equipment specification section of this instruction.

5.13.1 Poles

To be hardwood, of durability class 1 or 2, and have full length preservative treatment in accordance with AS 2209.

5.13.2 Pole hardware

Steel bolts in accordance with AS 1111, nuts in accordance with AS 1112, and shall be hot dipped galvanised in accordance with AS1214 (refer to MCI 0005 for more details).

5.13.3 Crossarms

To be cut and drilled from hardwood of stress grade class S1 and S2, durability and structural class 1 and 2. The minimum stress shall not be less than grade F17 for unseasoned timber as shown in table A1 in AS 2082. To be drilled and fitted with gang nail plates in accordance with the appropriate design drawings.

On completion of sawing, crossarms shall be protected against end checking and splitting by the application of Caltex Timber Seal or equivalent.

Crossarms, regardless of type, that is, natural sawn or preservative treated, shall be painted on the top (nominated) surface. The following paint system is acceptable:

One (1) coat of Dulux Weather Prime Acrylic paint or equivalent, followed by two (2) coats of Dulux Weather Shield Acrylic paint or similar, coloured avocado green, ref no. G34 to AS 2700 and applied to manufacturer’s specification using a brush or roller (not sprayed).

5.13.4 Crossarm braces

Three (3) sizes of cross arm braces are required – 750mm, 900mm and 915mm (angle). These are to be constructed in accordance with Drawing no. 011962.

5.13.5 Miscellaneous items

These items include those set out in the construction drawings but not listed above.

These items are to be manufactured in accordance with the Australian Standard, where applicable, alternatively refer to Integral Energy for clarification.

5.13.6 Cables/conductors

- Cable LV 0.6/1kV copper black XLPE insulated PVC sheathed to AS 5000.1.
- Cable aluminium 6.35/11kV.
- Covered conductor thick (CCT) to AS 3675 table J2.
- All other cables/conductors to the relevant Australian Standard.
### 5.14 Approved materials

The following components have been approved for use on the pole substation. This is the only equipment to be used in these applications. The materials are identified by the supplier and part numbers. Where a part requires variations from the standard, a drawing reference may apply (refer to the relevant SDI for major equipment approved components).

#### Insulator CCT 11kV pin insulator

<table>
<thead>
<tr>
<th>Supplier</th>
<th>Part number</th>
<th>Stock code</th>
</tr>
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<tbody>
<tr>
<td>NGK Stanger</td>
<td>DA-45150M</td>
<td>SY10166</td>
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#### Transformer HV possum guard 11kV

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<tr>
<td>Adapt</td>
<td>Adapt-30 (3 way)</td>
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<tr>
<td>Adapt</td>
<td>Adapt-23 (one way)</td>
<td>1543222</td>
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<tr>
<td>Gilbert Lodge</td>
<td>Part no. 10851</td>
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<tr>
<td>Raychem</td>
<td>Part no. BCIC-3010 or BCIC-3020</td>
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#### Transformer HV possum guard 22kV

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#### Cable aluminium 6.35/11kV CCT

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#### Cables LV 0.6/1kV copper black double insulated

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#### Cable 0.6/1kV copper red/white double insulated

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<tr>
<td>National</td>
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#### Cables LV 0.6/1kV copper black single insulated

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<td>1007403</td>
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<td>National</td>
<td>D010-Black</td>
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#### Lug aluminium tinned

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#### Lugs copper

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<td>Ed Keller</td>
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<td>Utilux</td>
<td>H1423/25</td>
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<td>Aust Power</td>
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<td>Cable Accessories</td>
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<td>Utilux</td>
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11/22kV single pole substation design and material requirements

Amendment no. 5

7/1.70/M10 Cable Accessories Part no. CAL16-10 Utilux Part no. H1408A/50 SL12727

19/2.14/M10 Ed Keller Part no. CL70-10 Utilux Part no. H1422/25 Burndy Part no. B70M SL10511

Low voltage switchgear link LV switchfuse 400A
NGK Stanger Part no. NZ4239A SL11844
ABB Part no. 722101

Low voltage switchgear link LV switch 630A
NGK Stanger Part no. NZ4284A SL11801
ABB Part no. 7211600

Low voltage switchgear service switch fuse 100A, 1 phase
Krone Part no. 6459-1-014-10 SS11102
Stanger Part no. 1x71931 & 1x72485/3

Low voltage switchgear service switch fuse 100A, 3 phase
Krone Part no. 6459-1-020-00 SS11101
Stanger Part no. 3x71931 & 1x72485/3

Low voltage switchgear ABC switch fuse 400A, 3 phase
Krone KGH 400 3-phase (IPC) Part no. 6459 1 122-02 1548841
Krone KGH 400 3-phase (Stud) Part no. 6459 1 001-30 SS18410
Krone KGH 400 3 x single phase Part no. 6459 1 115-20

22kV Boric acid drop out fuse
S&C SMD20-Holder Part no. 92143R3-MS103 1550987
S&C SMU20-8 Amp fuse Part no. 703008 1550961
S&C SMU20-20 Amp fuse Part no. 703020 1550979

Connector insulator piercing 95-25/35-6 mm sq XLPE
Pfisterer Part no. 332-405-003-PLUS E 1066237
RNJ Sicame Part no. TTD151FA
Mosdorfer Part no. 5214-WPR3
AMP Control Part no. 708055-1
Krone Part no. CDP2-6469-0-320-03
Michaud Part no. K330
Dulmison Part no. K441

Connector insulator piercing Bare Al/ 35-6 mm sq XLPE
Dulmison Part no. K473 1108299
RNJ Sicame Part no. NTD351AFA

Connector insulator piercing Bare Cu/35-6 mm sq XLPE
Dulmison Part no. K472 1108307
RNJ Sicame Part no. NTD301SA
RNJ Sicame Part no. NTD301F

Connector insulator piercing 95/95 mm sq XLPE
Dulmison Part no. K445 1066092
RNJ Sicame Part no. TTD301FA
5.15 Operational requirements

The operational requirements will generally be covered in the design drawing detail, however to ensure safe and efficient operation, the ASP shall ensure the following requirements are met in all cases:

- A minimum clearance of 2.7 metres is required from the lifting point on top of the transformer to the bottom of the drop out fuse. This will allow the transformers to be changed with the overhead high voltage mains alive.

- It shall be possible for the operator to open the drop out fuse from a platform, using Integral Energy's standard operating handle.

- It shall be possible to attach the safety belt and work without encroaching on the relevant minimum safe working distances, as set out in Integral Energy's Safety Rules.

5.16 Drawings

All construction drawings are contained in MCI 0005 except those listed below, which are new and will be incorporated in MCI 0005 at the next revision.

<table>
<thead>
<tr>
<th>Drawing</th>
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<tr>
<td>303376</td>
<td>A</td>
<td>Pole substation coastal design, single and twin LV fuse up to 400kVA</td>
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<tr>
<td>303404</td>
<td>A</td>
<td>O/H concrete pole coastal substation hole former and ferrule layout</td>
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6.0 AUTHORITIES AND RESPONSIBILITIES

6.1 Distribution Engineering shall be responsible for the updating and clarification of interpretation of this instruction.

6.2 Accredited Service Provider (ASP)

It will be the ASP’s responsibility to ensure that:

- All new installations conform to the requirements of this instruction.
- Staff have available and use the latest issue of any drawing relevant to or listed in this instruction and MCI 0005 during construction of any project.

6.3 Contractor Operations Manager, Network Connections Branch shall be the authorising officer for external staff or organisations to carry out installation works, and shall be responsible for ensuring that all new installations are inspected for compliance to the requirements of this instruction.

7.0 DOCUMENT CONTROL

Documentation content coordinator: Distribution Engineering Manager

Documentation process coordinator: Branch Process Coordinator