

Working with Electricity

Standard



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1 Introduction

This standard describes the minimum requirements whilst working with electricity on Ericsson business to ensure that the health and safety aspects are properly managed.

Where local legislation exceeds requirements in this standard, local legislative requirement shall apply.

2 Definitions

In this standard, the following terms will always have the meanings given in this section.

“Authority to Work” means the formal notification to the Competent Person that they can proceed with the designated electrical work provided all method statements, risk assessments, permits are in place.

“Charged” means that a part is at a dangerous voltage or energy level, has been given an electrical charge by induction or statically, or has retained or regained a charge from capacitance effects following disconnection.

“Circuit conductor” means any conductor in a system which, in normal conditions, is intended to carry electric current, or to be energized. This includes a combined neutral and earth conductor but does not include a conductor provided solely to form a protective function by connection to earth or other reference point.

“Competent person” means someone possessing the following attributes:

- Adequate understanding of the system to be worked on and practical experience of that system.
- Understanding of the hazards which may arise during the work and the precautions which need to be taken.
- Ability to recognise at all times whether it is safe to continue.
- Adequate technical knowledge of electricity.
- Adequate experience of electrical work.

“Conductor” means a conductor of electrical energy.

“Danger” means risk of injury, or of damage to equipment or system functionality.

“Electrical equipment” means anything used, intended to be used, or installed for use to generate, provide, transmit, transform, rectify, convert, conduct, distribute, control, store, measure or use electrical energy.



“Extra low voltage (ELV)” means voltage not normally exceeding 50V AC or 120V DC, whether between conductors or to earth.

“Handover Permit” means the formal handover document of an electrical system or part of an electrical system or electrical equipment, to a Competent Person who is not normally responsible for its safety, for carrying out electrical work.

“High voltage (“HV”) means all voltage exceeding low voltage.

“Isolated” means that the equipment is securely disconnected from all sources of electrical energy, by means of a safe gap between the live and neutral conductors of the energy sources and the corresponding conductors in the equipment. It also means that locking devices on the disconnection mechanism have been operated to provide guaranteed protection against re-connection by accident or deliberate action taken in ignorance of the danger.

“Live” means that the equipment in question is connected to a source of electricity, so that parts of it will be at a voltage. It also implies, unless otherwise stated, that the live parts are exposed so that they can be touched either directly or indirectly by means of a conducting object, and that either their voltage or energy levels are dangerous.

“Live work” means work where there is danger of inadvertent contact with conductors which are accessible, and which are live or charged.

“Low voltage (“LV”) means voltage normally exceeding extra-low voltage but not exceeding 1000V AC or 1500V DC between conductors, or 600V AC or 900V DC between conductors and earth.

“Permit to Work” means a documentary procedure designed to ensure that a “Safe System of Work” is operated. The key elements are competence of the persons involved, detailed planning of the work, guaranteed system isolation, safe working methods, safety testing to approved standards and formal transfer of safety responsibilities at the start and finish of the work.

“Point of supply” means the point at which conductors are connected to a source of electrical energy.

“PPE” means Personal Protective Equipment.

“Safe System of Work” means a procedure resulting from a risk assessment of working processes, which identifies hazards and specifies work methods designed either to eliminate or control the hazards or minimizes the relevant risks.

“System” means an electrical system in which all the electrical equipment is, or may be, electrically connected to a common source of electrical energy, and includes such source and such equipment.



3 Responsibilities

3.1 Line managers

Line managers controlling locations or activities in which there are electrical safety issues are responsible for:

- Developing and maintaining a risk assessment of electrical activities.
- The outcome of any risk assessment shall be action(s) to control the risks of electrocution by either using existing (such as Permit to Work, Competent Persons, Isolation Permits and PPE) or implement new measures.
- Ensuring that only Competent Persons design, plan, install, commission, operate, inspect and maintain any electrical systems or equipment, and where necessary, identifying and arranging for appropriate electrical awareness and skills training.
- Ensuring that electrical safety equipment provided for use by their employees is maintained and that periodic checks of proper use are undertaken, plans updated and recorded.
- Ensuring that contractors engaged to undertake electrical duties are competent to do so (taking copies of relevant certificates) and that their performance is monitored.
- Ensuring that their employees have been issued with the relevant certification to carry out their duties.

It is also sufficient that the Contractor confirms with a personal signature that the contractor's employees have all the necessary certificates for the electrical engineering work at the location to be carried out.

3.2 Employees

Employees are responsible for:

- Complying with all legal requirements and this instruction, so far as they relate to matters within their control.
- Co-operating with Line managers and the appointed Competent Person so far as is necessary to enable Ericsson to comply with the provisions of relevant legislation.
- Only undertaking electrical work within activities for which their certification qualifies them as competent.
- Following approved safe working procedures so as not to give rise to danger.



4 General requirements

The following requirements shall apply:

- Live electrical work on High Voltage Systems is strictly prohibited.
- Lone working on Live Installations (excluding ELV) is strictly prohibited.
- The Responsible Manager shall ensure planning and local risk assessments of working with electricity are carried out.
- PPE such as gloves, boots, barriers and mats shall be provided and used according to the tasks and identified risks.
- Work equipment such as insulated tools (screwdrivers, side cutters, wire strippers) shall be provided and used according to the tasks and identified risks.
- Persons undertaking work activities on electrical equipment are required to have and maintain a level of competence appropriate for the work they will carry out. Refresher training or re-examination shall be carried out as defined in local legislation, or where not defined shall as a minimum be carried out every two (2) years.
- Electrical work shall only be carried out on electrical equipment which comply with current local legislation and local electrical safety standards.
- All portable electrical tools shall operate at safe voltage as further defined herein.

5 Electrical work

5.1 Design and specification of electrical installations

The design and specification of new and/or extensions to existing electrical systems shall be carried out by persons with the appropriate technical knowledge, experience and understanding of applicable local legislative regulations, standards, and codes of practice.

The following shall be considered:

- Electrical engineering work may only be carried out after being commissioned by the employer.
- All items of electrical equipment shall be selected as suitable for the environment in which they are to be installed or used.
- All electrical equipment shall be designed for installation in such a manner that it can be safely maintained.



- Circuit diagrams and plans are drawn up and maintained to provide an up to date and comprehensive record of all electrical systems, including all modifications (including those made during installation).

5.2 Advance notification / Handover permits

All pre-planned electrical work shall be subject to risk assessment (see section 8 herein) and be in accordance with local legislation. Included within the risk assessment shall be all appropriate permits, plans and customer provided information (such as Handover Permit where used.)

Advance notification in writing of pre-planned electrical work shall always be given to the person responsible for the system and where possible also for emergency work.

Two types of handover permits are described herein:

- Electrical Isolation Permit; and
- Authority to Work (on Live Systems).

This system is necessary to ensure that the ownership of responsibility for safety is always clearly defined and understood by all the parties involved.

5.3 Working on isolated electrical systems

Work on electrical systems or equipment where workers may come into contact with a conductor shall be undertaken isolated, unless this cannot be achieved by any reasonable means. Exceptions will be where live functional testing must be carried out, or where the equipment is constructed to standards giving specific exemption.

5.3.1 Electrical Isolation Permit

To ensure work on isolated electrical systems are safe, an electrical isolation permit shall be used to ensure all responsible parties are aware of the work being carried out to prevent unauthorized turning back on the electrical supply until such work is reported as completed.

5.3.1.1 Permit to Work

The Permit to Work shall be issued for a designated period for a specified electrical system or piece of equipment to certify it is isolated. Such permits shall only be issued to by the Responsible Person to Competent Persons.

A Permit to Work shall always be used for work on High Voltage systems, in any room or enclosure housing High Voltage plant, or around exposed energized parts which pose an arch flash, electrocution or shock hazard.



Live High Voltage working is strictly prohibited.

Permits to Work must be uniquely numbered and copies retained for at least one (1) year. Longer archiving may be required where the permit is relevant to the investigation of an accident or a dangerous occurrence.

5.3.1.2 Electrical Isolation Permit

Before a Permit to Work is issued it may be necessary to isolate the equipment or plant to be worked on. The Isolation Permit provides a means of documenting both electrical and mechanical isolations so that the task may proceed safely.

The Isolation Permit shall be signed by the appointed Competent Person.

These are separate from the Permit to Work but are referenced on each document.

There are two categories of supplementary Certificates:

1. Isolation (Lockout and labeling).
2. Confined Space.

5.3.2 **Actions to be taken before working on isolated systems**

Systems shall always be tested to ensure the system is not live and that free residual stored energy is discharged, using approved measurement equipment before work commences. The equipment shall itself be tested, before and after use. The application of a voltage and the achievement of an appropriate meter reading shall be used for volt meters. This is particularly important where fused test leads are used, because a blown fuse would lead to a false indication of safety.

It is also important to note that dangerous voltages may not be detected if the voltage indicator is set to the wrong range, i.e. set on AC when measuring DC or vice versa. Meters shall be tested on live deadline to verify accuracy before use. All meters shall be calibrated annually (or have calibration requirements by 3rd party certifications).

5.3.3 **High Voltage (“HV”) systems**

Working on HV systems shall only permitted using approved specialist HV Contractors or the Electricity Provider.

5.4 **Working on live electrical systems**

All activities shall comply with relevant local Regulations governing live working.



In the absence of a more rigorous statutory requirement, live working shall be governed as described below.

No person shall be engaged in any work activity on or so near to any live conductor (other than one suitably covered with insulating material to prevent danger) that danger may arise unless:

- It is unreasonable in all circumstances for it not to be live.
- It is reasonable in all circumstances for the person to be at work on or near it whilst it is live.
- Suitable precautions (including, where necessary, the provision of suitable protective equipment) are taken to prevent injury.

When a decision to work live has been taken based on the above, a written risk assessment and method statement shall be prepared and approved by the appointed Competent Person responsible for the system, to describe a system of work which will avoid injury.

The elements of the Safe System of Work shall include:

- Risk Assessment.
- A description of measures required to minimise risk.
- A statement of the sequence of actions to be taken.
- A statement of competence required of persons carrying out and in charge of the work, and of those providing safety cover.
- Details of personal protective equipment, such as gloves, insulated boots, insulating screens, tools, barriers, and mats to be used.
- Emergency plans to be adopted in the event of mishap, overrun or changed circumstances.

5.4.1 Authority to Work

An Authority to Work shall be given together with a Permit to Work for live working on all ELV and LV systems, that is, whenever there is danger because of working on or near to equipment that cannot be made dead for operational reasons. An Authority to Work requested from the appropriate responsible person, shall always involve approval of a method statement, and of a risk assessment for the work which must include detailed information on the precautions to be taken.



5.4.2 Low Voltage systems ("LV")

When live working on LV systems is required, the following tasks shall be undertaken to minimize risks:

- Installation of sub-circuit cabling to live distribution boards having adequate penetrations, free space and access to switch gear.
- Installation and removal of new or redundant circuit breakers or fuses supplied via 'slide lock' type primary isolated connections (non-screw, stud, bolt type); i.e. direct contact with energized system, bus bars or connections is not required.
- Termination of sub-circuit cabling to new or existing circuit breakers or fuses, within energized boards and enclosures, with the sub-circuit fuse removed or the circuit breaker in the open position.
- De-installation from energized boards or enclosures of redundant cabling with exposed cable ends suitably insulated to prevent accidental re-energization.
- EEW permit/assessment.
- Identification of potential energy and donning necessary PPE based off potential energy.
- UPS battery testing.

The tasks above are not permitted in distribution boards or enclosures containing exposed live bus bar systems or readily accessible non-shrouded terminations. The task list is not exhaustive, and variations require local risk assessment and discussion with a Competent Person.

Competent Persons executing the above tasks may only do so when accompanied by a second Competent Person who is familiar with the installation and with the detailed arrangements to de-energize, isolate, and make it safe. If in doubt, consult the relevant expertise for guidance.

5.4.3 Extra Low Voltage systems ("ELV")

When telecommunications equipment is supplied from ELV 50V DC systems, then live working on such systems to install and de-install new equipment or cabling are permitted if it is assessed as reasonable in all the circumstances, and that suitable precautions are taken to prevent injury, using protective equipment, insulated tools and, if necessary, protective clothing.

Special attention must be taken when a battery pack is installed. A breaker between the battery pack and the installation must be present. First actions if touching an ELV system is to disconnect the battery pack.



Due to the diverse nature of electrical tasks on ELV systems, it is impossible to cover all possible scenarios. However, the following are examples of live work that may be carried out by a Competent Person working alone. These shall be used as a guide when assessing other live working tasks and the necessary manning levels. Where the stated conditions are not met a second Competent Person shall be assigned to assist with the task.

- Battery discharge tests where access to the cells and their terminals is neither restricted nor at a height that requires climbing, and where the battery under test can be safely disconnected from the rest of the system.
- The removal, insertion or replacement of circuit breakers and fuse carriers within energized distribution boards and enclosures, where there is no direct risk of short circuit between exposed bus bars or connections, for example by the use of insulated tools and/or inserted temporary means of insulation.
- New cabling installations into live ELV distribution boards and enclosures, provided that the conductor ends are suitably insulated, and that neither the internal cable routes nor working access are restricted by exposed bus bars or connections.
- The removal and replacement of printed circuit boards in equipment shelves, provided that the power connections are protected against accidental short circuiting by shrouding.
- Live connection or termination of cables or other conductors is NOT permitted. Circuits must always be de-energized and isolated to prevent current flow at the contact points, i.e. with fuses withdrawn or breakers open, before any new connection is made.
- If a short-circuit current at a voltage lower than 50 V AC can be greater than 3 mA, or at 120 V DC greater than 12 mA, the regulations for work under voltage must be observed.

5.5 Live functional testing

Live functional testing may be undertaken as it is not practical to carry out testing with the conductors electrically isolated. The following shall be used during live functional testing:

- A safe area, restricting access by non-essential persons, must be created for live functional testing unless the physical disposition of the equipment allows it to be carried out without risk to persons not involved in the task.
- Approved insulated tools and test equipment, insulating screens, barriers, mats, gloves, and boots shall be used.

Lone working is not allowed during live functional test.



5.6 Requirements on final installation / commissioning work

- Red-line Circuit diagrams and plans shall be provided to the designer to ensure an accurate record of the installed electrical system is available for subsequent work.
- All new electrical installation work shall be inspected and tested by a Competent Person prior to its handover or being put into service.

5.7 Maintenance of electrical system (where applicable)

Once installed and commissioned, the following shall apply:

- All electrical systems shall be periodically inspected and tested, and appropriate records maintained.
- All electrical systems shall be maintained to industry standards to prevent danger.

5.8 Use of portable tools for installation work

- All portable power tools shall be either:
 - Battery powered.
 - Operate at a voltage of 110V AC or less, supplied via a transformer (centre tapped to earth) which is protected by a Residual Current Device at the point of connection to a Mains system.
 - Powered from a Mains supply be of double insulated construction and protected at the point of connection by a Residual Current Device.
- Portable power tools and equipment shall be maintained, inspected and tested in accordance with the local relevant legislation.
- Equipment known to be defective shall not be used and must be kept in a secure place or immobilized pending repair or replacement. A label must be fixed to the equipment indicating that it is defective.
- No extension lead shall be used unless inspected by a Competent Person and is clearly identified as being an item that is within its inspection period. All extension leads must have adequate mechanical protection for the environments in which they are used. Extension leads shall not be 'daisy chained' (connected in series) or used under floor and voids.

6 Competency categories

A range of competence categories of electrical activity has been identified, based on levels of risk. Workers shall be authorized to perform electrical



activities related to each category or subcategory using safe working practices set out in their local work instructions. The categories are defined in the following text.

Within each category, competent workers shall have documented technical training and knowledge to work on the equipment and systems specified, and therefore are competent both in identifying where electrical hazards exist and in what actions to take to avoid such hazards.

6.1 Telecommunications equipment

Workers installing, commissioning, and maintaining equipment already connected to the DC or AC supply can perform the following work:

- Switching the operation of circuit breakers and switches.
- Replacing in shelf, rack and end-of-suite fuses in DC systems up to 60V, and fuses integral to equipment units in Mains AC systems.
- Minor repairs including replacement of plug-in components such as lamps, PCBs or fuses in disconnected equipment.
- Other repairs involving unit or components dismantling may only be included if specifically identified during the appointment process.

Workers in this category are **not allowed** to perform:

- Live working.
- Work within power distribution racks.
- Work on DC systems below 60V DC and up to 50AH capacity including the changes of modular rectifiers on DC systems.

6.2 Minor electrical work

Workers within this category can perform:

- Connect equipment racks or individual units into Mains AC fused spurs.
- Running cables, fitting standard plugs and replacing blown fuses.
- Perform testing for Minor Electrical Installation Works

The workers within this category can sign the appropriate certificate on completion.

The workers in this category shall not provide new circuits into a distribution board.



6.3 High Capacity DC

Workers within this category can install, maintain, and test DC systems over 50 AH capacity, or exceeding 50V.

6.4 High Voltage DC

Workers within this category can perform High Voltage DC work (competent through attending a manufacturer's equipment training course or other similar training).

6.5 Electrical installations

Workers within this category are allowed to perform and test electrical installation work and certify the electrical installation as safe.

6.6 High Voltage installations and equipment

Workers within this category are allowed to perform high voltage installations and work on equipment (competent through attendance of safety and technical training specific to High Voltage systems.)

7 Training

It is mandatory that all workers directly managing, supervising, or working on electrical equipment have adequate and appropriate training in the duties for which they are responsible. Formal training shall include the following:

- Safe working practices.
- Relevant safety regulations.
- Local site safety rules.
- Emergency first aid.
- This Standard.
- The permit or assessment which has been updated to meet local regulatory standards.

In addition, workers directly working on electrical equipment shall have the following training:

- Basic electrical engineering training as required by local regulations.
- Specific local training in the installation, operation, maintenance and testing of equipment to be worked on.



All workers shall be assessed as competent for electrical work activities and be issued with a certificate indicating the activity categories they are authorised to undertake, and any restrictions which apply. This shall be signed by an appropriate person with competence to make the assessment.

All workers shall be issued with a certificate which relies on proof of adequate training, appropriate experience, and knowledge of the system to be worked on, together with knowledge of relevant local instructions.

8 Personal Protective Equipment

PPE shall be suitable for the task, certified to international standards, issued, and recorded on a personal basis. Employees must be trained in the care, examination, and storage of all PPE they may require.

Certain basic items of PPE shall be issued to all persons carrying out electrical work:

- Insulated tools: such as screwdrivers, side cutters, wire strippers.
- Voltage Tester.
- Details of additional personal protective equipment which may be needed, such as gloves and boots, and insulating screens, barriers, and mats to be used.

PPE must be inspected at the following times:

- Prior to first use - Formal inspection documentation supplied by the manufacturer.
- Prior to each use - Inspection by the user.
- Every **6 months** - Thorough examination by a competent person.

9 Risk assessments

Risk assessment shall be carried out covering electrical work tasks. Before starting any electrical work, local hazards identified in the risk assessment shall be controlled.

The required controls are defined in this Standard and in any health and safety legislation applicable in the country where the electrical work takes place.



10 **Monitoring and review**

Adherence to this Standard shall be monitored by reviewing and keeping records of:

- Training and certification
- Risk Assessments and Method Statements.
- Portable electrical equipment issue and inspection form.
- Permits to Work.
- Isolation Permits.
- Authority to Work.
- Incident Statistics.

11 **Change information**

- 1 Entire text has been updated and clarified in accordance with updated global requirements
- 2 Responsibility section added