

Document No: EDI 0006

Amendment No: 0

Earthing Design Instruction

Earthing construction standard

IMPORTANT DISCLAIMER

As the information contained in this publication is subject to change from time to time, Endeavour Energy gives no warranty that the information is correct or complete or is a definitive statement of procedures. Endeavour Energy reserves the right to vary the content of this publication as and when required. You must make independent inquiries to satisfy yourself as to correctness and currency of the content. Endeavour Energy expressly disclaims all and any liability to any persons whatsoever in respect of anything done or not done by any such person in reliance, whether in whole or in part, on this document.

Copyright © Endeavour Energy 2017

EARTHING DESIGN INSTRUCTION

ASSET STANDARDS AND DESIGN

Document No : EDI 0006
 Amendment No : 0
 Approved By : GMAM
 Approval Date : 04/07/2017

EDI 0006 **Earthing construction Standard**

CONTENTS

1.0	PURPOSE.....	4
2.0	SCOPE	4
3.0	REFERENCES.....	4
4.0	DEFINITIONS AND ABBREVIATIONS.....	4
5.0	ACTIONS.....	7
5.1	General requirements.....	7
5.1.1	<i>Earthing construction and decommissioning safety.....</i>	<i>7</i>
5.1.2	<i>Robustness.....</i>	<i>8</i>
5.1.3	<i>Earthing system installations and accessories.....</i>	<i>8</i>
5.1.4	<i>Earthing system separation requirements to other metallic infrastructure</i>	<i>9</i>
5.1.5	<i>Low voltage network earthing</i>	<i>9</i>
5.2	General construction requirements	9
5.2.1	<i>Requirements to meet design</i>	<i>9</i>
5.2.2	<i>Electrodes and couplers</i>	<i>9</i>
5.2.3	<i>Corrosion.....</i>	<i>10</i>
5.2.4	<i>Earth cable sizes</i>	<i>10</i>
5.2.5	<i>USEW sizes.....</i>	<i>11</i>
5.2.6	<i>Earthing conductor burial depth</i>	<i>11</i>
5.2.7	<i>Connections and joints.....</i>	<i>11</i>
5.2.8	<i>Earthing connection warning labels.....</i>	<i>12</i>
5.2.9	<i>Copper theft protection</i>	<i>14</i>
5.2.10	<i>Secondary earthing risk mitigation works.....</i>	<i>14</i>
5.2.11	<i>Testing after construction.....</i>	<i>15</i>
5.3	Distribution equipment requirements	15
5.3.1	<i>Distribution earthing configurations.....</i>	<i>15</i>
5.3.2	<i>Earthing system configuration and connections</i>	<i>15</i>
5.3.3	<i>Conversions between earthing configurations.....</i>	<i>16</i>

5.3.4	Ground mounted distribution substations and switching stations	17
5.3.5	Aerial mains and overhead switchgear	18
5.3.6	Distribution equipment and lines on conductive transmission structures	22
5.3.7	Conductive distribution poles	22
5.3.8	External/equipment metalwork earthing	23
5.3.9	Street light column and rag bolts.....	23
5.4	Bonding of transmission earthing to distribution earthing	23
5.4.1	First cable out from zone or transmission substations.....	23
5.4.2	CMEN substations	23
5.4.3	Non CMEN substations.....	24
5.4.4	ZS/TS special bonding to distribution earthing	24
5.5	Provision of design and as constructed information.....	24
5.6	Standard drawings.....	24
5.6.1	General earthing.....	24
5.6.2	ABS earthing	25
5.6.3	UG/OH earthing	25
5.6.4	Recloser/load break switch earthing	25
5.6.5	Pole substation earthing	25
5.6.6	Padmount substation earthing	25
5.6.7	Indoor substation earthing	25
5.6.8	Switching station earthing	26
5.6.9	Padmount auto transformer earthing.....	26
5.6.10	URD earthing	26
5.6.11	Streetlight column earthing	26
5.7	Approved parts and accessory list.....	26
6.0	AUTHORITIES AND RESPONSIBILITIES.....	26
7.0	DOCUMENT CONTROL	27

1.0 PURPOSE

To set the minimum standard for construction of the earthing systems in the company's network. This standard establishes minimum requirements so that the construction of earthing works on the network are carried out in consistent, safe and cost effective manner.

2.0 SCOPE

This instruction covers the earthing standard construction practices for distribution earthing and common practices for transmission earthing. Specific earthing construction instructions for transmission are provided in:

- EDI 516 *Major substation earthing design, construction and commissioning*; and
- EDI 0004 *Earthing of transmission mains*

For general information in relation to distribution construction reference will be made to:

- MCI0005 Overhead distribution construction manual; and
- MCI0006 Underground distribution construction manual

This standard applies equally to the company staff and ASPs.

3.0 REFERENCES

Internal

- Company Policy (Network) 9.7.1 – Network Asset Construction
- Earthing Design Instruction EDI 001 – Earthing Design Risk Assessment
- Earthing Design Instruction EDI 0004 – Earthing design, construction and testing of overhead transmission mains
- Earthing Design Instruction EDI 0005 – Distribution earthing test
- Earthing Design Instruction EDI 100 – Distribution Earthing Design
- Earthing Design Instruction EDI 516 – Major Substations Earthing Design, Construct and Test
- Mains Construction Instruction MCI 0005 – Overhead distribution: Construction standards manual
- Mains Construction Instruction MCI 0006 – Underground distribution: Construction standards manual
- Mains Design Instruction MDI 0031 – Overhead distribution design standard manual
- Mains Design Instruction MDI 0047 – Overhead transmission mains design
- Standard Asset Data SAD 0001 – Project Drawing Standards
- Substation Design Instruction SDI 528 – Substation Signs and Equipment Labels
- The company Electrical Safety Rules
- Network Management Plan December 2013 Review

External

- *Work Health and Safety Act 2011 NSW*
- *Work Health and Safety Regulation 2011 NSW*
- ENA National Electricity Network Safety Code (Doc 01-2008)
- AS/NZS 3000:2007 – Electrical Installations-SAA Wiring Rules
- AS/NZS:7000:2010 – Overhead line design-Detailed procedures

4.0 DEFINITIONS AND ABBREVIATIONS

ABC

aerial bundled conductor – insulated overhead cable

Accredited Service Provider (ASP)

Accredited Service Provider, or “ASP”, means a person who has been accredited through a ministerially-recognised accreditation scheme to undertake contestable work.

CCT

covered conductor thick

CLAH

current limiting arcing horn and discharge connector

CMEN

Common Multiple Earth Neutral (CMEN) system is where the combined high voltage and low voltage earthing system is connected to a zone or transmission substation earthing system.

Important note: The company uses the CMEN terminology for a zone substation bonded to the distribution earthing and potentially LV MEN system either directly or through HV cable sheaths onto common earthed substations – this does not align with the majority of the industry and care must be used when assigning this term.

Common or combined earthing

A common or combined earthing system is one in which the HV distribution and low voltage electrical equipment is earthed to a common terminal bar. This is achieved by connecting the MEN system to the HV and LV earth at the distribution substation or other distribution asset.

Constructors

Earthing constructors who carry out the construction includes the company staff and ASPs

Designers

Earthing designers refer to company staff and ASPs undertaking or needing to undertake a design or calculation in accordance for earthing systems covered in the scope of this instruction.

Distribution network

Collection of assets (distribution lines, cables, substations and associated equipment) whose purpose is to distribute power from zone substations to distribution substations, which feed the low voltage network

Drawings

Drawings include design drawings and standard construction drawings

Earth electrode

Conductor which is embedded in the earth and conductively connected to the earth

Earth fault (EF)

Includes a single phase to ground fault and two-phase to ground fault – a fault caused by a conductor or conductors being connected to earth or by the insulation resistance to earth becoming less than a specified value.

Earthing conductor

Conductor intended to provide a conductive path for the flow of earth fault current for the control of voltage rise and reliable operation of protection devices.

Ellipse

The company asset management database

ENA

Energy Networks Australia

EPR

Earth Potential Rise. Voltage between an earthing system and reference or remote earth.

Equipotential

Surfaces have the same electrical potential or with negligible difference in potential.

GIS

Geographical Information System

HV

High Voltage - a voltage exceeding or equal to 1000V AC (refers to 11kV, 12.7kV and 22kV in this instruction).

Where the risk associated with the earthing system is considered to be low. Typically were the risk is less than 1 in 1,000,000. Refer to EDI 001 - Earthing design risk assessment

LV

Low Voltage - a voltage exceeding 50V AC but less than 1000V AC.

MEN

Multiply Earthed Neutral. A system of earthing in which the parts of an electrical installation required to be earthed in accordance with AS/ANZ 3000 are connected together to form an equipotential bonded network. This network is connected to both the neutral conductor of the supply system and the general mass of earth.

Network

The company electrical network of poles, wires, substations and other assets by which electrical power is transmitted/distributed to its customers.

NMSHV ABC

Non-Metallic Screened High Voltage Aerial Bundled Cable

Not practical

Economically not viable in the risk cost benefit analysis framework

OHEW

OverHead Earth Wire

PVC

poly vinyl chloride- a type of insulation used on cables

Remote earth (reference earth)

Part of the earth considered as conductive, the electric potential of which is conventionally taken as zero, being outside the zone of influence of the relevant earthing arrangement.

Remote location

For the purpose of earthing design, any location where probability of coincidence is considered to be low risk (less than 1 in 1,000,000). Typically, it is a location with few people around such as a rural area.

Safe design

The safe design is the integration of control measures early in the design process to eliminate or, if this is not reasonable practicable, minimise risks to health and safety throughout the life of the earthing system being designed. Refer to WorkCover-safe design of structures code of practice.

Soil resistivity

Specific resistivity of a material which is used to define the resistance of a material to current flow. It is defines as the electric field strength (Vm^{-1}) divided by the current density (Am^{-2}) which represent the value to 1 amp flowing into one metre cube of material yielding units of ohm meter (Ωm).

Separate earthing

A system where the HV and LV earths are electrically separate

Step voltage

The voltage between two points on the earth's surface spaced that are (one) 1 metre distant from each other, which is considered to be the stride length of a person. [ENA EG-0:2010]

Sub-transmission network

The collection of assets (transmission lines, cables, zone substation and associated equipment) whose purpose is to distribute power in bulk from transmission substations to zone substations which feed the distribution network or a particular customer substation. Sub-transmission voltages in Company's network are typically 132kV, 66kV and 33kV.

Substation

Part of a power system, concentrated in one place, including mainly the terminations of transmission and/or distribution lines, switchgear and housing which may also include transformers. The reference to 'major substation' in this document refers to all zone substations, transmission substations and switching substations with transmission voltages.

SWER

Single Wire Earth Return – a single phase electrical system where the return path for the load current is through the ground.

SWMS

Safe Work Method Statement

Touch voltage

The voltage between an accessible conductive part and a point on the earth's surface one (1) metre horizontally away, when the conductive parts is not being touched. (This is often referred to as "prospective touch voltage". For the purpose of this instruction, touch voltage implies "prospective touch voltage" only.)

Transfer voltages

Transfer voltages are a more specific form of touch voltage that can occur when a long metallic object such as a metallic fence transfers a voltage from one location to another closer to remote earth potential. Conversely a transfer-in touch voltage can occur when for instance a conductive tap bonded to the LV MEN system transfers-in a low voltage close to the area of a fault point. The local soil voltage caused by that fault point results in a high touch voltage to the conductive tap.

UGOH

Underground overhead – a connection between overhead and underground mains.

USEW

Under Slung Earth Wire

Works

All of the work necessary to complete the contract as described in an SDI or project and associated drawings.

XLPE

Cross linked polyethylene – a type of insulation used on cables

5.0 ACTIONS**5.1 General requirements**

The purpose of an earthing system is to provide safety and integrity of the network under fault conditions and control network voltages. It is of paramount importance that the earthing system is constructed in accordance with the design in order to minimise risk from earthing hazards.

5.1.1 Earthing construction and decommissioning safety

During construction, decommissioning and removing of earthing the increased risk to construction staff from electric shock hazard requires particular care. It is essential that the construction safety requirements identified and controls listed in the safety by design (SDR) report be implemented by the construction staff as appropriate.

If practicable, earthing systems must be constructed or decommissioned or removed whilst the asset is de-energised.

Safety policies and procedures of the company will be used as a minimum when undertaking risk assessments and determining appropriate mitigations. Any construction/maintenance worker will also assess onsite risks before commencing any work.

Care will be taken whenever making or breaking any earthing connection including, but not limited to, OHEW connections, connections to cable screens/ECC and connection to earthing electrodes. This work presents a risk of transferred currents in the event of a remote earth fault. Particular care is needed when working in close proximity to a zone or transmission substation where there is a risk of fault current transfer from cable screen and other substation earth connections. In general the designer and workers will consider the use of insulating PPE, temporary bonding conductors and the establishment of an equipotential work area. These options will be considered in consultation with the company Electrical Safety Rules and the relevant SWMS.

Lightning strike can impose an extremely high voltage for a short duration on the network. During lightning there is a risk from direct lightning strike as well as voltage transferred along conductors from a remote lightning strike, or step and touch voltages generated by a near-by strike. Work is to be avoided when there is a risk of a lightning strike in accordance with the Electrical Safety Rules.

Distribution earthing systems must always be constructed or decommissioned whilst the asset is de-energised. Where the earthing system is bonded to adjacent energised earthing systems (for example; HV cable sheath/screen connections to other substations) appropriate work practices including equipotential bonding leads will be used to reduce the risk due to transferred voltages. These personal safety measures will be incorporated into relevant SWMS and reflected in any safety in design reports.

When working on metallic objects adjacent to live mains, including work on adjacent pipelines, there is a risk of exposure to induced currents and subsequent hazardous voltages. There is also a risk of capacitively coupled voltages. The voltage on the metallic object will be tested prior to work and work will be undertaken using the risk mitigations outlined in the company Electrical Safety Rules and the relevant SWMS where required by a risk assessment.

All identified risks during the design will be included in the SDR that is submitted with the design package. The mitigations must strictly followed by construction staff.

5.1.2 Robustness

Earthing systems for the network must be constructed in accordance with the design drawings and the company standards. Earthing construction will be robust so that the system remains continuously effective for the life of the asset it is connected to.

The earthing system and its parts and accessories will be capable of withstanding and conducting the expected fault current without exceeding material or equipment limitations for thermal and mechanical stresses. During an earth fault, a large amount of energy may be dissipated through the earthing system, which can cause movement in any unrestrained earthing conductors. For this reason all earth conductors are appropriately restrained.

5.1.3 Earthing system installations and accessories

The distribution earthing system is made up of a number of installations and accessories depending on the design:

- earth rods – bare vertical electrodes driven into the general mass of the earth;
- grading ring – A buried horizontal ring of conductor around a substation or conductive pole used to make an equipotential area to reduce touch voltages;
- bonding conductors – The insulated conductors used to bond the different parts and accessories of the earthing system to the equipment;
- cable screens/sheath – Where HV cables are present, the HV cable screen/sheath will often be a key parts and accessory in the earthing system for fault current returned to source;
- LV neutral – If the earthing system is common earthed, a connection to the LV neutral and MEN connections will form part of the earthing system;

- ECC – Earth continuity conductor for bonding other earths to the earthing system; and
- OHEW/USEW – Overhead earth wire/Underslung earth wire

5.1.4 *Earthing system separation requirements to other metallic infrastructure*

The minimum safe separation requirements from the HV earthing system to third party assets stated in design drawings must be achieved. This includes, but is not limited to, telecommunications pits, fences, MEN connections, pipelines and other earthing systems.

5.1.5 *Low voltage network earthing*

The MEN system is a continuous electrical connection of consumer installation earthing and any low voltage equipment earthing through the LV neutral, which is also bonded to earth by the substation LV earthing system.

Care will be taken to maintain a low impedance MEN system and the integrity of the neutral connection.

5.1.5.1 *Key criteria for the MEN network*

- The low voltage neutral must always be connected, and remain continuously connected, across low voltage open points.
- In order to enhance the safety of the MEN network, LV neutrals will be extended to adjacent existing LV mains where practical. This will improve the integrity of the MEN network.

5.2 **General construction requirements**

5.2.1 *Requirements to meet design*

The key to earthing construction is to meet all the aspect of earthing design.

Where any aspect of the design is not met during construction, including the designed grid resistance, the designer must be consulted to determine the implications of the change. The electrode configuration must not be altered without the endorsement of the designer.

5.2.2 *Electrodes and couplers*

5.2.2.1 *Driven rod system*

Vertically driven rods with horizontally connected (bonding) cables may be used wherever deep insulation is not required and ground conditions are favourable.

The driven rod configuration may use hardened driving point attachments and friction couplings (refer drawing no. 348247) if specified by the manufacturer. Earth electrodes must be 15mm or equivalent imperial size (5/8 inch diameter) copper clad steel with a minimum 250µm thick layer of copper coating. Refer to parts and accessory list in MCI0005 – Overhead distribution construction standard manual for compliant products. Earth rods must be fully driven into ground. If an earth rod cannot be fully driven, the excess must be cut at 500mm below finished ground level provided this complies with the designer's instruction. The exposed steel at the end of the rod must be fitted with a PVC end cap containing high melting point grease (or similar) to prevent water ingress and corrosion.

5.2.2.2 *Deep drilled hole systems*

The deep drilled hole system will be used where the driven rods are not practical, or where deep installation depth is required. Plant operated earth borer must be used for drilling 50mm to 100mm diameter holes.

A copper clad steel rod bonded to a 70mm² stranded copper bonding cable must be used as the earth electrode for each of the deep drilled holes. Refer to drawing 348246 for more details.

After inserting the electrode, the deep drilled holes must be back filled with approved earthing enhancement compound in slurry form with manufactures recommended water to compound ratio. Refer to the parts and accessory list in MCI0005 – Overhead distribution construction standard manual for compliant products.

5.2.2.3 *Electrode separation*

Electrode separation of the same electrode system:

To minimise proximity effect on the expected earth grid resistance, the spacing between earthing electrodes must be equal to the bare depth of the adjacent electrode as a minimum. Details will be specified in the design.

Electrode separation of different electrode systems:

The minimum separation distance of an electrode from one earthing electrode system to an electrode from another earthing electrode system (such as the HV earth electrodes to the LV earth electrodes) must be as specified in the earthing design. The separation distance must not be less than the greater of the equivalent to the buried depth of the longest electrode or 4m. The design will show the specific requirements.

The buried depth of concrete or other conductive poles must be treated as large diameter electrodes and the separation distance criteria set out above is applicable for the conductive poles adjacent to different earthing systems and metallic infrastructure.

5.2.2.4 *Bonding conductor separation*

Insulated earth cables must be separated by a distance of not less than 100mm when they are direct buried. Insulated earth conductors installed inside conduits may be laid adjacent to one another.

5.2.2.5 *Supplementary earth rods*

Supplementary earth rods are installed as shown in relevant drawings listed in section 5.6. The purpose of the supplementary earth rods is to provide additional protection for the operator who may close HV switch to a fault. These supplementary earth rods will strengthen the effect of equipotential area for the operator and improve the earth connection redundancy.

5.2.3 *Corrosion*

If the design identifies that the ground appears to be or is known to be highly corrosive a suitable bedding or covering material must be used with consideration for electrical resistivity and rating. Refer section 5.2.6 for suitable bedding.

5.2.4 *Earth cable sizes*

The following earth cable sizes must be used in the network.

Distribution network and transmission pole earthing:

- 70mm² Copper or 95mm² Aluminium as specified in drawings

Z/S, T/S and transmission switching stations:

- 95mm² or 120mm² copper cables or 50mmx3.18mm tinned copper earth strap as specified in earthing design and standard drawings; and
- 240mm² copper insulated cable as ECC

5.2.5 USEW sizes

The size of USEW specified in mechanical design of overhead line (ref MDI 0031-Overhead distribution design manual) must be used.

The following aerial conductors are typical for USEW use.

- Cherry 6/4.75 AAC+7/1.60 GZ-Stock code 1031727
- Hydrogen 7/4.5 AAAC - Stock code 1113588
- Mercury 7/4.50 AAC - Stock code SZ12562

5.2.6 Earthing conductor burial depth

When earthing cables are installed in a trench along with other power cables the earth cables must be installed in the bottom of the trench. If the design indicates that excavated soil is not suitable, smooth foreign soil with PH value between 4.5 and 7.5 and resistivity below 100 Ωm must be used as the bedding material. The minimum thickness of the bedding material around earth conductors is to be 100mm. If earth enhancement material is used a minimum of 45mm thickness is required around the earth conductor.

Excluding grading rings, all underground earthing cables must be buried to a depth not less than 500mm from finished ground level. The grading ring must be installed 300mm below ground level.

5.2.7 Connections and joints

5.2.7.1 Bolted connections

Stainless steel bolts and nuts must be used to secure the earth connections installed above ground. Bolted connections must not be used for direct buried joints in ground or in concrete.

The bolted connections to below ground earth ferules on conductive poles are permitted provided these connections are secured with suitable grease to prevent from corrosion. As specified in the drawings listed in section 5.6 grease traps will be used to prevent grease leaking in to the ground in order to prevent soil contamination.

To prevent the nut from becoming loose a stainless steel spring or Belleville washer must be used as shown in Figure 1. If a stainless steel spring or Belleville washer is not used a lock nut must be used. The lug or copper bar must make full and direct contact with the surface to be earthed. The nut or washer must not be in the fault current path including installation between the lug and surface to be earthed. Cables doubled up under the same bolt on an earth bar or the metal work of a piece of equipment must be avoided where practical.

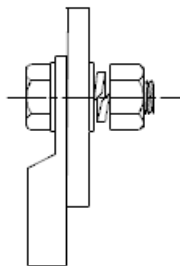


Figure 1: Stainless steel standard bolted connection

All lugs and pressure fittings must be fitted using the correct crimping die and crimping pressure, as recommended by the manufacturer.

All exposed conductor, joints, and lugs used for aluminium cable must be insulated and sealed with LV heat shrink. All above ground exposed conductor, joints, and lugs of the copper cable must be insulated and sealed with LV heat shrink.

During an earth fault, a large amount of energy may be dissipated through the earthing system, which can cause movement in any unrestrained earthing conductors. For this reason all earth conductors must be appropriately restrained using fasteners shown in parts and accessory list in MCI 0005 – Overhead distribution construction standard manual. Care must be taken that these fasteners are applied correctly and are tightly fitted.

5.2.7.2 Crimped connections

Use of crimped earth connections is the typical requirements unless otherwise specified in the design.

Where single crimped connectors are used, two (2) connectors must be provided for each joint with a separation of 50mm between connectors as shown in Figure 2. Care must be taken to select the correct die and to apply the crimping pressure recommended by the manufacturer. When crimping onto copper-clad steel electrodes, the electrode must be pre-crimped with a hexagonal die prior to applying the crimp connector to prevent the electrode rotating within the crimp.

If dual crimped connectors are used one connector is sufficient for each joint. Electrode pre-crimp with hexagonal die is not required with dual crimp connectors.

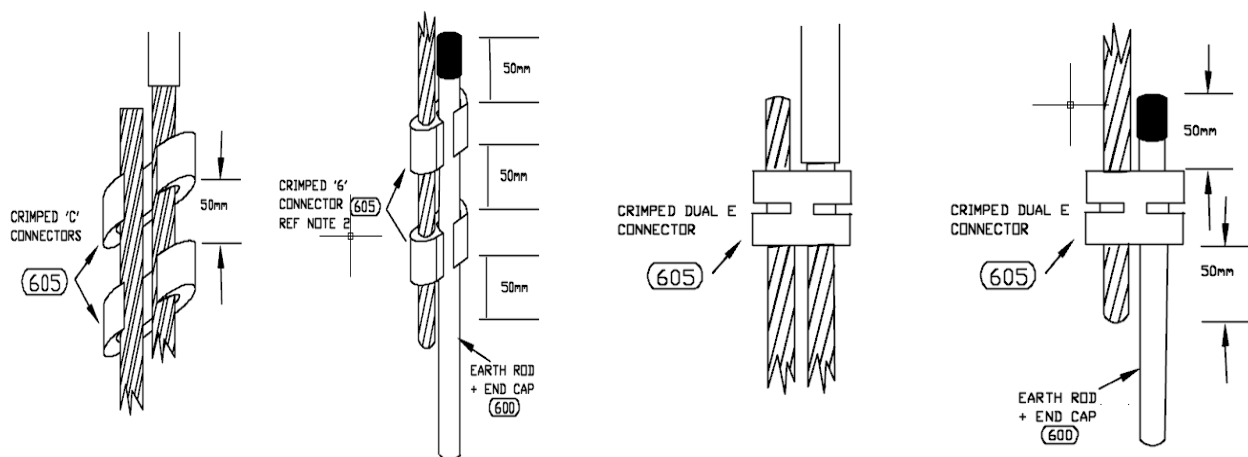


Figure 2 Crimped connections

5.2.7.3 Exothermic welding

Exothermic products and moulds may be used for joints in the earthing system at the discretion of the designer. Joints must be checked for secure connection and strength of the weld before burial.

Refer to parts and accessory list in MCI 0005 – Overhead distribution construction standard manual for exothermic products. The exothermic mixtures must only be used with manufacturer approved moulds. Exothermic mixtures from a particular supplier must not be used in moulds from a different supplier. The expired moulds will be replaced according to manufactures guide.

Exothermic welding must only be performed by operators who have been specifically trained by a suitably qualified representative of the manufacturer.

5.2.8 Earthing connection warning labels

A number or earthing connection warning labels are required based on the respective installation.

5.2.8.1 Indoor and padmount substations

Warning labels, as shown in Figure 3, must be affixed to the earth cables using plastic lock ties (refer Drawing no. 348245).

As earthing cables are not traceable warning labels are required for indoor and ground mount installations only.

The applicable identification letter shown in **Table 1** must be written on the warning labels using a durable marker as shown in Figure 3.



Figure 3 Earth connection warning label

Table 1: Warning label identification legend

Label	Purpose
L	LV earth cable
H	HV earth cable
C	Common earth cable
S	Supplementary earth cable
G	Grading ring cables
M	MEN connection-dedicated cable to street LV neutral
E	Earth counterpoise cable

5.2.8.2 CMEN connected zone substations

Where the earthing system is CMEN, a warning label as shown in Figure 4 must be attached using plastic lock ties to the nominated locations such as cable screen connections at padmounts and LV neutral connections as the first connection out of the zone substation.



Figure 4 CMEN Label

5.2.8.3 Underslung earth wire (USEW) markers

Yellow and green disk markers as shown in Figure 5 must be installed (nailed) adjacent to every second anchor point on poles to differentiate USEW from street lighting neutrals. Refer to parts and accessory list in MCI 0005 – Overhead distribution construction standard manual for approved parts..



Figure 5 Underslung earth wire marker

5.2.8.4 Insulated fence post sign

A danger sign as shown in Figure 6 will be installed on each insulated fence post as shown in drawing 061674 using four screws. Refer to parts and accessory list in MCI 0005 – Overhead distribution construction standard manual for the approved label..



Figure 6 Insulated fence post sign

5.2.9 Copper theft protection

Insulated 95 mm² AL 0.6/1kV XLPE/PVC cable as specified in the earthing design must be used as the earth down lead on poles up to 300mm above ground level. Copper down leads must not be used on poles due to the risk of copper theft.

Where there is a known or increased risk of copper theft in an area a copper theft deterrent system must be installed up to a minimum of 3m above ground level for high risk of copper theft locations. Refer parts and accessory list in MCI 0005 – Overhead distribution construction standard manual for copper theft deterrent systems. All buried earth conductors must be copper, or copper coated steel to counter the impact from conductor corrosion.

5.2.10 Secondary earthing risk mitigation works

Earthing design may include the following secondary earthing risk mitigation works where primary earthing design cannot mitigate earthing risk levels.

5.2.10.1 Fence electrical isolation

Hardwood (insulated) post must be used for the fence section required electrical isolation. Refer to drawing 061674 for more information. A danger sign as stating in section 5.2.8.4 must be installed on each insulated post.

5.2.10.2 Asphalt layer

An asphalt layer may be specified in the design. Where it is specified it will generally be required up to 1m outside the grading ring or a reinforced concrete may also be required with 50mm thick layer of hot mix asphalt. The asphalt layer installation must be free from cracks.

In this circumstance a larger size easement covering the asphalt layer is required for padmount installations as stated in drawings 348262, 348265 and 248266.

5.2.10.3 Grading ring

Grading rings are required for all separately earthed padmounts unless specifically noted in the design. The earthing design may specify an additional grading ring to provide control zone for touch and step potential a grading ring around other electrical installations such as conductive poles. All grading rings must be installed at a stride distance of 1m from the asset and 300mm below ground level for optimum effect. The design drawing will show site specific requirements.

5.2.10.4 Concrete apron

The earthing design may require a reinforced concrete apron to be installed around an electrical installation such as a conductive pole or, substation fence. Where required the concrete apron must be installed to cover a stride distance of 1m. The finish level of concrete apron must be close to natural ground level or level with existing concrete foot path etc. to avoid any trip and falls. Reference will be made to the design drawing for site specific requirements.

5.2.10.5 Insulation coating on conductive poles

Conductive poles with pre-coated insulation layer may be installed to mitigate touch voltages. When it is required the coating must cover the pole up to 2m from ground level as a minimum. The thickness of the coating will be specified by the design and must be a minimum of 2mm. The insulation coating will be provided by an approved service provider with approved products.

5.2.11 Testing after construction

After installation, the resistance of the earth system must be tested as outlined in EDI 0005 – Distribution earth testing, SMI 104 – Major substation test and EDI 0004 – transmission line earthing design, construction and test as applicable. The test results must be compared with the designed values.

If the tests prove that the required resistance values are not achieved, modifications may be required to the earth grid to. This may involve adding more or deeper electrodes. Any modifications must be made in consultation with the Earthing Designer.

Results of this test must be recorded and submitted on works executed drawings.

5.2.11.1 Provisions for testing

Earthing cables at test locations marked in standard drawings must be spaced 75mm from each other and from fixed walls and objects to make provisions for 'clip-on' or 'tong' testing.

Earth down leads installed on poles must be arranged to provide a suitable test location as stated in relevant drawings with sufficient clearance between the earth cable and the structure to allow a 'clip-on' or 'tong' tester to enclose the cable and test the earthing resistance.

5.3 Distribution equipment requirements

5.3.1 Distribution earthing configurations

Two (2) practices are presently used for distribution earthing:

- Interconnection of all HV with LV earthing systems – referred to as Common Earthing.
- Separation of HV from LV earthing systems – referred to as Separate Earthing.

Interconnection (Common Earthing) is the preferred practice and is the usual practice in urban areas. The method of earthing at each location must be specified by the designer.

5.3.2 Earthing system configuration and connections

5.3.2.1 HV earth connections for distribution separate earthing

The earth connections associated with the HV earthing system for a separately earthed system are (where applicable):

- Transformer tank(s);
- LV switchgear frame in padmount and indoor substations;

- HV switchgear housing or supports;
- Padmount plinth and culvert (no direct earth connection is required);
- Padmount sub metallic cubicle;
- HV cable metallic sheaths, screens and armouring;
- UG/OH bracket;
- HV surge arresters (earth side);
- Metallic tank of a voltage regulator, LBS, recloser, metering transformer, or similar item;
- HV ABC catenary wire;
- HV concrete/ conductive pole butt plate and earth ferrule; and
- HV earth bushing (SWER system only).

5.3.2.2 *LV earth connections for distribution separate earthing*

The earth connections associated with the LV earthing system for a separately earthed system are (where applicable):

- Transformer neutral bushing;
- LV cable neutral, metallic sheath/screen/armouring;
- Connections to metallic water pipes;
- LV surge arrester (earth side);
- LV aerial neutral; and
- LV only concrete/conductive pole butt plate and earth ferrule.

LV earth connections for separate earthing must be appropriately insulated from the HV earthing system and connected components as specified in the relevant drawing.

5.3.2.3 *Earth connections for a distribution common earth system*

For a common earthing system, all the applicable HV earth connections and the LV earth connections stated in 5.3.2.1 and 5.3.2.2 must all be bonded to one (1) earthing system unless the asset provides the first connection to the zone substation. In this case the HV cable screen connections will depend on the zone substation bonding arrangement, see section 5.3.5.4 for more details.

5.3.3 *Conversions between earthing configurations*

5.3.3.1 *Conversions from separate to common distribution earthing*

If it is determined that an existing substation can be converted from separate earthing to common earthing, the following actions must take place:

- Pole mount substations – the conversion will be performed by installing a bond between the HV and LV down droppers at the test point located just above the earth batten using an insulated Al 95 mm² XLPE/PVC cable.
- Padmount substations – a bond will be made from the LV neutral earth bar to HV earth bar, using two (2) flexible 70mm² copper insulated cable leads as shown in Figure 7. If an LV switch frame is not provided with a HV earth bar the LV neutral earth bar must be connected to the switch frame using the flexible cable leads. This bond will be made so that it is easily visible during inspection and clearly identifies that the substation is common earthed or separately earthed.
- This conversion must be tested and recorded in the company's asset database.

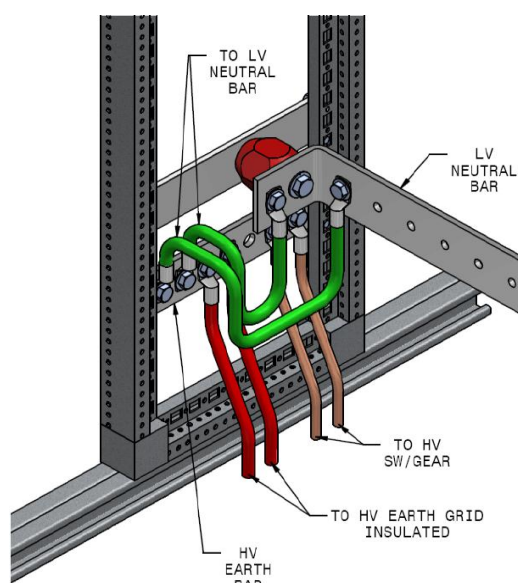


Figure 7: HV earth bar and LV earth bar linking

5.3.3.2 Conversion from common to separate earthing

Where it is determined that an existing common earthed substation cannot remain common earthed, it must be converted to separate earthing as outlined in the earthing design. Care needs to be taken in this process to confirm that the HV earth is effectively separated from the LV neutral, and that all of the requirements of this instruction relating to separate earthing are met.

For padmount substations that require conversion from common earthing to separate earthing, special care needs to be taken to insulate the neutral earth bar from the LV switch frame. This will require the installation of post insulators as shown in Drawing no. 348262.

5.3.4 Ground mounted distribution substations and switching stations

Predominantly fibreglass cubicles are used on padmount substations, switching stations and autotransformers. As a special design stainless steel cubicle may be specified on a padmount substation, switching station or autotransformer to control fire risk. Where metallic cubicles are used, all doors must be bonded to the cubicle and all sections of the cubicle must be electrically connected to each other using copper earth braids.

5.3.4.1 Padmount installations earth connections

Refer to Table 2 for padmount installations earth connections.

Table 2: Padmount stations earth connections

Type of Padmount Installation	Earthing Configuration	Refer to detail earthing arrangement in Drawing: Number:
Substation	Common Earthing	348261
Substation	Separate earthing	348262
Distribution switching stations	Common Earthing	348265
Distribution switching stations	Separate earthing	348264
Autotransformer	Common Earthing and separate earthing	348266
Autotransformer	Separate earthing	348262

All padmounts must have the cable screen connected to the HV earth except for the first padmount out of the zone substation where the bonding arrangement will be specified on the design drawing.

5.3.4.2 Pole mount substations earth connections

Refer to Table 3 for pole mount substations earth connections.

Table 3: Pole mount substations earth connections

Earthing Configuration	Refer to detail earthing arrangement in Drawing Number:	Special Requirement
Common Earth	348257 (wood) 348260 (concrete)	Refer to earthing design for special requirements
Separate earthing	348258 (wood) 348259 (concrete)	Refer to earthing design for special requirements including; - insulating coating on conductive poles - insulated earth electrodes deep in the ground

5.3.4.3 LV earthing for all substations

An LV earth system is required for separately earthed substations. The LV earth system must be constructed according to earthing design.

The LV neutral of a distribution substation must be connected to the neutral of LV network supplied from other substations to form a continuous LV neutral system (MEN) where it is practical to do so.

5.3.4.4 SWER substation earthing

Continuous insulated earth conductor in triangular configuration is used for the HV earthing installation for conductor redundancy and high reliability. Refer to drawing 060514 for more instructions on installation of earthing extensions.

Safety Note: The earth connection to SWER earth terminal of a SWER distribution transformer, SWER Voltage Transformer (VT), or SWER isolating transformer must **not** be disconnected when a transformer is energised as high voltage may appear on the open circuited earth cable/terminal.

Construction of SWER substations and isolating substations on conductive poles require approval from Earthing and Power Quality Manager.

5.3.4.5 Pole mounted HV voltage regulators

The regulator surge arresters and any other conductive parts and accessories must be bonded to the HV earthing system. Any associated switch handle must be installed as set out in section 5.3.5.1 where required.

5.3.5 Aerial mains and overhead switchgear

5.3.5.1 Air Break Switch (ABS) earthing

For all ABSs the operating down rods are to be made from insulating material or have an insulator in their path. All hand operated switch handles are to be mounted on stand-off insulators that are rated to withstand 12.7kV for 10 seconds.

If a HV earth is required, (such as at a recloser with an air-break bypass switch or the termination of the catenary of HV ABC) then the HV earth must be:

- located on the opposite side of the wood pole to the ABS handle or operating mechanism;
- not connected to the ABS handle, or ABS handle earth; and
- install insulated earth deep in the ground in accordance with the design.

ABS with waist level mounted operating mechanism

The earthing requirements for ABS with waist level mounted operating mechanism are in Table 4 .

Table 4: Operating handle earthing for ABS with waist level mounted operating mechanism

ABS construction	Operating handle earthing requirement
Standard fibreglass down rod	Handle not earthed
Steel or wooden down rod (applicable to existing ABS only)	1x2.4m electrode bonded to ABS handle.

ABS with mid pole mounted operating mechanism

The metallic parts and accessories associated with a mid-pole mounted ABS operating mechanism must not be connected to earth.

5.3.5.2 Load break switches

New load break switches (LBSs) installed on wood poles do not require connection to an earthing system under normal operation. A 1x2.4m earth stake must be installed and connected to the LBS tank through an under slung, or earth continuity link. This link will be normally open in normal operation and will be closed when the switch is used as an isolation point. Where an LBS has communications installed a full earthing design is required with all components connected to earth. The underslung link is not required to be numbered and can be utilised in coastal areas.

For this earthing arrangement to implement on HVABC termination wood poles with LBSs, the catenary earthing system must be installed at the adjacent pole.

LBSs installed on conductive poles, on joint use transmission and distribution poles and installed on wood poles with other assets requiring earthing a full designed permanent earthing system for LBS is required to be installed.

Where fitted, any associated switch handle will be installed as set out in section 5.5.2.1.

5.3.5.3 High voltage underground to overhead terminations (HV UGOH)

The cable screen, sheath, armour, surge arresters, HV ABC catenary (where applicable) and mounting bracket are to be bonded together and to earth. An earth bar must be used on all UGOH poles. The earthing arrangements are shown on drawing 348254.

Earthing requirements for UGOH poles connecting feeder cables from zone and transmission substations are specified on the earthing design.

PVC moulded cable guards must be used for new installations and to replace existing galvanised steel cable guards when they are due for replacement. The cable guard must be installed from a depth of 100mm below ground level.

Where metallic cable guards are used (old construction) on concrete poles, the guard must be bonded to an earth on the pole.

5.3.5.4 HV cable screens at padmount substations and switching stations.

Other than at first terminations out from a zone and transmission substation, HV cable screens will be earthed at each termination end. At padmount substations, switching stations, and auto-transformers and indoor substations, the HV cable screens will be terminated to the HV earth bar.

For first out substations from zone and transmission substations HV distribution cable screen termination is based on the earthing design. Refer to section 5.4 for HV cable screen bonding arrangements.

5.3.5.5 Low voltage underground to overhead terminations (LV UGOH)

Where metallic cable guards are used on LV UGOH poles, the cable guard must always be bonded to LV neutral.

For LV UGOHs installed on shared transmission poles refer to section 5.3.6

For LV UGOHs on conductive poles carrying HV lines refer to section 5.3.7

For LV UGOHs on LV only conductive poles the neutral must be bonded to the pole earth ferrule.

5.3.5.6 Covered Conductor Thick (CCT) surge arresters, CLAH/DC

High voltage covered conductor thick (CCT) is an insulated unscreened conductor and does not require an earthing system to maintain its integrity. However, the system uses a Current Limiting Arcing Horn and Discharge Connector (CLAH/DC) system, to divert surge energy to earth in the event of a lightning strike, and these require suitable earthing.

The CLAH/DC units must be installed and earthed at the following locations and intervals:

- Every 400 metres of route length on wood pole.
- Every 250 metres of route length on concrete/conductive poles.
- At every interface between open wire/cable screens and CCT.

All surge arresters/CLAHs must be connected to earth as follows:

- All surge arresters/CLAHs must be separately earthed from the LV MEN system. CLAH earth can be combined with the power frequency earthing system such as a substation earth. Installation of a minimum of one (1) 2.4m electrode for CLAH earthing for discharging lightning surges is required.
- The earth down lead must not be bonded to the LV neutral and must be separated from LV ABC bolt hooks or LV ABC by the maximum distance possible across the pole face to avoid lightning surge flashover to the LV ABC.

5.3.5.7 NMSHVABC – catenary earthing

The HV ABC catenary must be bonded to earth at the following locations and intervals:

- Terminations;
- Tees;
- every 200-250 metres of route length on wood pole; and
- every concrete/conductive pole.

If there is a LBS installation on a wood pole where NMSHVABC is terminated, installation of the catenary earth must be done at the next pole to leave LBS pole free from a power earth connection.

For wood pole NMSHVABC installations with route lengths less than 100m, bonding of the catenary to earth at one location is sufficient.

The catenary must be electrically continuous throughout its length (including across open points). At conductor open points, and where the catenary is jointed, at least one earthing connection to the catenary must be provided on either side of the joint (not necessarily both at the same pole).

The earthing construction of catenary will meet the earthing design.

Bonding to LV neutral

Where common earthing is used and LV ABC is installed with NMSHVABC on the same pole, the following must be carried out:

- Wood poles: The same LV neutral earth must be used to earth the NMSHVABC catenary. A 95sqmm XLPE/PVC cable lead is suitable for this bonding; and
- Concrete poles: The LV neutral must be bonded to each pole to assist in earthing the NMSHVABC catenary.

Note: In separate earthing areas, the HV earth must not be bonded to the LV neutral.

Surge arrester earthing

Surge arresters must be installed at every transition bare aerial mains to NMSHVABC catenary, except at pole substations. At pole substations the substation HV surge arresters will suffice. Surge arrester earths are considered to be a HV earth and must be constructed according to earthing design.

Earthing at distribution substations

The catenary earth wire is to be connected to the substation HV earthing system. For catenary to earth connection details; refer to Drawing no. 332002.

Refer to Figure 8 for conceptual diagrams showing earth connections for wood poles with NMSHVABC.

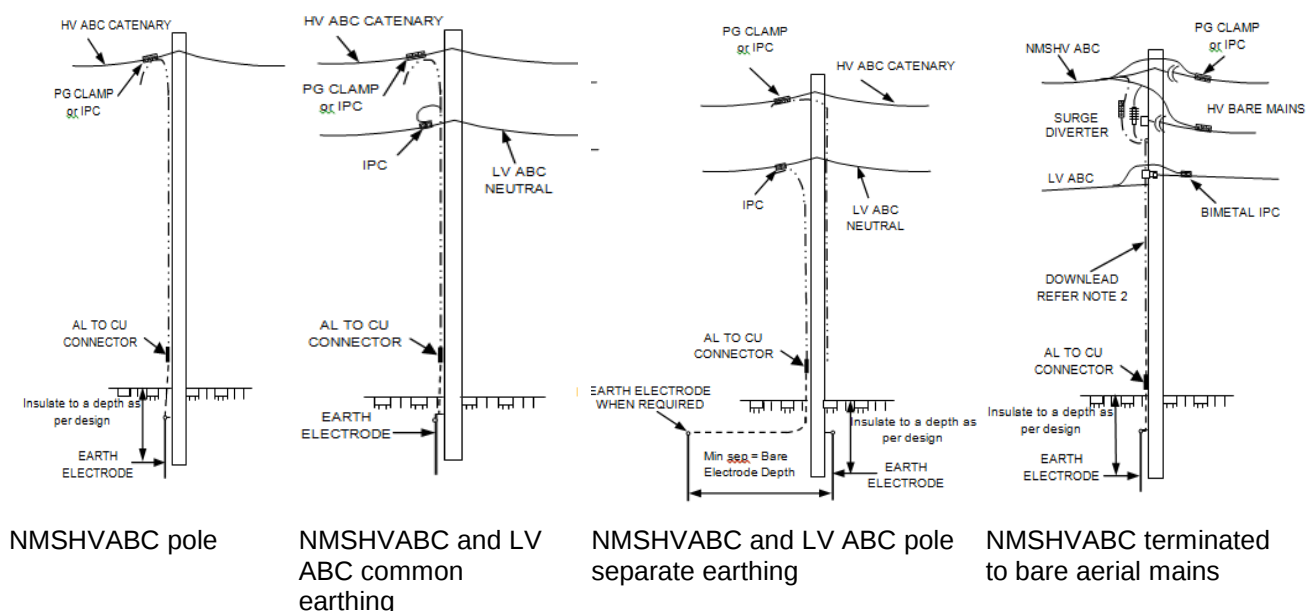


Figure 8: Earth connections for wood poles with NMSHVABC.

Conductive poles carrying NMSHVABC lines only

The NMSHVABC catenary must be connected to the pole-earthing ferrule at every pole.

Refer to Figure 9 for conceptual diagrams showing earth connections for conductive poles with NMSHVABC.

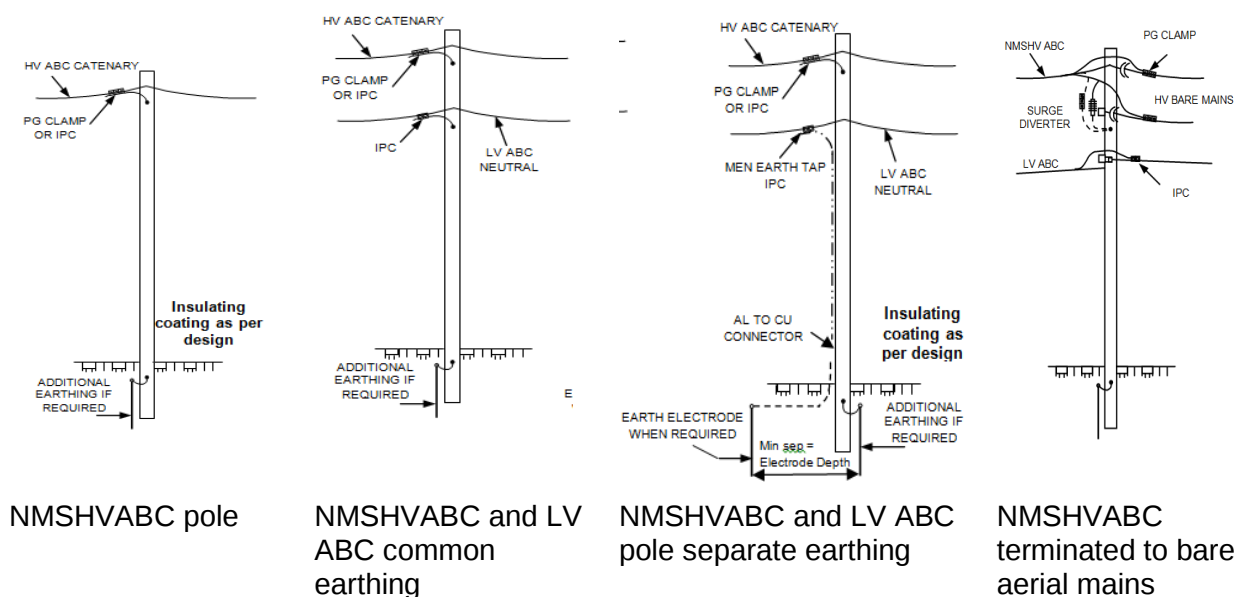


Figure 9: Earth connections for concrete poles with NMSHVABC.

5.3.6 Distribution equipment and lines on conductive transmission structures

Distribution equipment and lines on conductive transmission or sub-transmission structures must be installed as stipulated in the design.

5.3.6.1 Low voltage assets on conductive transmission or sub-transmission structures

LV, streetlight conductor and streetlight fittings must not be installed on a conductive transmission poles or structures unless the insulation requirements as stated in MDI 0047 – Overhead transmission mains design are met and stated in the project drawings. LV aerials installed on wood cross arms on transmission conductive poles meet this insulation requirement and no further design is required for fittings install on wood cross arms.

LV UG/OHs installed on shared conductive transmission poles must be insulated to the maximum EPR expected on the conductive structure for a HV earth fault (for example an insulation level of 19kV is required for 33kV). Construction of LV UG/OH on conductive transmission pole must be done according to the earthing design.

5.3.7 Conductive distribution poles

Additional electrodes may be required on concrete poles as specified in the design.

5.3.7.1 Poles for LV construction only

The LV street neutral must be connected to the pole-earthing ferrule at each and every pole along the line on LV conductive poles. This applies to LV lines with bare conductors and to lines using LV ABC conductors.

5.3.7.2 Poles carrying NMSHVABC lines only

The NMSHVABC catenary must be connected to the pole-earthing ferrule at every pole.

5.3.7.3 Conductive poles carrying both HV and LV lines (common earthed)

The LV neutral must be bonded to every pole at the earth ferrule where the earthing design shows that common earthing is applicable.

5.3.7.4 *Conductive poles carrying both HV and LV lines (separate earthed)*

- The LV neutral must **not** be bonded to the pole earth ferrule.
- All LV service cables must be installed so that they do not come in contact with the pole.
- All streetlight cables must be double insulated and the streetlight lantern must be insulated from the pole to withstand at least 2kV.
- In existing open wire constructions, LV aerial cables are to be mounted on standard wooden cross arms.
- LV UGOHs must not be installed on separately earthed concrete poles carrying HV conductors in separately earthed areas, unless specified in a design.

5.3.8 *External/equipment metalwork earthing*

External metalwork that may reasonably be expected to become energised from the electricity supply system in the event of a failure of insulation or contact with a live conductor must be insulated or earthed as set out in the earthing design.

Equipment (such as structures, cubicles, pillar boxes and other metalwork associated with the distribution equipment) must be bonded to the following items as applicable:

- The LV neutral;
- LV cable sheaths and armouring where applicable; and
- Copper earthing conductor buried beneath the structure or a single 2.4m electrode.

Earthing of equipment and metalwork (other than substations, reclosers, LBS and other enclosed switches and equipment) is to be as follows:

- Metalwork associated with ABS mechanism, king bolts, and cross arm braces on wood poles do not require earthing. Refer to conductive pole drawings for respective earth bonding of metal works on conductive poles.
- The safety rails (when installed) associated with pole substations on wood poles do not require earthing, refer to Drawing 348257 and 348258.

5.3.9 *Street light column and rag bolts*

Street light columns and rag bolts do not require an additional earth electrode as the steelwork is already earthed through the concrete footing and LV neutral. Refer to drawing 010638. If the steel street light column is not bonded to neutral, double insulated light fittings and cables must be used.

5.4 **Bonding of transmission earthing to distribution earthing**

5.4.1 *First cable out from zone or transmission substations*

Screen/sheaths of all HV distribution feeder cables must be bonded to earth at ZS/TS end. Bonding or not bonding of the other end of cable screens/sheaths at the first out padmount station is to be based on ZS/TS earthing design. In all cases the cable screen at the first out UGOH is to be bonded to earth. If cable screens are not sufficiently long enough to terminate to the earth bar, 70mm² copper insulated cable extensions with crimped earth connectors must be used. Exposed bare cable section and crimped connectors must be insulated using heat shrink.

5.4.2 *CMEN substations*

For CMEN ZS/TS the cable screen must be bonded at first distribution common earthed asset as well as at ZS/TS earth grid. Where a UGOH is the first termination out of a CMEN zone substation a connection is also required to the LV neutral.

Where the bond to the distribution network is by means of underground cable screen/sheaths or earthing cables, a warning label must be fixed to both ends of the cable at the connection point as stated in the drawings. Refer to section 5.2.8.2 for more information on required warning labels.

Where the bond to the distribution system is by means of overhead connections (USEW), the connection must be as specified in the ZS/TS earthing design.

Refer to drawing 348254 for the CMEN earthing arrangement on a HV UGOH wood pole.

5.4.3 Non CMEN substations

For non-CMEN ZS/TS, the metallic sheath of HV cables between ZS/TS and distribution padmount station must be bonded to earth at the ZS/TS end only. The metallic screen/sheath of the cable at the first padmount station end must remain unconnected but insulated to prevent personnel contact or flashover to the distribution earth. The open screen wires at the substation end must be firmly wound to the cable and insulated with heat shrink

The metallic screen/sheath of a HV cable between a ZS/TS and the HV UGOH must be bonded to the zone substation earth and to the UGOH earth bar unless specified otherwise in the ZS/TS earthing design.

5.4.4 ZS/TS special bonding to distribution earthing

Some ZS/TS earthing designs require non-standard earthing connections which will be specified in the design. In this case equipment Labels stating, "SPECIAL EARTH CONNECTION do not disconnect" must be fixed to both ends of the cable at the connection point to distinguish the special earth connection.

5.5 Provision of design and as constructed information

The designer will provide complete design information design information format given in standard drawing 358689 for construction.

After construction and commissioning the project manager/ASP is required to provide as constructed information.

5.6 Standard drawings

Any deviations from the standard drawing arrangements will only be allowed with the prior approval from the Earthing & Power Quality Manager. The reasons for the deviations must be stated clearly and objectively for the Earthing & Power Quality Manager's consideration and assessment.

5.6.1 General earthing

Drawing no.	Amd. no.	Subject / Title
348243	B	Cadweld Joints & Compression Connectors
348244	B	Driven Earth Electrode Assembly Detail
348245	B	Earth Connection Warning Label
348246	B	Deep Drilled Earthing System
348247	B	Driven Rod Earthing System.
348248	B	Earth bar and electrode connections
348249	B	Earth batten/Cable Guard installation on poles
358689	B	Format of Earthing information on Project Drawings (Page 1 and 2)
348251	B	Standard Earthing Symbols

Drawing no.	Amd. no.	Subject / Title
332002	C	Standard Assemblies Miscellaneous items brackets-connections sheet 1 & 2 from MCI-0005
061674	E	Insulated Fence Posts and EPR Danger Sign
404121	A	Timber pole theft deterrent earthing assembly

5.6.2 *ABS earthing*

Drawing no.	Amd. no.	Subject / Title
348252	B	Wood/ Concrete Pole ABS Earthing

5.6.3 *UG/OH earthing*

Drawing no.	Amd. no.	Subject / Title
348254	B	UG/OH 11/22kV Earthing with an earth bar

5.6.4 *Recloser/load break switch earthing*

Drawing no.	Amd. no.	Subject / Title
348255	B	22 and 11kV Recloser/Load Break Switch on Wood / Concrete Pole Earth Detail
348256	B	DSA Recloser/Load Break Switch Control Box Earth Connections

5.6.5 *Pole substation earthing*

Drawing no.	Amd. no.	Subject / Title
348257	B	Wood Pole 22 and 11kV Substation Common Earth Arrangement
348258	B	Wood Pole 22 and 11kV Substation Separate Earth Arrangement
348259	B	Concrete Pole Substation Separate Earth Arrangement
348260	B	Concrete Pole Substation Common Earth Arrangement
060514	F	12.7kV SWER Substation and Isolating substation Earthing Arrangement-Wood Pole
060970	F	12.7kV SWER Substation and Isolating substation Earthing Arrangement-Concrete

5.6.6 *Padmount substation earthing*

Drawing no.	Amd. no.	Subject / Title
348261	B	Padmount Substation Common Earth Layout (Page 1 and 2)
348262	B	Padmount Substation Separate Earth Layout (Page 1 and 2)

5.6.7 *Indoor substation earthing*

Drawing no.	Amd. no.	Subject / Title
348263	B	Indoor Substation Common Earth Layout

5.6.8 *Switching station earthing*

Drawing no.	Amd. no.	Subject / Title
348264	B	22&11kV Switching Station Separate Earthing Layout
348265	B	22&11kV Switching Station Common Earthing Layout

5.6.9 *Padmount auto transformer earthing*

Drawing no.	Amd. no.	Subject / Title
348266	B	Padmount Auto Transformer 11/22kV padmount earthing layout

5.6.10 *URD earthing*

Drawing no.	Amd. no.	Subject / Title
010639	F	URD pillar earthing arrangement

5.6.11 *Streetlight column earthing*

Drawing no.	Amd. no.	Subject / Title
010638	D	Streetlight column earthing arrangement

5.7 **Approved parts and accessory list**

Parts and accessory list referred in the drawings are provided in MCI 0005 – Overhead distribution construction standard manual.

Also refer to the company product approval database for updated approved products offered by different suppliers.

6.0 **AUTHORITIES AND RESPONSIBILITIES**

General Manager Asset Management has the authority and responsibility for:

- approving this instructions; and
- approving any variations to the requirements of this instruction.

Manager Asset Standards and Designs has the authority and responsibility for:

- endorsing this instruction; and
- recommending changes and revisions to this instruction.

Substation Design Manager has the authority and responsibility for:

- endorsing this instruction; and
- recommending changes and revisions to this instruction.

Regional Managers have the authority and responsibility for checking that all earthing constructions carried out by regional employees conform to the requirements of this instruction.

Manager Network Connections has the authority and responsibility for establishing that all earthing constructions carried out by Accredited Service Providers (ASP) conform to the requirements of this instruction.

Earthing & Power Quality Manager has the authority and responsibility for:

- revising and updating this instruction in accordance with Endeavour Energy's Policy and Procedures; and
- recommending changes and revisions to this instruction.

7.0 DOCUMENT CONTROL

Documentation Content Coordinator : Earthing & Power Quality Manager

Documentation Distribution Coordinator : Standards & Process Coordinator