Technical Specification - Earthing and Lightning

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Revision details

Version No.	Clause	Description of revision
1.0	All	General revision
2.0	All	General revision
3.0	All	Format update, changing ‘shall’, ‘should’ and ‘may’ to must where relevant to Sydney Water, ‘approved’ replaced with ‘accepted’, minor editorial changes elsewhere.

Introduction

This Specification is for the design, supply and installation of Earthing and Lightning works for Sydney Water assets.

Sydney Water makes no warranties, express or implied, that compliance with the contents of this Specification shall be sufficient to ensure safe systems or work or operation.

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Acronyms

Term	Definition
AC (ac)	Alternating Current
AS	Australian Standard
AUD	Australian Dollars
c/w	complete with
DC (dc)	Direct Current
DI	Digital Input
DO	Digital Output
ELCB	Earth Leakage Circuit Breaker

Term	Definition
ELV	Extra Low Voltage (i.e. ≤ 50 V AC or ≤ 120 V DC)
EN	European Normalised Standard
EPR	Earth Potential Rise
ESW	Earth Switch
GA	General Arrangement (drawing)
HV	High Voltage (i.e. > 1000 V AC or > 1500 V DC)
IEC	International Electrotechnical Commission
IEEE	Institute of Electrical & Electronic Engineers
ISO	International Standards Organisation
ITP	Inspection and Test Plan
LV	Low Voltage (i.e. greater than ELV but ≤ 1000 V AC or ≤ 1500 V DC)
MCB	Miniature Circuit Breaker
MCC	Main Control Centre
PLC	Programmable Logic Controller
pu	per unit
SAA	Standards Association of Australia
Sec.	second
SLD	Single Line Diagram
TBA	To Be Advised
TBC	To Be Confirmed

1. General

1.1 Introduction

This specification defines the minimum technical requirements for the design, installation, and commissioning of Sydney Water electrical earthing and lightning protection systems.

1.2 Scope

This specification covers the technical requirements for earthing and lightning protection system in Sydney Water High Voltage installations.

Key stakeholders for this specification includes Sydney Water Electrical Operations team, maintenance provider and project delivery parties.

1.3 Proprietary items

Nomination of a proprietary item by Sydney Water does not imply preference or exclusivity for the item identified.

Alternatives that are equivalent to the nominated items can be submitted to Sydney Water for acceptance. The submission must include appropriate technical information, samples, calculations and the reasons for the proposed substitution, as appropriate.

2. Technical requirements - earthing

2.1 Earthing method and design

Earthing provisions for all electrical equipment must be designed, installed, commissioned and maintained to comply with the requirements for a solidly earthed system.

All equipment must be securely bonded directly to the main earth bar. Each item of electrical equipment is to be effectively earthed. Earthing by relying on a structure for earth continuity is not acceptable.

A main earth bar must be installed in each switch room for each of the earthing systems. All items of equipment connected to the earth bar must have a separate earth conductor with a cable identifier at each end. A 16 mm^2 earthing conductor must be run from the main earth bar in the switch room to a convenient brass or copper earth terminal on each floor of the switchroom building. A 150 mm x 150 mm sign must identify the terminal that will be used for statutory earth continuity testing.

3. Technical requirements - earth leakage protection

3.1 General

Earth leakage protection must be provided in accordance with Australian Standards.

Earth leakage protection must be provided on all outgoing power circuits above 50 V.

3.2 Grading

Earth leakage protection must be graded so that the device nearest the earth fault clears the fault without tripping upstream devices.

3.3 Sensitivity

Earth leakage protection must be provided with the following sensitivities unless otherwise approved or nominated by Sydney Water:

a) Main LV switchboard or distribution board, 0 - 500 mA, complete with an adjustable time delay in the range of 0 - 500 ms

b) Backup earth leakage on an LV MCC or distribution board, 0 - 500 mA, complete with an adjustable time delay in the range of 0 - 500 ms, to trip supply breaker (i.e. HV circuit breaker)

c) All motors fitted with a motor protection relays must have core balance CT's fitted for sensitive earth fault detection. 100 - 300 mA

d) Control circuits that are above extra Low Voltage, 30 mA

e) All 415 V welding and 240 V general power circuits and lighting circuits, 30 mA.

3.4 Earth leakage relays

Each earth leakage relay installation must be equipped with the following facilities:

a) a test pushbutton and a test resistor

b) a reset pushbutton (external)

c) A trip indicator which remains operated until the reset button is pushed.

d) An analogue output, representative of the total earth leakage current flowing, must be retransmitted to the PLC for display and alarming.

(a), (b) and (c) above must be mounted on a cubicle door or a dead front panel.

The test pushbutton must apply a 500 mA earth leakage via a suitably rated test resistor. The test circuit for low voltage applications must be arranged so that a true earth test is applied to the system. The test circuit must not be routed through the earth leakage toroid.

Earth leakage relays for variable speed drive protection circuits must be selected to ensure operation reliability, personnel safety and equipment protection. Type B earth leakage relays are preferred.

4. Technical requirements - power, lightning and signal earths

4.1 General

The optimum earthing system for earth installation must be determined during the design phase, however as per the recommendations of AS 1768 preference must be given to a common earthing system for HV and LV power supplies, lightning and signal screens.

4.2 Earth conductors

Main Earth cables must not be less than 70 mm^2.

Buried earth conductors must be bare hard drawn copper wire. Bare earth conductors must not be used in any other situation except with the written permission of Sydney Water.

In all other instances earth conductors must be PVC insulated and coloured a combination of yellow and green. The use of green PVC tape is **not** permitted.

4.3 Looping and disconnection

Earth conductors must not be looped between items of equipment.

Removal of any piece of equipment must not require the disconnection of earthing connections to any other piece of equipment.

4.4 Screen earthing

Cable screen must be terminated onto the signal earth bar at the power supply end only. The screen must be labelled using interlocking white thermoplastic ferrules with black machine printed identification.

4.5 Earthing of steelwork

All steelwork including all hinged panels and doors must be earthed with separate earth conductors, using bolted connections. Paint must be removed from around the connections to ensure a secure joint. The surface must be cold galvanised and then re-painted to ensure adequate surface protection.

Conductive cable trench covers (grating, plates etc) must be bonded to earth.

4.6 Earthing of cable ladder/tray

All cable ladder routes must be provided with earth connections. Each cable ladder route must be earthed by a minimum of 35 mm^2 earth cable and at a maximum of 30 m intervals. All cable ladders must be bonded to earth and to supporting structure column. 16 mm^2 earth bridges must be installed at all hinged horizontal and vertical splice plate connections along the cable ladder routes.

4.7 Maximum number of earth terminations on a stud

Junction boxes, control panels and the like requiring more than four earth terminations must be fitted with an earth bar or SAK earth terminals (studs are not acceptable).

4.8 Mandatory connections of earths

Earth conductors, metallic sheaths and metallic protection of low voltage power and control cables or systems must be connected to the earth bar at both ends. This must be done regardless of the number of earth cores already connected between the two points.

Screens on extra low voltage instrumentation cables must be connected at one end only, and preferably the switch room end.

5. Technical requirements - substation / electrical equipment room earthing

5.1 General

Where a new installation or upgrade or extension to an existing system is to be completed the following must apply.

5.2 Standards

The contractor must design a complete earthing system in accordance with AS 2067, IEEE 80, ESAA EG1, AS 3835, AS 4853, AS/NZS 3000 and all other applicable Australian and statutory requirements.

5.3 Substation/ switchroom earthing arrangement

The switchroom/ substation must be fitted with a split main earth bar of tinned copper material. The split earth bar must consist of two separate earth bars mounted on stand-off insulators with a copper link fitted between them to assist with testing of the earthing system with equipment still in operation. The earth bar must typically be located on the internal back wall of the HV switchgear room adjacent to the cable trench.

The earth bars must be of suitable size and must have minimum of 30% spare pre-punched holes complete with bolts, washers and nuts fitted.

All metallic equipment including but not limited to HV switchgear, control panels, cabinets, cable ladder, metal frames/ roofing and steel-reinforcing in concrete slabs must be effectively earthed to the switchroom earth bar via two separate earthing cables, each connected to different earth bar.

Each earth bar must be clearly labelled. All earth cables must be individually labelled.

5.4 Substation fences

Care must be taken in the design of the system which must comply with AS 2067, Clauses 5.6.2 "Design of Earthing System" and Clause 5.6.3 "Earthing of Fences and Outdoor Installations", and the requirements of IEEE Std 80. Where conflict arises in these documents, the more onerous requirement must be adopted.

All substation fencing must be electrically continuous with a minimum of one earth point on each side of the fenced yard. All substation gates and hinged joints must be earthed by minimum 70 mm^2 flexible braid. The braid must be installed such that the braid does not experience any excessive tension throughout the full range of movement of the gate.

The fence posts must have a welded tab with a 13 mm hole in the centre. This will be connected to the 70mm^2 or greater copper cable connecting the main earth grid. All metal work must be protected from the environment and atmosphere.

All earth cables external to the yard, or cables exposed to possible cable damage must have mechanical protection.

5.5 Prospective fault levels and clearance times

The future maximum phase-to-earth fault level and associated back-up clearance times must be utilised for assessment and evaluation of step and touch potential safety criteria. If it is found that a design to back-up clearance times is inappropriate or hard to achieve then a risk assessment for compliance to primary protection must be performed.

6. Technical requirements - development of earthing system model

6.1 Soil model

Soil resistivity measurements must not be taken until all earthworks at and in the vicinity of the earthing installation have been completed and prior to any foundations or further civil works commence.

Soil resistivity measurements must be taken for the site with electrode spacing up to the diagonal of the substation/switchyard as a minimum. A multilayer soil structure must be formulated by computer modelling. The multilayer soil model must be used in the earthing system design. Equivalent uniform soil structures are not to be used. Soil resistivity testing must ensure that the test is not corrupted by underground or overhead services.

6.2 Earth grid model

A computer model must be created to design the appropriate earthing system for the substation. The program of the model and associated data must be provided to Sydney Water in soft and hard copy. In the report, the version number and type of program must be specified. Any assumptions must be documented.

All buried earth conductors will be bare copper (or equivalent material) installed at a depth of 500 mm. All vertical electrodes will be stainless steel (or equivalent material) of a suitable size. Calculations are to be submitted to the Sydney Water representative for approval. All earthing materials must be suitable for the harsh environment.

6.3 Touch and step voltages

Touch voltages at the substation must be assessed in accordance with the relevant Australian Standard and step voltages outside the substation perimeter fence are to be assessed according to IEEE Standard 80 (50 kg) and step voltages inside the substation are to be assessed according to IEEE Standard 80 (70 kg).

Touch and step voltage plots generated by the computer simulations are to be supplied to the Sydney Water. representative in report format, prior to installation of any earthing systems.

6.4 Earthing system EPR and transfer voltages

The earthing system Earth Potential Rise (EPR) during a phase to earth fault must be computed using computer simulation. The soil voltage gradient in the area surrounding the substation must be computed to ensure that touch voltages that may exist due to the conduction of voltage through the soil are in compliance with the relevant Australian Standing Including AS 3835.1 and AS 3835.2.

All exposed steelwork, pipes, metallic structures, conveyors etc, must also be considered during the earthing design stage to ensure that direct transfer of voltages from the substation to other equipment during a phase to earth fault is within the requirements of IEEE Standard 80 and AS 4853.

6.5 Conductor sizing

The earthing system conductors need to be correctly sized to safely dissipate the fault current without any damage. The sizing must be based on future maximum earth fault levels and back-up clearance times. At a minimum 70 mm² bare copper conductors must be installed.

6.6 Transformer bay earthing

All equipment including transformer casing, fencing, gates, main switchgear main earth, cable trunking etc. must be bonded to a suitable sized tinned copper earth bar located in the transformer bay. This earth bar must be pre-drilled with 13 mm holes for earth cable attachment. There must be 25% spare capacity of holes for future connections.

All connections must be identified. Earth grid connections must also be made at this bar.

7. Technical requirements - earthing electrodes

7.1 Number of electrodes

The total number of earth electrodes must be determined from the computer-generated model of the system.

7.2 Size and material

The materials used on Sydney Water sites must be robust for the environment. Stainless Steel Rods are preferred. All connections, whether they are exothermic welds or other, must be protected from the environment.

7.3 Installation of electrodes

Electrodes must not be driven until service scans and excavation permit requirements are fulfilled.

Where the ground permits, the earth electrodes must be driven.

Where extendible copper clad steel (or preferred stainless steel) electrodes are used they must be extended only with approved fittings.

If the ground is rocky or the electrodes cannot be driven, 75 mm diameter holes must be drilled to a minimum depth of 6 m. After drilling of the holes they must be filled with a mixture of 50% gypsum and 50% Bentonite by volume, to which must be added 1% by volume washing soda. The mixture must be thoroughly mixed, formed into a slurry and poured into the earth electrode holes. The earth electrode must then be lowered into a hole. It must be ensured that the connection between the earth cable and the earth electrode is accessible above the level of the Bentonite mixture.

Electrodes must be connected to the earth grid by either an exothermic weld or approved compression joint.

7.4 Earth electrode pits

Earth electrodes must be installed complete with pit and cover. The connection point must be no greater than 50mm below the lid in order for the connection point to be readily accessible.

A pit must be provided around the top 250 mm of the earth electrode. The pit must be surrounded by a concrete pipe of 300 mm minimum diameter or equivalent. A reinforced concrete lid must be provided for the concrete pipe.

The pipe and lid must be installed such that the lid must be flush with the ground surface or aggregate.

The pit lid must include provision for the easy removal using a tool. A minimum of two lid removal tools must be supplied to Sydney Water per site upon the completion of the installation.

The contractor must provide a site layout drawing detailing the location of each earth electrode and its corresponding GPS position.

8. Technical requirements - earth conductors

8.1 Burial requirements

Buried earthing bars and cables must be located at a maximum depth of 0.5 m below ground.

Buried earth conductors must be bare copper, or an approved equivalent to the size that would be used for a copper earth conductor.

8.2 Earthing of hinged equipment

Cables to moveable or hinged equipment must be braided flexible copper.

8.3 Earth bar material

Earth bars must be hard drawn copper (and tinned) or equivalent for the harsh environment. The insulators must be suitably rated in kV.

9. Technical requirements - earth connections

9.1 Buried connections

All buried and exposed taps, splices and connections in bar and cables must be made by exothermic welding or approved compression fittings. The pre-welding treatment of the conductors must be in accordance with the manufacturer's instructions. The Sydney Water representative must inspect all buried connections before backfilling. The use of buried bolted connections is **not** permitted.

9.2 Cable

All cable connections from the earth grid to equipment must be PVC green/yellow sheathed.

9.3 Cable joints

Unless otherwise accepted, all joints must be visible and accessible. Other cables must not cover earth cables. Tee off joints of earth cables must be visible.

10. Technical requirements - equipment earthing

10.1 General

Every unit of electrical equipment (except for double insulated equipment) must be earthed via an earthing conductor at its point of supply. In the event that there is no earth in the supply cable to the equipment a separate earth conductor must be installed.

Earth conductors, metallic sheaths and metallic protection of low voltage power and control cables or systems must be connected to the earth bar at the point of supply and to the earth connection of all equipment to which they are connected in an accepted manner.

10.2 High voltage equipment

All HV equipment must be connected to the main earth grid at two points located on diagonally opposite sides of the equipment by two separate conductors originating from the earth grid or main earth bar.

All Outdoor HV equipment with manual operating mechanisms must be fitted with 70 mm^2 tinned copper flexible earth braids across all hinged joints.

10.3 Transformers

Transformers must be earthed at all earth connection points provided.

Pole top and small capacity transformers must be earthed at the earth connection tabs provided by the manufacturer.

10.4 Support structure earths

Structures used to support electrical equipment with exposed metalwork must be provided with an earth cable or bus bar for the purposes of earthing the exposed metalwork. The connection points on the structures for equipment within a locked switchyard should be approximately 300 mm above ground level.

Provision for the quick and easy connection of portable earths must be provided on all such support structures.

The earth connection point for structures outside of a locked switchyard will be approximately two metres above ground level and PVC or equivalent insulating cover must be used to mechanically protect the exposed hard drawn copper (or equivalent) earth wire from the ground level to the first connection point approximately two metres above ground level.

All connections will be via double bolted cable lug-to-lug utilising stainless steel or brass bolts washers and nuts or proprietary quick lugs as approved by the Sydney Water representative.

All cables for the purpose of earthing support structures must be green - yellow PVC covered copper earth cable of minimum 70 mm^2.

10.5 Enclosure lids and doors

All metallic enclosures and their lid or door must be connected to earth.

10.6 Earthing of metallic trefoil clamps

Cable metallic trefoil clamps must be solidly connected to earth.

10.7 Earth bonding

All metallic parts of the plant not intended to be alive, including fencing and gates, must be bonded to create a substantially uniform earth potential.

The following items of equipment must be connected solidly to the earth system:

a) Cable bridges

b) Pipe rack frames

c) Steelwork of bridges

d) Cable ladder hinged horizontal and vertical splice plates

e) Steel reinforcing in all concrete foundations

f) Other items as stated in AS/NZS 3000 and AS 2067.

10.8 Installation

During the installation of any and all earthing systems the Sydney Water representative will make periodic inspections of the installation of the earthing system. They must witness all buried conductors and jointing prior to backfilling and compaction of trenches.

10.9 Earthing of concrete foundations

All concrete foundations and concrete slabs must be earthed by:

a) Ensuring the steel reinforcing is electrically continuous (arc welding reinforcing together for entire foundation to provide continuity)

b) Providing a minimum of two diagonally opposite copper earthing external connection points to allow the steel reinforcing to be connected to the Earthing system. The connection point must be clearly labelled in the field and identified on the earthing system drawings, easily removable mechanical protection of the connection point must also be provided.

The external connection point copper (or Stainless Steel - material resistant to the environment) flag must be connected to the steel reinforcing by exothermic welding, arc welding or using the approved compression system.

The concrete connection points must be connected to the main earth grid at two points located on diagonally opposite sides of the slab or foundation.

The electrical continuity of the reinforcing and external connection points must be tested, documented and inspected by the Sydney Water representative prior to the cement being poured.

11. Earthing system testing requirements

11.1 General

Routine tests must be carried out in accordance with the relevant standards and to ensure the quality of the installation. An installation must not be deemed complete until all wiring and equipment has been checked and tested.

Quality system procedures and test records sheets must be provided for review and approval prior to commencing testing.

The test records must clearly describe the details of the tests and the test results. All calculations must be provided.

Defects found in any work pre-formed must be rectified and/or replaced.

'As built' drawing must be provided for all earth systems showing, in relation to the fixed electrical equipment, the position of equipotential bonds and position and depths of all earth electrodes, grid conductors.

11.2 Minimum tests requirements

The following minimum tests records must be used to ensure the quality of the installation. All test sheets must be signed off after completion and submitted to Sydney Water prior to energising and commissioning the installation.

When tests are conducted all necessary preventive action must be taken to avoid damage to sensitive and electronic devices.

a) **Earth continuity tests** - This must include at least the following information: drawing number, item of equipment, results, testing method, cable and core marking in place, name of person conducting tests, date of testing and project name.

b) **Earth loop impedance tests** - This must include at least the following information: Drawing number, item of equipment, results, testing method, cable and core marking in place, name of person conducting tests, date of testing and project name.

c) **Current injection test** - The testing must be performed by the current injection method. The test results must identify step and touch potentials, the earth system resistance, drawing number, name of person conducting tests, date of testing and project name. Attention is drawn to the requirement for correct placement of the current injection probe remote from the earth system and outside the sphere of influence of the Earth System under test.

d) **Measurement of voltage hazard around the site**

e) **Measurement of local grid resistance**

Representatives from Sydney Water must be given the opportunity to witness the tests. 14 calendar days' notice must be given to Sydney Water prior to tests being completed.

A comprehensive Site Test report must be submitted to Sydney Water for approval within five working days of completion of the tests (or on handover, whichever is the earlier). The Site Test Report must include as a minimum:

a) Drawing showing the full details of the earthing installation and all test points including locations, details and arrangement of current injections points and remote earth points and connection point to the system under test. GPS co-ordinates of the above test locations must also be provided on the drawing.

b) Results of tests

c) Copies of site defect lists / punchlists

d) Copy of the completed Site ITP

e) Statement confirming compliance with all specified and legislated requirements.

At the completion of testing, checks must be made to ensure that all links have been closed and tightened and all terminations are tight.

12. Technical requirements - lightning protection

12.1 General

Lightning protection must be in accordance with requirements set down in AS/NZS1768. As a minimum, in each location this must include:

a) Air termination at the highest point (materials used for this must be suitable for the Sydney Water site)

b) Down conductor (which is bonded to the air termination)

c) Earth grid

d) Equipotential bonding conductors

e) Surge protection.

12.2 Air terminal

All metallic objects at or above the main surface of the roof, such as sheeting, tanks, gutters, walkways, ladders, antennas, masts, pipes, cable tray, purlins, etc must be bonded to the air terminal network.

All the air terminals, interconnecting conductors and down-conductors must be interconnected into an enclosing network.

Where the roof consists of electrically continuous metallic materials, such metallic roofs will form part of the Lightning Protection System and typically obviate the need for air terminals.

Where Air Terminals air specified, air terminals must have a minimum current carrying capacity of that of a 35 mm^2 copper stranded conductors.

12.3 Down conductors

Down conductors must be distributed around the outside walls of the ‘protected’ structure.

Down conductors must be installed at each corner of the structure and additional down conductors installed at spacings not exceeding 20 metres (Exceptions apply for hazardous areas. Spacing must not exceed 15 metres).

Down-conductors must follow the most direct path possible between the air terminal and the earth. A maximum of 90 degree (right angle) bends may be used in installation.

Down-conductor routes must not be located in areas where personnel are liable to congregate.

The upper portion of the down conductors must be regarded as a continuation of the air terminal network and must be positioned as near as possible to the exposed outer vertical corner of the structure.

12.4 Earth grid

Earth terminations must be installed and connected as outlined in the earthing section of this specification (Exceptions apply for hazardous areas. Structure must have an additional 2 m grading ring installed, AS 1768:2007).

The interconnected Lightning Protection System (grid) must have an earthing resistance less than 10 Ω.

12.5 Equipment bonding for equipment protection

Bonding conductors must be kept short to reduce voltage differences (It is possible to have voltage drops during lightning surges exceed 1,000 V per metre).

12.6 Low voltage surge protection devices (SPDs)

Surge Diverters (Varistors) must be installed from the phases to the neutral in all nominated panels as per the scope of works.

A gas discharge or spark gap device must be installed between the neutral and earth in all nominated panel without a MEN connection, as per the scope of works.

A fuse or circuit breaker must be installed ahead of the SPD to provide for the safe disconnection of a failed SPD (as per the manufacturer protection specifications). In the absence of the manufacturer's specifications a high rupturing capacity (HRC) 63 A fuse may be installed.

The SPD must be installed after the main switch. The connection wiring from the main switch via the protective circuit breaker and the SPD back to the neutral bar must be a minimum of 6 mm^2 stranded copper cable and be as short as possible. The total connection lead length must be less than one metre in length.

13. Reference documents

All associated equipment and materials must be designed, manufactured, installed and tested in accordance with the latest revisions of the Federal and State statutory requirements, applicable Australian and IEC Standards, as well as the Sydney Water standard specifications.

Document type	Title
Legislation	- Latest edition of the Work Health and Safety Act - Latest edition of the Service and Installation Rules of New South Wales
Policies and procedures	
Other documents	
Standards	- AS ISO 1000: The International System of Units (SI) and its application (ISO 1000) - AS 1289: Methods of testing soils for engineering purposes - AS 1319: Safety signs for the occupational environment - AS/NZS 1768: Lightning protection - AS 1824 (IEC 60071): Insulation coordination (phase-to-earth and phase-to-phase, above 1k V) (Parts 1 and 2) - AS 2067: Switchgear assemblies and ancillary equipment for alternating voltages above 1 kV - AS/NZS 3000: Electrical installations (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 / 1 kV - Typical Australian installation conditions - AS/NZS 3835: Earth potential rise - protection of telecommunications network users, personnel and plant - AS/NZS 4853: Electrical hazards on metallic pipelines - AS 60479: Effects of current on human beings and livestock - AS/NZS 60990: Methods of measurement of touch current and protective conductor current - ENA EG1: Substation earthing guide - IEEE Std 80-2000: IEEE Guide for safety in AC substation grounding - IEEE Std 81: IEEE Guide for measuring earth resistivity, ground impedance, and earth surface potentials of a ground system - IEEE Std 81.2: IEEE Guide for measurements of impedance and safety characteristics of large, extended or interconnected grounding systems - IEEE Std 837: Standard for qualifying permanent connections used in substation grounding

13.1 Conflicts between Specification, Standards and/or Codes

Review the above standards and make use of them where they are applicable. Identify any conflicts between the above standards and recommend which criteria to use. The Contractor must refer and conflicts in the information to Sydney Water for clarification.

Ownership

Ownership

Role	Title
Group	Integrated Systems Planning - Liveable City Solutions
Owner	Manager of Urban Design and Engineering
Author	Lead Engineer Electrical

Change history

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1	Robert Lau / Andrew Manganas / Paul Zhou	05/12/2014	Norbert Schaeper	05/12/2014
2	Robert Lau / Paul Zhou	14/09/2018	Ken Wiggins	14/09/2018
3	Paul Zhou	20/02/2020	Steve-Keevil Jones	20/02/2020