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Engineering Standard - NSW

Category

Electrical

Title

Operating Work - High Voltage System

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The technical content of this document has been approved by the relevant ARTC engineering authority and has also been endorsed by the ARTC Safety Committee.

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About This Standard

This instruction sets out the mandatory requirements for isolating and proving dead High Voltage Equipment. It also sets out the situations where High Voltage Equipment must be earthed and the procedures for operating earthing switches.

Aspects of Operating Work that a maintenance contractor must document and include in its Electrical Safety System are also listed.

Document History

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1.1	11/03/2005	Disclaimer	Minor editorial change

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1 Isolation of High Voltage Equipment

High voltage equipment must be isolated from all sources from which it could be made live by providing at least one break in each source. If possible, isolation should be by a visible break.

Where a low voltage supply can provide a back feed via a transformer, the supply via that transformer must be isolated. The ARTC's mechanically interlocked low voltage changeover contactors do not provide a back feed. Signalling solid state changeover contactors that have been fitted with an auxiliary contactor in the normal LV supply may be treated in the same manner as mechanically interlocked low voltage changeover contactors.

Isolations must be such as those provided by:

- opening of air break switches or isolating links,
- removing of fuses or jumpers,
- withdrawing of circuit breakers, switches or switch fuses, or
- the operation of enclosed switchgear to place it in the isolated position.

The devices providing these breaks must be Danger Tagged and when outside a substation or sectioning hut, they must be locked with a Special Lock. (Jumpers that have been removed to effect isolation are not Danger Tagged or Locked.)

When such an isolating device can also be operated by remote control, the remote control must be made inoperative and the means of making it inoperative must be Danger Tagged.

Operation of equipment in substations and sectioning huts must be carried out in accordance with Local Instructions.

All such isolations must be carried out under the direction of the Electrical System Operator.

WARNING

An open circuit breaker is not a sufficient isolating break. The circuit breaker must be withdrawn or the associated air break switch or links opened.

2 Operation of Isolating Devices

WARNING

An isolating device with a Danger Tag attached must not be operated.

2.1 Air Break Switches

Except in emergency conditions, air break switches in series with, and associated with, circuit breakers must only be opened after the associated circuit breaker has been opened and must not be closed unless the associated circuit breaker is open.

Air break switches are to be operated with a single unhesitating movement. A visual check of the blade position must be made for each phase to ensure the switch has operated correctly.

When an air break switch outside a substation is used for isolation purposes it must be locked open with a special lock and Danger Tagged.

2.2 Isolating Links and Fuse Links

High voltage isolating links and fuse links must be operated with a single unhesitating movement. When closing, care must be taken to ensure that the link is closed completely and the safety latch, where fitted, is engaged.

Links in series with, and associated with, air break switches or circuit breakers must only be opened after the associated air break switches or circuit breaker has been opened and must not be closed unless the associated air break switch or circuit breaker is open. This requirement does not apply to 2kV links and links controlling transformers where the low voltage switches have been opened.

2.3 Enclosed Switchgear

Isolation by withdrawing circuit breakers, switches or switch fuses or by the operation of switchgear to place it in the isolated position must be carried out in accordance with the Local Instructions for the equipment concerned.

2.4 Removal of Jumpers

Where jumpers are to be removed to isolate a high voltage overhead line or cable, any free ends must be positively secured so that they cannot come into contact with other conductors or earth.

Isolated conductors must be separated by the following minimum fixed clearance from live exposed conductors.

Up to and including 33 000 Volts	-	320 mm
Above 33 000 Volts and up to and including 66 000 Volts	-	630 mm
Above 66 000 Volts and up to and including 132 000 Volts	-	1100 mm

3 Danger Tags

3.1 General

Danger Tags must be attached to all devices used to provide isolating breaks and to the means of making inoperative any remote controls for these devices.

A separate Danger Tag must be used for each WHVI or Permit for which the isolating break is required. Subsequent Danger Tags must not obscure Danger Tags which are already in place.

3.2 Attachment of Danger Tags

The Danger Tag must be:

- placed so that it cannot be removed other than deliberately, and
- positioned so that it is obvious to any person who may attempt to operate the device.

If it is impracticable or unsafe to attach a Danger Tag directly to a device the Danger Tag must be attached as close as practicable to the device.

3.3 Information to be shown

The Danger Tag must show:

- the name of the person who attached the Danger Tag, and
 - the WHVI number or Permit number for work outside a substation, or
 - the Permit number for work inside a substation at which the Danger Tag is being placed, or
 - the name of the substation at which the work is being carried out if the Danger Tag is placed outside that substation, and
- the date and time attached.

3.4 Removal of Danger Tag

The Danger Tag must only be removed on the direction of

- the Electrical System Operator (in the case of a Danger Tag placed for a WHVI), or
- the person who is cancelling the Permit (in the case of a Danger Tag placed for a single Permit.).

WARNING

When there is more than one Danger Tag attached to a device, care must be taken that the correct Danger Tag is removed.

4 Proving Dead High Voltage Equipment

4.1 General

Each conductor of high voltage equipment that has been isolated for work must be proved dead using a suitable test voltmeter at the points where the earths are to be applied, immediately prior to applying the earths.

The test voltmeter must be switched to the correct range for the voltage being tested.

The test voltmeter must be checked on known live high voltage equipment, or by means of a self check facility of the test voltmeter, immediately prior to testing the equipment and also at the completion of the test to ensure that the test voltmeter was functional throughout the test.

Care must be taken to ensure that the safe working distances set out in PMP 09 - "Work Near High Voltage Equipment - Permit Requirements and Safe Working Distances" are maintained.

When high voltage equipment containing capacitors is being proved dead, sufficient time must be allowed for the capacitors to discharge.

Where provision is made for proving dead of high voltage enclosed switchgear, the proving dead must be carried out in accordance with the Local Instructions for the equipment concerned.

For certain types of high voltage enclosed switchgear, proving dead is not required before applying earths. This is covered by the Local Instructions relevant to the equipment concerned.

For HV pole mounted switch frame equipment with an earthing switch on each side of a fuse, proving dead before earthing is not required provided the LV switch is open and the HV switch blades are visually checked open.

4.2 High Voltage Cables

Isolated high voltage cables must be proved dead at cable/equipment/overhead line junctions and at supply point switchgear where there is provision for testing.

Before cutting a high voltage cable, the cable must be proved dead by spiking at the work site with an approved cable spike by a person trained in its use.

Cables must not be proved dead by spiking in the case of:

- sheath, screen or serving repairs, or
- insulation or joint repairs where the cable is not cut, or
- non-concentric cables energised from an unearthed 2kV system.

Under these circumstances, identification of the cable must be by two independent methods.

5 Earthing High Voltage Equipment

5.1 Locations where Earths must be Applied

Isolated and proved dead high voltage equipment must be short circuited and earthed at the following locations:

- (i) Safety earths must be applied as close as practicable to the source of supply on each side of a worksite.

Where a number of sources of supply are connected on one or both sides of the worksite, the source of supply may be considered as being the worksite side of the “Tee” connection closest to the worksite.

- (ii) Working earths must be applied to all conductors on which work is being carried out on each side of the worksite. At least one set of working earths must be near the work site and positioned to be readily checked. Where safety earths are in the work area they can be considered as working earths provided that they are connected to the equipment on which the work is being carried out. All earthed conductors at the worksite must be connected to a common earth to ensure equipotential conditions.
- (iii) Additional working earths must be applied where there is a risk of dangerous voltages being induced in the conductors being worked on from live overhead lines in the area.
- (iv) When work is carried out on an overhead line at a pole or structure which is conductive and is not connected to an aerial earthwire, the structure must be bonded to the conductors being worked on prior to any person bridging between the structure and the conductors.
- (v) If a conductor is broken or is to be broken, the two sides are to be bridged together with a bond before bridging by hand. The bridging may be via other unbroken phase or aerial earth conductors.
- (vi) In cases where conductors of an overhead line are being lowered to or raised from the ground in the vicinity of other services an earth must be attached to the conductor throughout the operation.
- (vii) For cable work, working earths must be applied at cable/equipment/overhead line junctions where a section of overhead line exists between the worksite and the point of supply.
- (viii) Exposed busbars within substations need only have safety earths applied between the worksite and any source of supply.
- (ix) Busbars of enclosed switchgear must be earthed at the points indicated in the Local Instructions.

- (x) If it is necessary to work on an overhead line at a time when there is an increased risk due to lightning, all conductors, including aerial earth wires, must be short-circuited together and earthed at each pole or structure being worked on.
- (xi) Working earths must be positioned such that there are no fuses between the working earths and the worksite.

5.2 Enclosed Switchgear

Earthing of enclosed switchgear must be carried out in accordance with Local Instructions relevant to the equipment concerned.

If a circuit breaker is used to effect earthing it must be made inoperative once the earths have been applied.

5.3 Earthing Switches - Outdoor Unenclosed

Immediately prior to closing an earthing switch, each conductor must be proved dead, except for HV pole mounted switch frame equipment.

Earthing switches are to be operated with a single unhesitating movement. A visual check of the blade position must be made for each phase to ensure the switch has operated correctly.

For HV pole mounted switch frame equipment with an earthing switch on each side of a fuse, proving dead before earthing is not required provided the LV switch is open and the HV switch blades are visually checked open.

6. Portable Earthing Equipment

Portable earthing equipment must be in accordance with specification PMS 01 - "Requirements for Portable Earthing Equipment for the High Voltage System".

Procedures for the use of the contractor's portable earthing equipment must be included in the contractor's Electrical Safety System user documentation.

7. Portable Insulated Operating Sticks

Portable insulated operating sticks must be in accordance with POP 02 - "Suitable Operating Equipment".

Procedures for the use of the contractor's portable insulated operating sticks must be included in the contractor's Electrical Safety System user documentation.