Engineering Standard

Electrical

CRN EL 001

ELECTICAL LOW VOLTAGE DISTRIBUSTION AND INSTALLATIONS EARTHING REFERENCES AND DEFINITIONS

Version 1.1

Issued August 2016

Owner: Principal Signal Engineer

Approved by: Stewart Rendell

Authorised by: James Zeaiter

Document control

Revision	Date of Approval	Summary of change
V2.0	March 2005	EP 12 00 00 02 SP Low Voltage Distribution and Installations Earthing References and Definitions
V1.0	January 2012	Conversion to CRN Signalling Standard CRN EL 001
V1.1	August 2016	Review and Update

Summary of changes from previous version

Section	Summary of change
	Include abbreviation EPR for earth potential rise
	Change end of electrified area in Newcastle to Hamilton

Contents

1 References

1.1 General Publications

- AS-3000 - SAA Wiring Rules
- AS/NZS 61558.2.4:2009 - Approval and test specification-particular requirements for isolating transformers and safety isolating transformers

  AS/NZS 3017 2007 - Electrical installations—Verification guidelines

- UIC - 605-1 - International union of railways codes
- Cathodic protection of underground structures by W. K. Woodberry

2 Definitions used in this Volume

2.1 1500 V structure

A 1500 V structure is a structure which has 1500 V equipment attached to it with insulators. This includes structures specifically designed for supporting overhead wiring and structures built for other purposes but also supporting overhead wiring, such as overbridges.

2.2 Appreciable dc leakage current

If 200 mA of dc current can be measured for a period of 2 hours during a test conducted over 24 hours, this structure or building is to be regarded as likely to pick up appreciable amounts of stray current.

2.3 Bonding conductor

A bonding conductor is a conductor connecting two or more metal structures with

1500 V overhead wiring attached for the purpose of carrying traction fault currents during electrical disturbances. The bonding conductor shall have a minimum size of

70 mm^2 copper and shall be insulated to 0.6/1.0 kV.

2.4 Conductor

A conductor is a wire, cable or other form of material suitable for carrying current.

2.5 Consumer’s mains

The consumer’s mains are the conductors between the point of attachment and the service equipment. They are determined in accordance with the local Electricity Distributor’s Service and Installation Rules and from AS 3000.

2.6 Consumer’s terminals

The consumer’s terminal is the point at which the Distributors system is connected to the consumer's installation.

2.7 Distribution Substation

The distribution substation means all non-system substations containing high voltage electrical equipment (ie high voltage locations without circuit breakers).

2.8 Earth grid (also known as Earth mat)

The earth grid or earth mat is a group of conducting elements, both vertical and horizontal, in electrical contact with the earth designed to disperse electrical fault currents into the earth and to control touch and step voltages.

2.9 Earth potential rise (EPR)

The earth potential rise is the maximum potential rise of an earthing system, with respect to remote earth.

2.10 Earthing conductor

The earthing conductor is a conductor used to connect any metal work required to be earthed to the neutral point of the transformer or such other earthing point as may be determined.

2.11 Earthing system

The earthing system includes the earth grid and all conductors, piping, electrodes, clamps and other metalwork connected to the grid.

2.12 Electrified area

The electrified area is the section of railway provided with 1500 $_{Vdc}$ overhead wiring, nominally bounded by Bowenfels, Glenlee, Kiama and Hamilton.

2.13 Electrode (also known as earth rod)

The electrode or earth rod is a vertical conducting element specifically designed or adapted for discharging the earth fault current into the ground as required by the earthing system design.

2.14 Electrolysis

Electrolysis refers to the process where corrosion occurs to a buried metal structure when dc current leaves the structure to enter the electrolyte of the surrounding soil.

2.15 High voltage

This is a voltage exceeding 1000 $_{Vac}$ or 1500 Vdc.

2.16 Installation main switchboard

This is a low voltage switchboard from which the supply to the whole installation can be controlled. An installation is as defined in AS 3000, SAA Wiring Rules. This switchboard contains the consumer terminals and should not be confused with the supply main switchboard, refer to definition 2.36.

2.17 Insulated

Insulated means separated from adjoining conducting material by a non-conducting substance which permanently provides resistance to the passage of current, or to disruptive discharges through or over the surface of the substance at the operating voltage, to obviate danger of shock or injurious leakage of current.

2.18 Local Electricity Distributor

The local electricity distributor is any organisation engaged in the supply of electricity, excluding the Australian Rail Track Corporation.

2.19 Low voltage

Low voltage is a voltage exceeding 50 Vac or 120 Vdc but not exceeding 1000 Vac or 1500 Vdc.

2.20 Metalwork

Metalwork includes any reinforced or prestressed concrete parts of an installation but shall exclude minor attachments to wood poles and wood pole identification discs.

2.21 Near 1500 V track

Near 1500 V track is that area inside the railway boundary and within

- 20 m of the centre-line of any track with overhead wiring which is electrified at nominal 1500 $_{Vdc,}$ or 20 m of any 1500 $_{Vdc}$ negative equipment or conductors, or
- 20 m of any metal which is spark-gapped to the rail measured horizontally at right angles.

2.22 Point of attachment

The point of attachment is the point at which a local Electricity Distributors service mains are terminated on a JHR CRN building, pole or structure.

2.23 Prospective touch voltage

The prospective touch voltage is the voltage difference which may appear between any uninsulated metalwork located within 2.4 metres of the ground and any point on the surface of the ground separated by a horizontal distance of one metre, which is considered to be equal to a person's normal reach.

2.24 JHR CRN consumer's terminals

JHR CRN consumer's terminals are the point at which the JHR CRN Distribution system is connected to the consumer's installations.

2.25 JHR CRN service mains

The JHR CRN service mains are the conductors between the supply main switchboard, or change-over panel if there is a back-up supply, and the JHR CRN consumers terminals on the installation main switchboard.

2.26 JHR CRN supply

The JHR CRN supply is an electricity supply taken from a JHR CRN owned high voltage or low voltage network.

2.27 Rail

Rail is the traction rail that is the rail intended for conduction of the traction return current.

2.28 Railway corridor

The railway corridor is any land owned by Country Rail Infrastructure Corporation.

2.29 Remote earth

Remote earth is a true earth potential of zero volts.

2.30 Sectioning Hut

A sectioning hut is a System Substation, with dc circuit breakers but without rectifiers, that sectionalises the 1500 Vdc overhead wiring for dc protection and voltage regulation.

2.31 Service equipment

Service equipment is the metering and control equipment supplied and installed as specified in either JHR CRN's or the local Electricity Distributor's service and installation rules.

2.32 Service line

Service lines are the conductors supplied by a local Electricity Distributor to the point of attachment.

2.33 Spark gap

The spark gap is a device used to connect specific types of 1500 V structures (refer to Specification EP12200001 SP - “Bonding of Overhead Wiring Structures to Rail” contained in Volume 1) to rail when the potential difference between the two rises above 750 V.

2.34 Step voltage

The step voltage is the voltage which may appear between any two points on the surface of the ground separated by a horizontal distance of one metre, which is considered to be equal to a person’s normal step.

2.35 Substation

This is a substation, traction substation, transformer room, switchroom, sectioning hut, pole or pad mounted transformer location, containing high voltage electrical equipment.

2.36 Supply main switchboard

The supply main switchboard is the first low voltage switchboard between the transformer terminals and the low voltage installation. The supply main switchboard is owned by JHR CRN and is the location to establish the one and only connection between earth and neutral.

2.37 Switchboard

A switchboard is any distribution board or switchboard other than the supply main switchboard or installation main switchboard.

2.38 System Substation

A system substation a traction substation, sectioning hut or a substation location that has a voltage greater than 2 kV and includes a high voltage circuit breaker as an item of equipment. The voltage of greater than 2 kV has been selected to exclude the JHR CRN 2 kV (nominal) distribution system.

2.39 Touch voltage

Touch voltage is the voltage across the body, under fault conditions, in a position described as for the prospective touch voltage but allowing for the voltage drop caused by a current flowing in the body.

2.40 Traction Substation

A traction substation is a System Substation that supplies 1500 Vdc power for the overhead wiring using high speed dc circuit breakers.

2.41 Transfer voltage

Transfer voltage is the voltage difference between an earthing system and an exposed metal object connected to a remote earth.

2.42 Transformer mains

Transformer mains for a supply from the JHR CRN high voltage network are the conductors between the transformer secondary terminal and the supply main switchboard, or change-over panel where there is a back-up supply. For a supply from a local Electricity Distributor network the transformer mains are the conductors on either side of the isolating transformer, that is, between the service equipment and the supply main switchboard, or change-over panel where the supply is installed as a back-up supply.

2.43 Voltage

Voltage means nominal potential difference between conductors or the nominal potential difference between a conductor and earth, whichever is applicable