

SAFETY AND HYGIENE REGULATIONS



Servei de Prevenció de Riscos Laborals
UNIVERSITAT POLITÈCNICA DE CATALUNYA

WORKING DEAD (NO VOLTAGE)

CODI

SHR 501

Date:

December 2009

Revision:

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IN ACCORDANCE WITH ROYAL DECREE 614/2001, ON THE MINIMUM PROVISIONS FOR PROTECTING THE HEALTH AND SAFETY OF WORKERS FROM ELECTRICAL RISKS – APPENDIX II

DEFINITION: Working dead means working on electrical installations once the necessary precautions have been taken to ensure that they remain disconnected from the power source.

A. GENERAL PROVISIONS

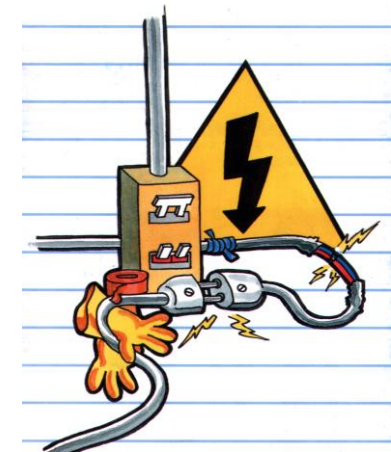
All operations and manoeuvres designed to disconnect an electrical installation from the power source before starting to “work dead” and to restore power on completion of the task must be carried out by authorised workers. In the case of high voltage installations, the workers must be qualified.

A.1 Voltage suppression

Once the areas and elements of the installation on which work will be undertaken have been identified, follow the process described below, which is divided into five stages to be carried out sequentially, unless there are vital reasons for approaching the task in another way:

1. Disconnect
2. Secure against potential reconnection
3. Check that there is no electrical power
4. Ground
5. Protect against adjacent live elements, if applicable, and put up safety signs to demarcate the work zone

Until the five stages have been completed, the start of the work cannot be authorised, and the affected part of the installation will be considered to be live. However, to put up the safety signs indicated in the fifth stage, the installation can be considered to have no voltage if the four previous stages have been completed and danger zones of adjacent live elements cannot be entered.



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1. Disconnect

The part of the installation in which the work will take place must be totally isolated from all power sources. Isolation must consist of an air gap or the positioning of insulation that is sufficient to ensure electrical isolation.

Capacitors or other components of the installation that may still carry a charge after disconnection must be discharged using suitable devices.

2. Secure against potential reconnection

Switching devices used to disconnect the installation must be secured against potential reconnection, preferably by locking the switching mechanism. When necessary, a sign must be attached to prohibit use of the switch. If there are no mechanical locking devices, equivalent protection measures must be taken. When remote control devices are used, it is essential to prevent the wrong manoeuvre being carried out via remote control.

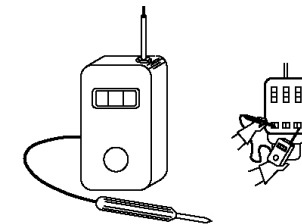
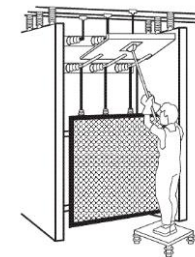
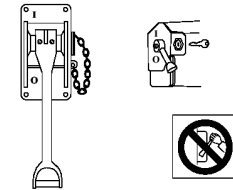
When an alternative source of energy is required to operate a cut-off device, this source of energy must be disconnected or should act on the elements of the installation so that the separation between the device and the power source is ensured.

3. Check that there is no electrical power

The absence of voltage must be checked in all active elements of the electrical installation in the work zone, or as close as possible to this zone. In high voltage installations, it is essential to check that voltage absence testers are working properly, before and after verifying the absence of voltage.

To verify the absence of voltage in insulated cables or conductors that could be confused with others in the work zone, devices that act directly on the conductors should be used (wire probes or similar), or other methods that follow a procedure to ensure the protection of the worker from electrical hazards at all times.

Remote-controlled devices used to verify that an installation is disconnected from the power supply must have a safe mode of operation and the position on the remote control must be clearly indicated.



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4. Grounding

Parts of the installation where the work is to be undertaken must be grounded:

- a) In high voltage installations
- b) In low voltage installations in which, by induction or other means, accidental reconnection could occur

Equipment or devices for grounding must first be connected to earth and then to the elements that need to be grounded, and must be visible from the work zone.

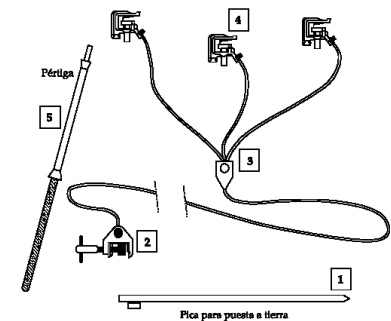
If the latter is not possible, the earth connections must be placed as close to the work zone as possible.

If conductors must be cut or connected during the work and there is a danger of voltage differences in the installation, protection measures must be taken. These could include the addition of bridges or earth connections in the work zone before the connection to the conductors is cut.

Conductors used for grounding and, if necessary, bridging must be suitable and have a large enough cross section for the short-circuit current in the installation in which they are placed.

Precautions should be taken to ensure that the ground connections remain in place throughout the duration of the work. When they need to be disconnected for measurements or tests, appropriate additional preventive measures must be taken.

Remote controlled devices used to short circuit an installation to ground must have a safe mode of operation and the position on the remote control must be clearly marked.





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5. Protect against adjacent live elements and put up safety signs to demarcate the work zone

If elements of the installation adjacent to the work zone need to remain live, additional protection measures must be adopted and implemented before work starts, according to the provisions in Section 7 of Article 4 of this Royal Decree.

Section 7 of Article 4: works carried out adjacent to live elements must be performed according to the provisions in Appendix V "Work in the proximity zone" or should be considered as work on live installations, and the provisions corresponding to this kind of work must be applied.



A.2 Re-energising the affected part of the installation

The installation will only be re-energised on completion of the work, once all the workers who are not indispensable have left the work zone and the tools and equipment used have been removed from the area.

The process of re-energising the affected part of the installation includes:

1. Removal, if applicable, of additional protection and safety signs that demarcate the work zone.
2. Removal, if applicable, of the ground connection.
3. Unlocking and/or removal of signs on cut-off devices.
4. Closing circuits to reenergise them.

As soon as one of the measures adopted for dead working under safe conditions is removed, the affected part of the installation will be considered to be live.

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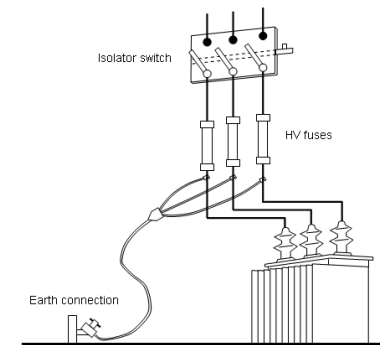
B. SPECIFIC PROVISIONS

The specific provisions established below for certain types of work must be considered complementary to those described in Section A of this Appendix, except when the specific provisions modify the general provisions explicitly.

B.1 Replacing fuses

In the specific case of replacing fuses described in the first paragraph of Section 4 of A.1 of this Appendix:

1. Grounding is not necessary when the disconnection devices on both sides of the fuse are in sight of the worker, the cut-off is visible, or the devices provide equivalent safety guarantees and there is no possibility of accidentally closing them.
2. When the fuses are connected directly to the primary side of a transformer, it is sufficient to ground on the high voltage side, between the fuses and the transformer.

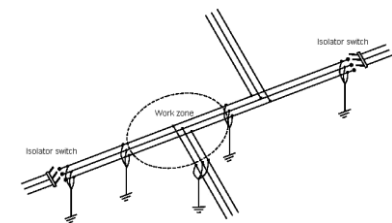


B.2 Work on overhead lines and high voltage conductors

1. When work is carried out on bare overhead lines and bare high voltage conductors, both sides of the work zone in addition to each of the conductors within this zone must be grounded. At least one of the pieces of equipment or devices for grounding must be visible from the work area. These rules have the following exceptions:

1a For specific tasks in which the conductors are not cut during the work, one ground connection in the work zone is acceptable.

2a When the equipment or devices for grounding cannot be seen from the limits of the work zone, a local earth device, an additional safety sign or any other equivalent identification should be put into place.



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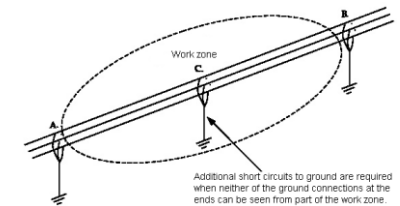
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When work is performed on just one conductor of the high voltage overhead line, a short circuit will not be required in the work zone if the following conditions are met:

- At the disconnection points, all the conductors are grounded in accordance with the above indications.
- The conductor on which the work is carried out and all conductive elements inside the work zone, except the other phases, are connected electrically to each other and earthed using a suitable piece of equipment or device.
- The earth conductor, the work zone and the worker are outside the danger zone determined by the rest of the conductors in the electrical installation.

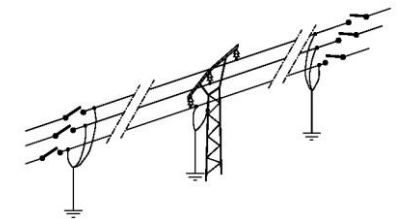
2. In work on insulated overhead lines, cables or other insulated high voltage conductors, the grounding is placed on the bare elements of opening points of the installation, or as close as possible to these points, on each side of the work zone.



B.3 Work carried out in installations with capacitors that can accumulate energy dangerously

To de-energise an electrical installation when it contains capacitors that have a capacity and voltage that could cause a dangerous accumulation of electrical energy, the following process must be followed:

- The separation of potential sources of voltage must be carried out and guaranteed by disconnecting them, either through a visible cut-off or reliable proof of the absence of voltage.
- A discharge circuit must be applied to the capacitor's terminals, which could be the grounding circuit referred to in the following section when it includes a grounding switch. Then, the capacitor must be given time to discharge.
- The capacitors must be grounded. When there are semiconductors, fuses or automatic switches between the capacitors and the means of cutting the circuit, the operation must be carried out on the capacitor terminals.





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B.4 Working on high voltage transformers and machinery

1. To work dead in a power or voltage transformer, all the primary circuits and all the secondary circuits must be de-energised. If possible, depending on the cut-off means, the circuits with less voltage must be separated first. To re-energise the installation, the reverse procedure should be followed.

To work dead on a current transformer, or on the circuits it feeds, the primary circuit must be de-energised first. Circuits connected to the secondary side must not be opened if the primary circuit is live, unless this is necessary for some reason, in which case the terminals of the secondary side must be grounded.

2. Before working on the inside of an electric motor or generator, it must be checked that:

- a) The machine is completely stopped.
- b) The power supply is disconnected.
- c) The terminals are grounded.
- d) The fire protection is locked.
- e) The atmosphere is not harmful, toxic or inflammable.

