



ESA Principles

1. Foreword

According to the Swedish Work Environment Act, the employer must take all necessary measures to prevent employees from being exposed to ill-health or accidents. It is also a legal requirement that satisfactory safety measures are taken against injury caused by electric current. By following these instructions, the employer mainly meets these requirements. For work at a particularly complicated installation or where these instructions do not provide sufficient support, the instructions must be supplemented with a customized instruction by the employer.

The revised electrical safety instructions, ESA Principles and ESA Work, are intended to include all the main types of electrical installations, such as grid installations, industrial installations, office and residential installations and more.

In the text there are three titles that are not translated into English: elanläggningsansvarig¹, eldriftledare² and elsäkerhetsledare³. They are all explained in English at the bottom of every page where they occur.

The section with definitions contains the headwords in English and in Swedish. The Swedish headwords are in brackets and marked “Sw”.

In the appendices with examples of different forms (e.g. request for permit-to-work) the English translation is followed by the Swedish original.

A new capacity, “person responsible for an electrical installation” in ESA named “elanläggningsansvarig¹”, has been added to the Swedish standard SS-EN 50110-1:2013. The role of elanläggningsansvarig¹ is to create instructions for the care of the proprietor’s installation and how it should be conducted in a safe manner for the workers. Elanläggningsansvarig¹ can define instructions to prevent injury caused by electricity if the nature or the operation and work activity of the installation so requires.

The Electrical Safety Instructions, ESA, is an example of such instructions referred to in the Swedish National Electrical Safety Board Regulations. ESA is a way for the electricity industry to comply with the Swedish Work Environment Act and the industry’s interpretation of the Swedish Standard for Operation of Electrical Installations, SS-EN 50110.

This means that the employer or elanläggningsansvarig¹ can decide on ESA to be adopted in full or in part, and / or supplemented with additional internal safety instructions to achieve satisfactory safety.

ESA provides a number of different functions and their duties and responsibilities. Depending on the size of the company or the work activity, several functions may be held by one person and in other contexts, the same role can be shared by many people or functions.

It is important that it in each company is clearly described, documented and communicated how the functions are allocated and limited, for example, geographically or in voltage levels. Functions may also, through agreements, be operated by a contractor.

ESA Industry, ESA Installation and ESA Working on Parallel Transmission Lines as well as the working procedures Dead Working, Working in the Vicinity of Live Parts and Live Working are all included in ESA 14.

1 person responsible for an electrical installation

2 nominated person in control of an electrical installation during work activities

3 nominated person in control of a work activity

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2. Liability according to law — Work environment and legislation relating to electricity

Employer

An employer is the person who, within a company, an administration or other organization, has the task of conducting its operations.

The company's managing director (or equivalent) has the ultimate employer responsibility. If necessary, duties required to fulfill this responsibility, can be delegated within the organization of the company.

The employer must ensure that all work or actions are carried out in such a way that the requirements for the necessary safety for the employees are met. All work must be planned thoroughly and, if necessary, in writing. An assessment of the electrical risks involved must be the basis of how the work activities should be carried out. Employers are obliged to have and operate a routine for a systematic health and safety work.

Employers must ensure that employees have the necessary training for the work activity and are aware of the risks that may be associated with it.

Proprietor

Proprietor of an electrical installation is the person who has the installation at his or her disposal.

According to the *Heavy Current Ordinance* (Starkströmsförfordningen 2009: 22) the proprietor of a power plant or device is responsible for that the work activity on, or in connection with, the plant or the device is performed in such manner and is carried out by, or under the supervision of, persons with such knowledge and skills, that satisfactory safety measures against personal injury or property damage are followed.

This means that a proprietor must provide the necessary information about his or her installation or device and its operation to those who work at or in the vicinity of it. The information must take into account the complexity of the installation, the extension, the included components and more. Documents that must be part of the information are such as diagrams, charts, drawings, and instructions.

During the construction of an installation, the person performing the construction can be the proprietor of the installation until it is handed over to the purchaser.

At the dismantling of an installation the proprietor is responsible until the installation is dismantled.

If the proprietor is a company, an administration or other organization, the ultimate liability rests with the company's managing director (or equivalent). If necessary, duties required to fulfill this liability, can be delegated within the organization of the company. In a company with numerous and / or geographically dispersed heavy-current installations, such a delegation is often necessary.

The proprietor must ensure that the installation is constructed and maintained in such a condition that it provides necessary safety for individuals (both employees and the public) and property and exercise supervision of the installation. The proprietor must also maintain hardware and devices used to generate, convert, transfer, distribute or use electrical energy in such a condition, that necessary safety is assured. Where there is generation into the grid, which is not the proprietor's own, this must be documented by the proprietor.

The proprietor is obliged to systematically monitor and check the installation so that any defects and shortcomings can be detected and corrected. Certain installations and installation parts require a more thorough checking at specific intervals or intervals that are determined by the design and use of the installation.

The responsibility for operation measures, for example checks or maintenance work to be carried out in a safe way, is held by elanläggningsansvarig¹ and can be found in the *Swedish Standard for Operation of Electrical Installations*.

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3. Definitions

Automatic reclosing

(Sw. Återinkopplingsautomatik)

Automatic reclosing means:

automatic reclosing (ar)

fast automatic reclosing (far)

delayed automatic reclosing (dar)

automatic network restoration (anr) and

automatic system for a neutral point resistance

Barrier

(Sw. Avspärrning)

Temporary device intended to remind people of danger and warn against entering particular area.

Blocking – protection against switching while work is in progress

(Sw. Blockering skydd mot koppling under arbete)

An action aimed at preventing inadvertent operation.

Boundaries

(Sw. Avgränsningar)

Well-defined switching points which marks off a working area.

Bulky equipment

(Sw. Skrymmande redskap)

Equipment that may, inadvertently, come into the live working zone when operated as specified and with normal care.

Certificate of commissioning

(Sw. Driftbevis)

A certificate that a part of the installation is ready for energizing, as far as the person handing over the certificate of commissioning is concerned, including the changes noted in the certificate of commissioning.

Close supervision

(Sw. Vakthållning)

Safety measure during short-duration work, using the working procedure Working in the vicinity of live parts.

Contractor

(Sw. Entreprenör)

A company engaged by the proprietor to carry out work at or near an electrical installation.

Dead

(Sw. Spänningslös)

At or about zero voltage, that is, without voltage and/or charge present.

Dead working (AUS)

(Sw. Arbete utan spänning)

Work activity at electrical installations, which are neither live nor charged, carried out after all measures to prevent electrical danger have been taken.

Disconnection

(Sw. Frånkoppling)

Generic term for one or many switching measures, for example break, disconnect and block.

Earth terminal

(Sw. Jordtag)

Work according to ESA refers to earth terminals with such a low earth electrode resistance, that the installation will be disconnected automatically if there should be an unintentional energizing.

Earthing for work

(Sw. *Arbetsjordning*)

Earthing and short-circuiting for work of such design that it withstands the highest normal operating current, normally the short-circuit current.

Earthing tools

(Sw. *Jordningsverktyg*)

Tools for connecting conductors to each other (short-circuiting) and to an earth terminal.

Electrical coordinating manager

(Sw. *Elsamordningsledare*)

A person given the task to coordinate electrical safety issues when there are many elsäkerhetsledare³ in a work area.

Elanläggningsansvarig¹

Nominated person with the overall responsibility to ensure the safe operation of the electrical installation by setting rules and organisation or framework.

Eldriftledare²

Person who is responsible during work activities for the safe operation of the electrical installation.

Elsäkerhetsledare³

Person nominated with the ultimate responsibility for the work activity at the work location.

Emergency disconnection

(Sw. *Nödbrytning*)

Acute de-energizing for rescue actions.

Employer

(Sw. *Arbetsgivare*)

An employer is the person who, in a company, an administration or other organization has the task of conducting its operations.

Hired manpower

(Sw. *Inhyrd arbetskraft*)

A person made available to work under the management of the person hiring him or her.

Instructed person

(Sw. *Instruerad person*)

Person adequately advised by a skilled person to enable him or her to avoid dangers which electricity may create.

Isolate

(Sw. *Frånskilja*)

Disconnect completely a device or circuit from other devices and circuits by creating a physical separation able to withstand the anticipated voltage differences between the device or circuit and other circuits.

Live working (AMS)

(Sw. *Arbete med spänning*)

All work in which a worker deliberately makes contact with live parts or reaches into the live working zone with either parts of his or her body or with tools, equipment or devices being handled.

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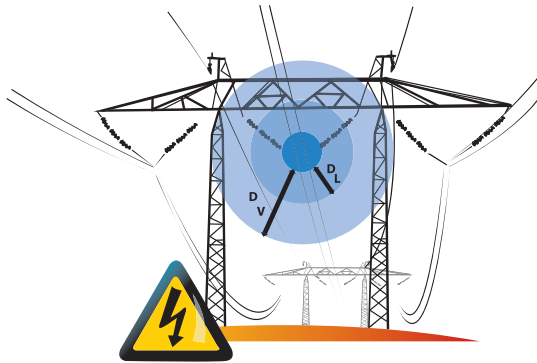


Figure 1. Vicinity zone and live working zone.

Live working zone (D_L)

(Sw. Riskområde)

A space around live parts in which the insulation level to prevent electrical danger is not assured when reaching into or entering it without protective measures.

See figures 1 (above) and 4 (page 13).

Note: If a live part of the installation is not protected by its design or by a special contact protection (including protective screen) the live working zone is as specified in table 1 (page 14).

If an insulator, an insulator chain, a phase conductor, a cable termination or the like, extends outside the live working zone, as shown in the table, the insulated part must, in all its length, be included in the live working zone.

Non-electrical work

(Sw. Icke-elektriskt arbete)

Work near an electrical installation, such as construction work, digging, cleaning, painting and so on.

Operating order

(Sw. Driftorder)

A written order stating measures to be taken for work.

Operation (keeping the installation available)

(Sw. Drift)

Activities to keep an electrical installation energized (live) and accessible.

Operation (operation and maintenance)

(Sw. Skötsel)

All activities, including work activities, necessary to permit the electrical installation to function.

Note: These activities include switching for work, control, monitoring, supervision of the electrical installation, inspection and maintenance.

Both electrical and non-electrical work is included.

Operation measures

(Sw. Skötselåtgärd)

Limited and short-duration measures that can be performed in a safe way with the appropriate equipment.

Ordinary person

(Sw. Lekman)

A person who is neither a skilled person nor an instructed person.

Permit

(Sw. Bevis)

A written message used with one of the working procedures.

Permit-to-work

(Sw. Arbetsbevis)

A document certifying that safety measures have been taken for work at a part of an installation in accordance with one of the working procedures to the extent stated in the permit.

Potential difference

(Sw. *Potentialskillnad*)

A voltage (potential) difference between parts of an electrical installation, between electrical installations or between an installation and earth.

Potential equalisation of a work location

(Sw. *Potentialutjämning av arbetsplats*)

Electrical connection to require voltage equalisation between parts that can get different levels of voltage.

Request for permit-to-work

(Sw. *Arbetsbegäran*)

A request for permission to carry out work at an electrical installation in accordance with one of the working procedures in ESA.

Risk

(Sw. *Risk*)

A combination of the probability and the degree of the possible injury or damage to health of a person exposed to a hazard or to hazards.

Risk management

(Sw. *Riskhantering*)

The co-ordinated activities to control and lead an organization with regard to risk.

Risk management at performance (Risk-Pe)

(Sw. *Riskhantering vid utförande (Risk-U)*)

Risk management carried out at the work location.

Risk management at planning (Risk-Pl)

(Sw. *Riskhantering vid planering (Risk-P)*)

Risk management carried out at the planning of the work activity.

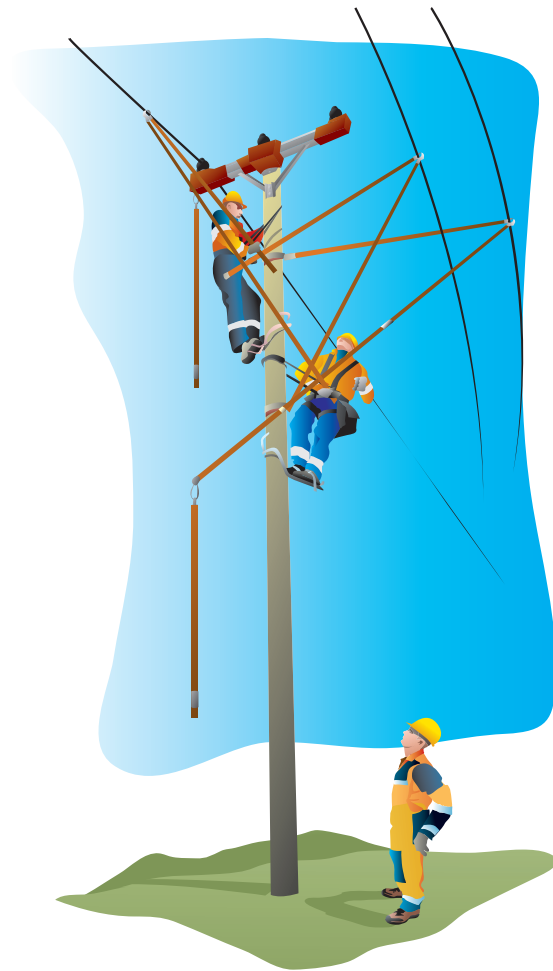


Figure 2. A safety observer at Live working.

Safety distance

(Sw. *Säkerhetsavstånd*)

A distance decided by *elsäkerhetsledare*³ for each work activity with regard to working procedure, tools, equipment, the duration of the work activity and the competence of the workers.

Safety observer

(Sw. *Säkerhetsman*)

A worker that, for live working, is appointed to focus on the personal safety of the workers from a good position at the work location. See figure 2.

³ nominated person in control of a work activity

Screen*(Sw. Avskärmning)*

Any device, which may be insulated or not, which is used to prevent approach to any equipment or part of an electrical installation which presents electrical danger.

See figure 3.

Note: Permanent or not permanent safety device to prevent from entering the live working zone.

Skilled person*(Sw. Fackkunnig person)*

Person with relevant education, knowledge and experience to enable him or her to analyse risks and to avoid hazards which electricity could create.

Supervision*(Sw. Övervakning)*

A safety measure for Working in the vicinity of live parts, where a person is appointed by elsäkerhetsledare³ to observe the positions and working procedures of the workers, with respect to live parts of the installation and to warn the workers when necessary.

Switching*(Sw. Koppling)*

An action that results in a change of the switching status.

Switching area*(Sw. Kopplingsområde)*

An area with defined boundaries to other switching areas.

Switching confirmation*(Sw. Kopplingsbekräftelse)*

Confirmation that an ordered action has been carried out or that a part of the installation has the switching status specified in the confirmation.



Figure 3. Screen with an insulating board.

Switching operator*(Sw. Kopplingsbiträde)*

A person who carries out ordered switchings.

Switching responsibility*(Sw. Kopplingsansvar)*

The responsibility of eldriftledare² or a switching supervisor to perform switching measures within a well-defined switching area.

Switching schedule*(Sw. Kopplingssedel)*

A written directive with measures to be taken for work.

Switching supervisor*(Sw. Kopplingsledare)*

A function or a person who is in charge of switching operations within a specified area.

Note: Only applicable when the switching responsibility is handed over from eldriftledare².

Telefem*(Sw. Telefem)*

A message transmitted by phone, radio or electronically, with the same validity as a written message.

Vicinity zone (D_V)*(Sw. Närområde)*

A limited space outside the live working zone. See figure 4 (page 13).

² nominated person in control of an electrical installation during work activities

³ nominated person in control of a work activity

Voltage

(Sw. *Spänning*)

- ▶ Nominal voltage – the voltage by which a network is known and to which certain operating values are related.
- ▶ Operating voltage – the phase-to-phase voltage that occurs at some point on the network, under normal operating conditions.
- ▶ Highest voltage for equipment – the highest phase-to-phase voltage for which an installation and the equipment are designed, taking into account such factors as insulation. The highest voltage for equipment is the highest operating voltage at which the installation, equipment, etcetera, can be used. It is stated only where the nominal voltage is above 1 kV.
- ▶ Phase-to-phase voltage/system voltage – the voltage between the phases.
- ▶ Phase to neutral voltage – the voltage between phase and earth.
- ▶ High voltage (HV) – nominal voltage over 1000 V alternating current or over 1500 V direct current.
- ▶ Low voltage (LV) – nominal voltage up to and including 1000 V alternating current or up to and including 1500 V direct current.

Voltage detector

(Sw. *Spänningsprovare*)

Portable device used to reliably detect the presence or the absence of the operating voltage and used to verify that the installation is ready for earthing.

Voltage testing

(Sw. *Spänningsprovning*)

Checking that the operating voltage is disconnected.

Work activity

(Sw. *Arbete*)

Any form of electrical or non-electrical work where there is a possibility of an electrical hazard.

Work location

(Sw. *Arbetsplats*)

Site(s), place(s) or area(s) where a work activity is to be, is being, or has been carried out.

Worker

(Sw. *Arbetare*)

All persons who, regardless of their employment status, carry out work under the management of *elsäkerhetsledare*³.

Working area

(Sw. *Arbetsområde*)

An area with one or several work locations where work is carried out.

Working in the vicinity of live parts (ANS)

(Sw. *Arbete nära spänning*)

All work activity in which a worker with part of his or her body, with a tool or with any other object enters into the vicinity zone without encroaching into the live working zone.

Written directive

(Sw. *Skriftlig förebild*)

Documentation for a switching operation. The documentation can take the form of an operating order, switching schedule, diagram or the like, with the actions specified, written down and numbered.

³ nominated person in control of a work activity

4. Terminology and tables

Safety distance, vicinity zone and live working zone

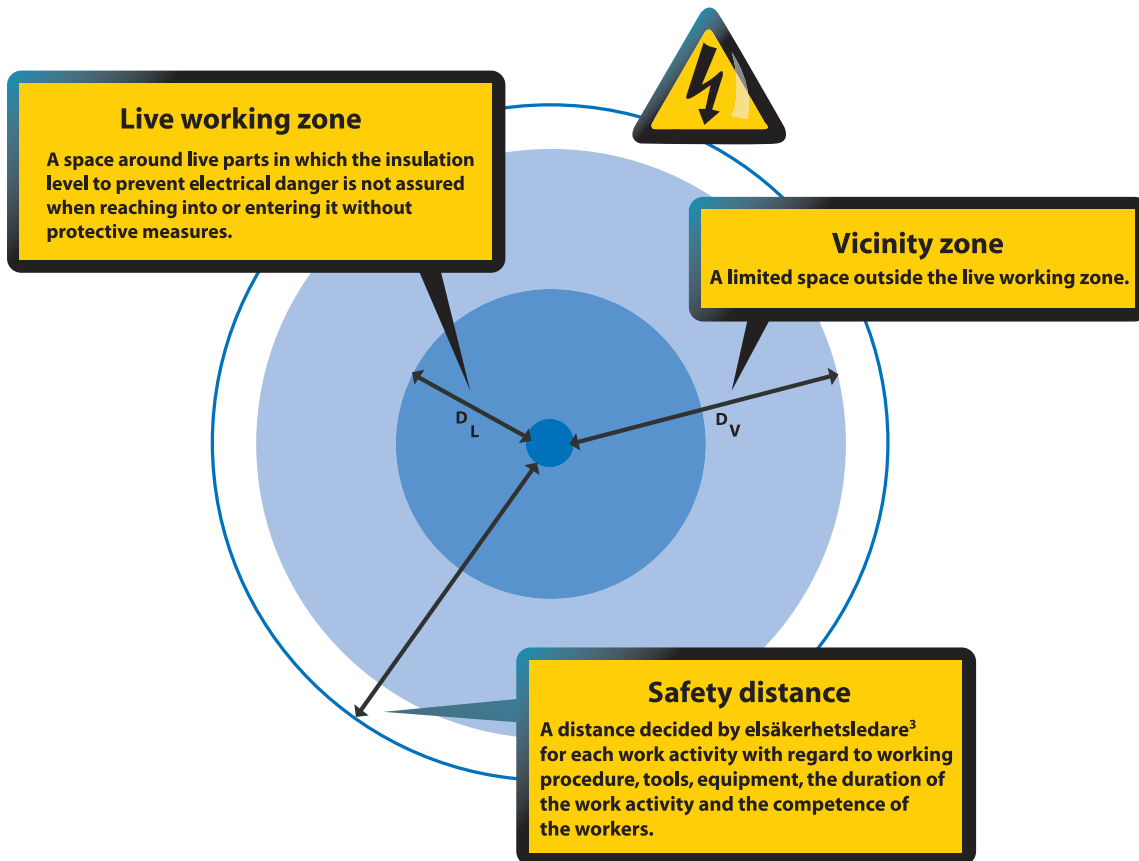


Figure 4. Safety distance, vicinity zone and live working zone.

³ nominated person in control of a work activity

Table 1. Vicinity zone and live working zone.

| Nominal system voltage (U _N kV) | Minimum acceptable distance in air defining the outer limit of the vicinity zone. (D _V mm) | Minimum acceptable distance in air defining the outer limit of the live working zone. (D _L mm) |
|---|---|---|
| ≤ 1 | 300 | no contact |
| 3 | 1120 | 60 |
| 6 | 1120 | 90 |
| 10 | 1150 | 120 |
| 15 | 1160 | 160 |
| 20 | 1220 | 220 |
| 30 | 1320 | 320 |
| 36 | 1380 | 380 |
| 40* | 1430 | 430 |
| 45 | 1480 | 480 |
| 50* | 1530 | 530 |
| 60 | 1630 | 630 |
| 70 | 1750 | 750 |
| 110 | 2000 | 1000 |
| 132 | 3000 | 1100 |
| 150 | 3000 | 1200 |
| 220 | 3000 | 1600 |
| 275 | 4000 | 1900 |
| 380 | 4000 | 2500 |
| 480 | 6100 | 3200 |

**) The standard table from SS-EN 50110 is an informative appendix, supplemented with frequent Swedish voltage levels.*

Up to 70 kV: A wide range of values exists for D_L because ergonomic considerations prevail on the calculation of the electrical component when calculating D_L.

Över 70 kV: The electrical component becomes predominant when calculating the distance.

In the absence of computation methods for DC-systems, the values for distance D_L and D_V for AC-systems could also be used for DC-systems up to 70 kV.

Note: Intermediate values for D_L and D_V may be determined by linear interpolation between the voltage levels respectively.

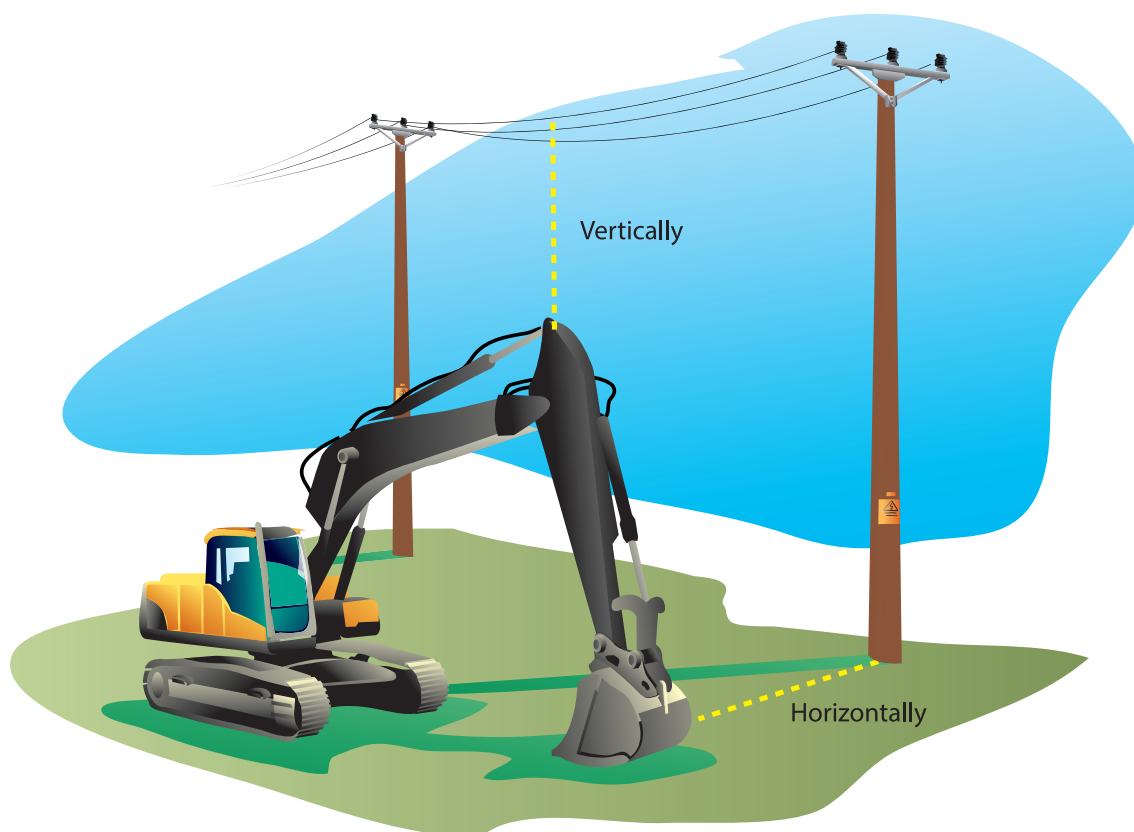


Figure 5. Distance from a part of an electrical installation, not using any working procedure.

Table 2. Safety distance (see figure 5)

Distance from a part of an electrical installation, not using any working procedure.

| Direction | Voltage | Safety distance* |
|--------------|----------|------------------|
| Horizontally | 0,4 kV | ≥ 2 m |
| | 1- 40 kV | ≥ 4 m |
| | >40 kV | ≥ 6 m |
| Vertically | 0,4 kV | ≥ 2 m |
| | >1 kV | ≥ 4 m |
| | 400 kV | $\geq 4,5$ m |

*) If the stated safety distance cannot be held, the work activity must be carried out according to one of the working procedures Dead working, Working in the vicinity of live parts or Live working.

Tabel 3. Terminology

The following terminology must be used when applying ESA:

| Object | Position indication* | | Order expression | |
|--|-----------------------------------|--|------------------------------------|---|
| Circuit-breaker Switch Contactor Disconnecting circuit-breaker | On or 1 | Off or 0 | Close | Open |
| Disconnecter Switch disconnector Fuse-switch-disconnector Fuse-disconnector | Closed or 1 | Open or 0 | Close | Open |
| Safety switch | 1 (= closed) | 0 (= Open) | Close | Open |
| Disconnection by withdrawable unit | Closed or Operating position or 1 | Open or Disconnected position or 0 | Close or Set to operating position | Open or Set to disconnected position |
| Disconnecter with possibility of earthing for work | Operating position or Closed or 1 | Disconnected position or Open or 0 or Earthed position | Set in Operating position or Close | Set in disconnected position or Open or Set in earthed position |
| Earthing switch | Closed or 1 | Open or 0 | Close | Open |
| Earth-circuit devise | Attached | Removed | Attach | Remove |
| Fuse Connecting piece Jumper | Attached | Removed | Attach | Remove |
| Relay protection Automatic system (e.g. anr, far) | Operating | Not operating | Take into operation | Take out of operation |
| Part of an installation | Connected | Disconnected | Connect | Disconnect |
| Blocking | Blocked | Not blocked | Block | Remove blocking |

**) Position indication can also take the form of an automatic change in a single-line diagram of the operational supervision system.*



Elanläggningsansvarig¹ must make sure that the necessary instructions for operating the different devices are available.

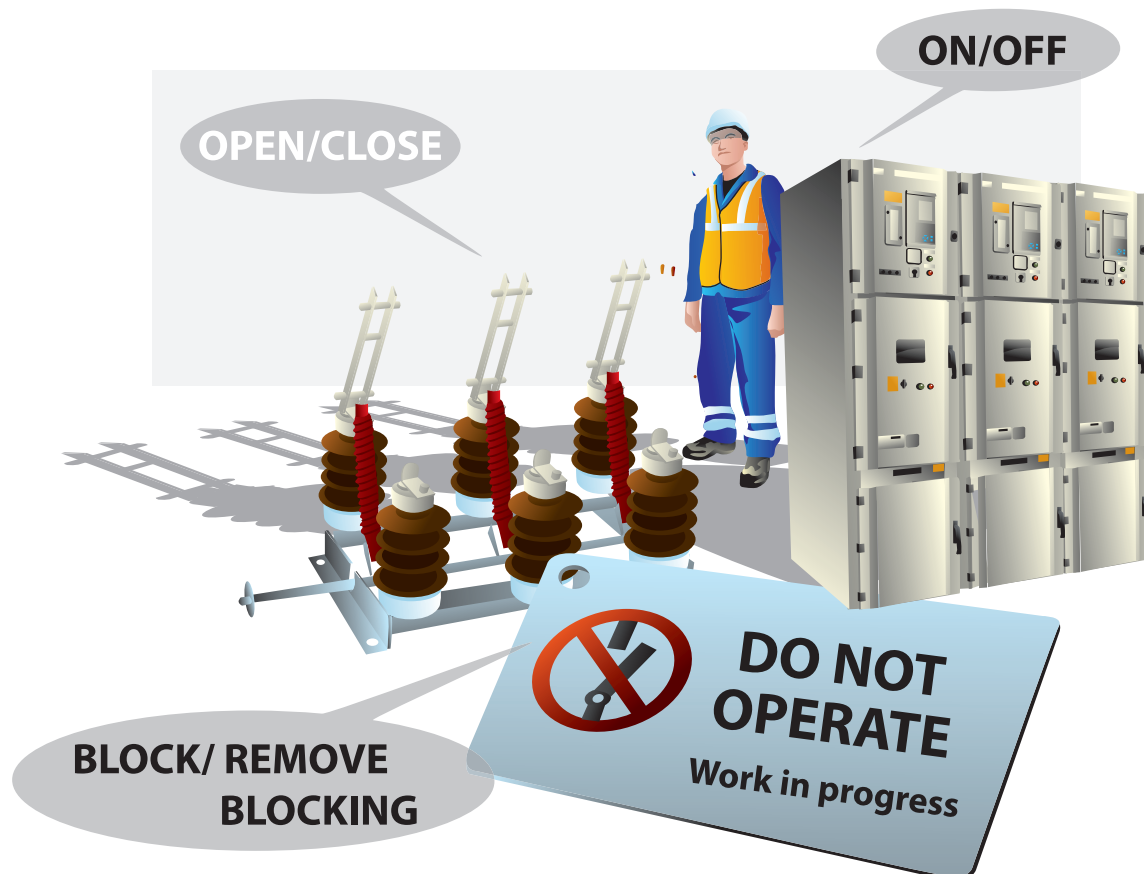


Figure 6. Terminology.

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5. ESA Education and skills

To pursue work, where there is or may occur an electrical hazard, requires that those who lead the work activity, plan the work activity and participate in the work activity must be skilled or instructed and have experience of the tasks. In addition, they must have undergone training that fills the regulatory requirements for competence and received training in first aid for injury caused by electricity.

The length of the course and the content depend on the type of installations the staff are going to work at. It is important to ensure the required level of knowledge and experience for each task.

Teacher

The ESA-training must be carried out by a teacher who has undergone teacher training *approved by Swedenergy AB* and who has a valid course certificate. In order to pursue the training, knowledge and skills must be maintained by practice and ongoing refresher training.

Student

The length of the course and the content depends on task, working procedure and type of installation.

For engaging in work activities, you must have the appropriate training and knowledge and skills. These must be maintained by practice and ongoing refresher training.

Refresher training must take place at least every three years.

Course certificates must describe the content of the training.

Those who have not regularly been engaged in work, should undergo new training to ensure the right competence.

6. ESA functions

General

The *Electrical Safety Instructions*, ESA, have been written in order to make it possible to perform a work activity or an operation measure in a safe way. Everyone involved in work activities must contribute to measures needed to achieve a good work environment.

Organization

For the safe management of each installation, there must be elanläggningsansvarig¹, who has the task to establish operating procedures for safe operation and decide on rules. Elanläggningsansvarig¹ also has the task to establish routines for how different functions in the organization will be allocated.

The task of eldriftledare² is to plan and supervise the operation, draw up operational orders, among other things, in a defined switching area. Eldriftledare² is also responsible for the safe operation of the electrical installation during the ongoing work activities.

Elanläggningsansvarig¹ can himself or herself act as eldriftledare² or delegate this task to others in his or her own organization or in an external organization. The delegation must be documented in writing, timed and indicate which section of the installation that is included. Support functions can be allocated to assist both elanläggningsansvarig¹ and eldriftledare² with various tasks.

The place of eldriftledare² in the organization varies - it can, for example, be dependent on the company's operation or organization.

If necessary, eldriftledare² can forward switching responsibility to a designated switching supervisor according to given instructions. The switching supervisor is responsible for the switchings in the whole, or a section of, eldriftledare² switching area. Forwarded switching responsibility must be in writing and well-defined.

If eldriftledare² or a switching supervisor needs help to perform certain switchings, for example, because of geographical distance, a switching operator can be ordered to perform certain switchings. Rules for the training and competence of the switching operator must be determined by elanläggningsansvarig¹, in consultation with the employer.

One person may hold several functions.

1 person responsible for an electrical installation

2 nominated person in control of an electrical installation during work activities

The employer shall, for each work activity, nominate a person responsible for electrical safety, *elsäkerhetsledare*³. The employer can appoint support functions that may e.g. nominate *elsäkerhetsledare*³.

In the following the person referred to is either a named person or a person that can be named by help of a, for each time-period, current guard list, preparedness list, shift schedule or the like.

*Elsäkerhetsledare*³ must, with the necessary skills and competence, lead the electrical safety work at the work location.

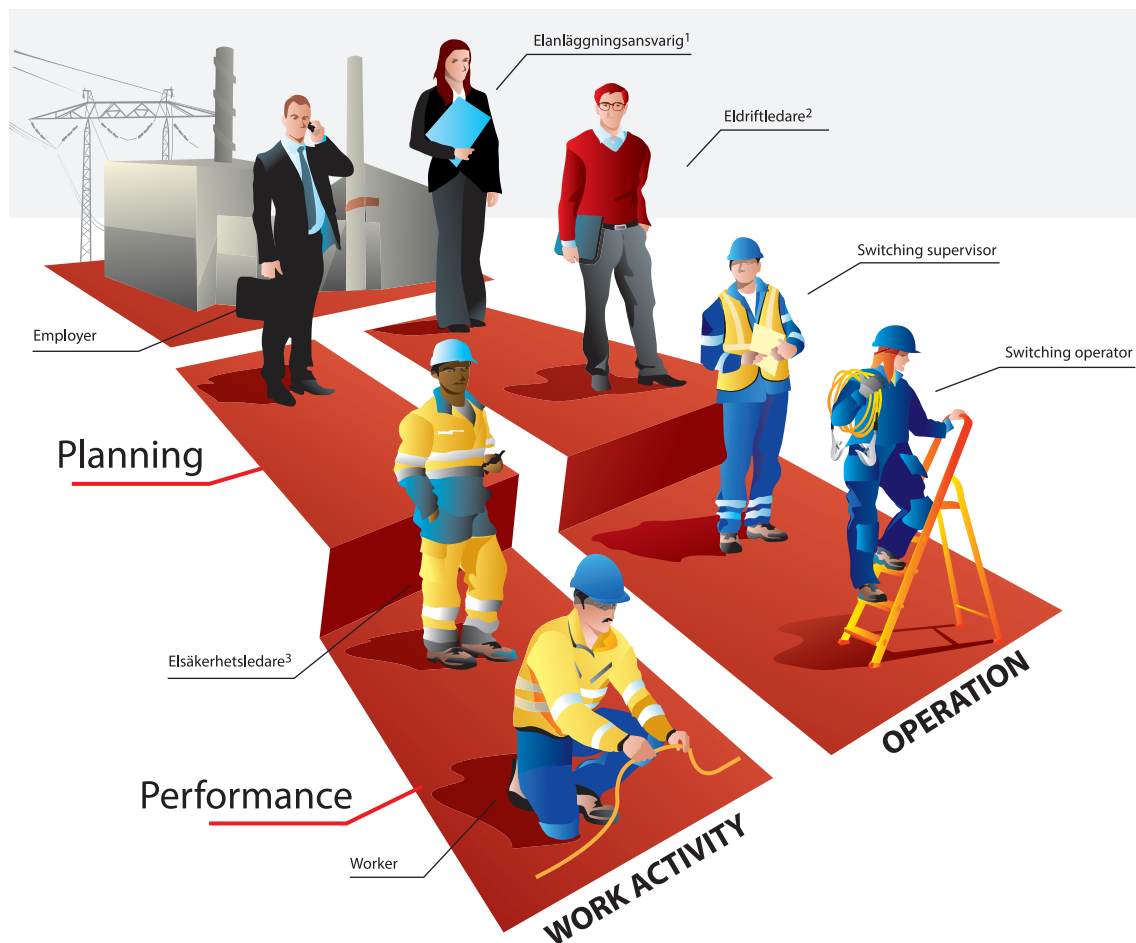


Figure 7. Organization according to ESA.

- 1 person responsible for an electrical installation
- 2 nominated person in control of an electrical installation during work activities
- 3 nominated person in control of a work activity

Elanläggningsansvarig¹

Every electrical installation must have an appointed person in charge, elanläggningsansvarig¹.

Elanläggningsansvarig¹ has the overall responsibility to ensure the safe operation of the electrical installation by making decisions on rules, organization and operational procedures.

Elanläggningsansvarig¹ must, among other things:

- ▶ issue instructions (for example operating instructions) for the safe operation of the installation both at normal operation, work and at disturbances.
- ▶ establish procedures for the maintenance and maintenance plans.
- ▶ issue instructions for appointing eldriftledare², switching supervisor and switching operator.
- ▶ establish routines for switching areas.
- ▶ establish routines for how and when the request for permit-to-work must be applied.
- ▶ establish routines for how the operation orders and the switching schedule must be used and designed.
- ▶ if necessary, issue local guidelines for testing and commissioning.
- ▶ if necessary, cooperate with other elanläggningsansvarig¹ at installations connected to each other. This should be documented in writing.
- ▶ define access rules to the installations.

Eldriftledare²

For every work activity, and according to instruction, an appointed eldriftledare² must plan and be responsible for the safe operation of the installation.

Eldriftledare² must, among other things:

- ▶ perform risk management.
- ▶ receive request for permit-to-work.
- ▶ plan switchings.
- ▶ if necessary, appoint a switching supervisor and hand over switching responsibility to the switching supervisor.
- ▶ if necessary, take back the switching responsibility.
- ▶ appoint a switching operator.
- ▶ order the switching operator to perform switching.

1 person responsible for an electrical installation

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- ▶ draw up an operating order.
- ▶ draw up a switching schedule.
- ▶ receive confirmation of received operation order.
- ▶ make certain that the measures in the operating order and the switching schedule are carried out.
- ▶ exchange switching confirmation.
- ▶ submit a permit-to-work.
- ▶ receive a certificate of commissioning.
- ▶ notify those concerned about changes in the operating order.



It is not possible to give or take back switching responsibility at an installation where a permit-to-work already has been exchanged.

Switching supervisor

At certain times and in accordance with established routines eldriftledare² can hand over the switching responsibility for all or a section of his or her switching area to a switching supervisor. If necessary, eldriftledare² can take back a given switching responsibility from a switching supervisor. Exchange of permit, when a switching responsibility has been handed over, must be in writing and be well-defined.

The switching supervisor must, among other things:

- ▶ receive the switching responsibility that has been handed over.
- ▶ make certain that the operation order or switching schedule is at hand.
- ▶ perform risk management.
- ▶ if necessary, appoint and instruct a switching operator to perform switching.
- ▶ receive confirmation of the received operation order.
- ▶ make certain that the measures in the operating order and switching schedule or test program are carried out.
- ▶ obtain switching confirmation.
- ▶ submit a permit-to-work.
- ▶ receive a certificate of commissioning.
- ▶ give the switching responsibility back to eldriftledare².

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Switching operator

It is only the holder of the switching responsibility that can appoint a switching operator.

The switching operator must, among other things:

- ▶ perform risk management before switching.
- ▶ check and verify, where applicable, the received operation order.
- ▶ have knowledge about the function of the devices in order to carry out switching.
- ▶ perform orders given by the holder of switching responsibility.
- ▶ hand over switching confirmation to the holder of switching responsibility.

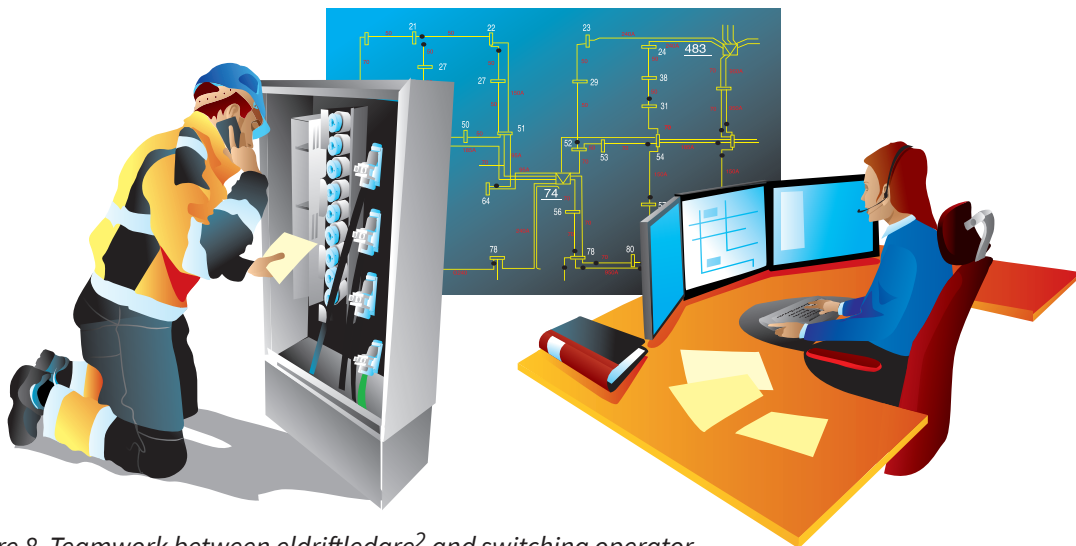


Figure 8. Teamwork between eldriftledare² and switching operator.

Employer

Planning and risk management of the work activity must be performed by the employer or by the persons within the organization that the employer has delegated it to in writing.

It is the employer's duty, among other things, to:

- ▶ perform risk management for planning (Risk-PI).
- ▶ ensure that the employee has the knowledge and skills needed for the work activity.
- ▶ nominate elsäkerhetsledare³.
- ▶ provide appropriate personal protective equipment and ensure that it is used.
- ▶ take all necessary measures to prevent that the employee is exposed to ill-health or accidents.
- ▶ regularly investigate working conditions and assess the risks of any person being affected by ill-health or accidents at work.
- ▶ be responsible for the request for permit-to-work.
- ▶ ensure the flow of information, such as routine for providing operation orders in a timely manner, or who can be appointed switching operator.

² nominated person in control of an electrical installation during work activities

³ nominated person in control of a work activity

Elsäkerhetsledare³

The employer must for each work activity appoint a person responsible for the electrical safety — elsäkerhetsledare³ — with the competence necessary to direct the electrical safety at the work activity and with the authority to undertake the necessary actions.

This means that the person appointed elsäkerhetsledare³ must have knowledge of the dangers of electricity, knowledge of the actual work location, and knowledge of the work activity to be carried out.

Elsäkerhetsledare³ must:

- ▶ have the authority and competence for the tasks.
- ▶ perform risk management (Risk-Pe).
- ▶ make certain that all workers have the skills and competence needed for the task.
- ▶ make certain that there are relevant and clear instructions.
- ▶ make certain that the work activity has been planned so that it can be carried out safely.
- ▶ request clarification from the holder of switching responsibility or the employer if anything is unclear or else stop the work activity.
- ▶ verify and confirm, where applicable, the received operation order and, if anything is unclear, ask for clarification.
- ▶ receive a permit-to-work.
- ▶ assess and manage remaining risks, if any.
- ▶ determine the safety distance.
- ▶ put in place supplementary safety measures such as earthing for work, potential equalization of the work location, safety barriers at the work location.
- ▶ go through risk management and instruct the workers about the safety measures taken, working area and other things.
- ▶ appoint a person for supervision, close supervision and a safety observer.
- ▶ give workers permission to start working.
- ▶ remain at or close to the work location.
- ▶ order the removal of safety measures during and after work.
- ▶ inform workers about the completion of the work activity.
- ▶ submit a certificate of commissioning to the holder of switching responsibility when the work activity is completed, if a permit-to-work exists.
- ▶ where appropriate, return the permit-to-work to the holder of switching responsibility.
- ▶ make certain who holds the switching responsibility and cooperate with him or her.

3 nominated person in control of a work activity

If the appointed elsäkerhetsledare³ does not feel he or she has sufficient skills, or cannot remain at or close to the work location, he or she must hand over his or her duties, after consultation with the employer and the workers concerned. If a permit-to-work has been submitted it must be returned to the switching responsible person and, if necessary, with additional information on changes in the operating setup.

The employer must appoint a new elsäkerhetsledare³ and notify the functions concerned such as eldriftledare², switching supervisor and workers. A work activity can be performed by elsäkerhetsledare³, or with the help of one or more workers.

Electrical coordinating manager

If the work activity is divided into several work locations, the employer may designate an electrical coordinating manager for a defined working area. The task of the electrical coordinating manager is to coordinate elsäkerhetsledare³ at each work location. At work of such magnitude that an electrical coordinating manager needs to be appointed, this must be documented in writing in a local instruction submitted by the employer in consultation with elanläggningsansvarig¹.

In cases where the electrical coordinating manager is unable to fulfill his or her duties, a new electrical coordinating manager must be appointed.

Worker

All persons who, regardless of their employment status, carry out work under the management of elsäkerhetsledare³.

Duties of a worker:

- ▶ make sure that he or she knows who elsäkerhetsledare³ at the work location is.
- ▶ participate in the risk management.
- ▶ not start the work activity until instructed to do so by elsäkerhetsledare³.
- ▶ follow the guidance and instructions given.
- ▶ use the safety devices, personal protective equipment and, in all other respects, take such care as is needed to prevent ill-health and accidents.
- ▶ ask elsäkerhetsledare³ for clarification if anything is unclear.
- ▶ take part in the work activity and in carrying out of the measures needed to achieve a good work environment.

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7. Planning work activities

A prerequisite for work to be carried out in a safe and secure manner is that all actions are carefully planned in good time in all phases of the process. When work is to be carried out at or near an electrical installation, several players may be involved.

In order to define the various roles and the boundaries of the assignments, it is appropriate to set these out clearly in a document, which also includes individuals to contact.

In order to achieve satisfactory safety at the work location, all communication must take place in a language that is understood by everyone involved.

Risk management

Risk management means coordinated activities to direct and lead an organization with regard to risk. This applies at all levels, from the overall planning to work planning and action.

Risk management must be carried out in writing.



Figure 9. Risk management at planning and performance.

In ESA risk management is divided into risk assessment and risk treatment as a way to ensure that the operation measures and work activities can be performed safely at electrical installations.

Risk treatment may lead to finding other risks. After completing the risk treatment a new risk assessment must be carried out, leading to a decision if and how a task can be carried out.

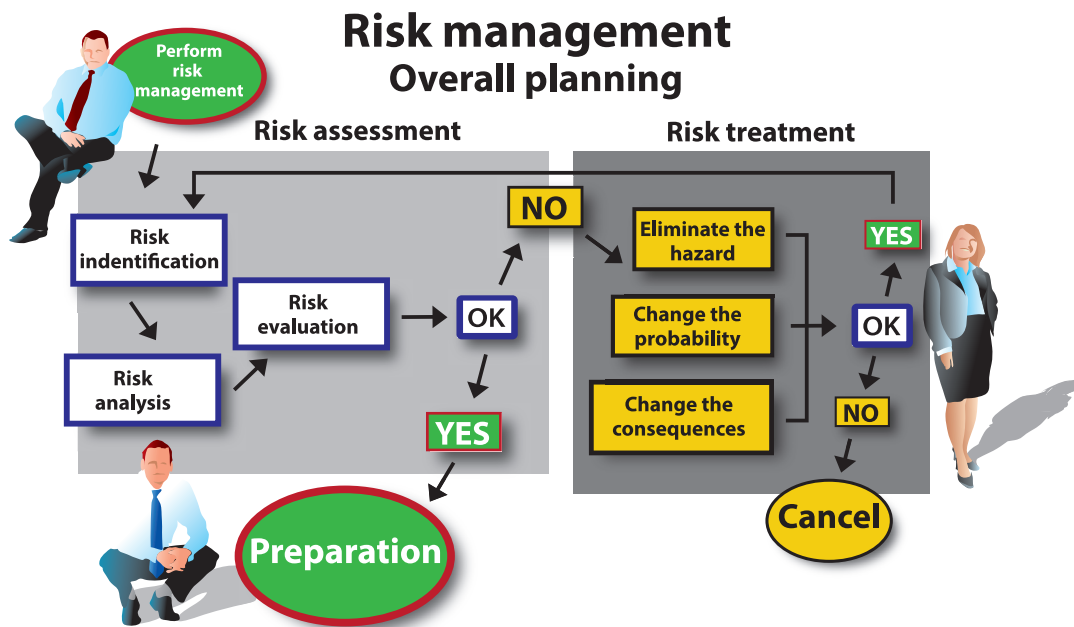


Figure 10. Risk management at the overall planning (Risk-Pl).

Below the main concepts used in the risk management standard SS-ISO 31000 are briefly presented.

Risk assessment

Risk assessment is the overall process of risk identification, risk analysis and risk evaluation.

Risk identification

In brief, risk identification means to identify (controllable or uncontrollable) hazards and areas that may be affected, events and their causes and potential consequences.

The inventory should be written down in form of a list.

Risk analysis

The risk analysis is about understanding the risks identified and provide the basis for whether the risks need to be acted on or not. The risk analysis may be performed in a varying degree depending on the risk.

Risk assessment

The risk assessment should provide support for decision making, based on the outcome of the risk analysis. Decisions should be taken in accordance with laws, regulations and other requirements. A risk assessment may also lead to the need for additional analyzes to be carried out.

Risk treatment

Risk treatment includes selecting one or more options to modify the risks, and to implement the chosen ones. Some key elements to assess and consider are the possibilities to:

- ▶ eliminate the hazard.
- ▶ alter the probability that something will occur.
- ▶ alter the consequences if something should happen.

Risk treatment may lead to other risks and, after the completion of the risk treatment, a new risk assessment must be performed, leading to a decision whether a task can be carried out or not.

Tools, equipment and devices

Tools, equipment and devices must meet the requirements of applicable Swedish standards, where these exist. The employer is responsible for providing the necessary tools, equipment and devices.

Example of tools, equipment and devices are:

- ▶ insulating shoes and gloves.
- ▶ eye or face protection.
- ▶ head protection.
- ▶ suitable and approved protective clothing.
- ▶ insulating mats, platforms and scaffolding.
- ▶ insulating flexible and rigid materials for protective screen.
- ▶ isolated and insulating hybrid tools.
- ▶ operating rods.
- ▶ locks, notices and signs.

- ▶ voltage detectors and voltage indicating systems.
- ▶ cable tracing equipment.
- ▶ earthing, short-circuit and potential equalization equipment.
- ▶ screens, flags and other marking aids.

Tools, equipment and devices must be used in accordance with the instructions for use provided by the manufacturer or supplier.

Tools, equipment and devices for the safe operation of electrical installations, must be suitable for the purpose, must be kept in good condition and must be used as intended.

There must be instructions which describe how to keep tools, equipment and devices in good condition and how to check them before starting work (visual inspection).

Electrical insulation strength checks must be documented.

Damaged tools, equipment and devices must be replaced.

Written directive

At switching there must be a written directive, for example a switching schedule, an operating order or other written directive.

If the risk management permits, a written directive can be omitted for low-voltage installations, for example if there is no risk of mix-up.

Request for permit-to-work

A request for permit-to-work must be made in writing to eldriftledare², in good time before the planned work activity. A suitable design and time planning must be set by elanläggningsansvarig¹.

The employer is responsible for drawing up a request for permit-to-work and that it is sent to eldriftledare² in question. If safety-related uncertainties or changes arise, a new written request for permit-to-work must be submitted.

At an installation where the switching responsibility is handed over, the switching supervisor decides if and when a written request for permit-to-work is needed.

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A request for permit-to-work must, among other things, contain details of:

- ▶ the part or parts of the installation affected by the work activity.
- ▶ the name, company, address, phone number and e-mail address of the person who submitted the request for permit-to-work.
- ▶ the boundaries of the work location. A sketch, diagram or map should be attached.
- ▶ the scope of work and working procedure, date requested for the work activity and the working hours required.
- ▶ the conditions under which the work activity can be carried out.
- ▶ the contact information and communication channels.
- ▶ any changes to the switching configuration / switching possibilities / relay functions after the work activity is completed.
- ▶ the request to take the automatic reclosing system out of operation.
- ▶ the necessary tests or inspections before and after commissioning.
- ▶ the commissioning plan, where one is needed.
- ▶ the risk assessment concerning adjacent live parts.
- ▶ the name of elsäkerhetsledare³ and contact information.

Example of request for a permit-to-work, see *appendix 1*.

Operating order

Operating orders must always be made when eldriftledare² from more than one organization are involved.

Moreover, operating orders must be made according to the issued instructions of elanläggningsansvarig¹.

Eldriftledare² and the employer must ensure that the personnel concerned is informed about the operating order in good time.

The persons that have been informed to act on the operating order must be given the opportunity to go through the operating order before any actions must be taken. Elanläggningsansvarig¹ must establish procedures for information.

Before an operating order is issued, it must be checked and signed by another person with the required competence.

An operating order can consist of written points of order, marking on a diagram and so on and must be drawn up in advance.

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Individuals who have received an operating order “to be acted on” must:

- ▶ read it through and check the relevant parts of it.
- ▶ ask for an explanation or a written notification of change if anything appears to be unclear.
- ▶ confirm that the operating order has been received.
- ▶ follow the operating order in all points and in the written sequence specified in the operating order.
- ▶ take actions in the sequence that the operating order is written.

A new operating order should be issued in the following cases:

- ▶ when need for new switchings, for example a change of boundaries.
- ▶ when extensive changes have been made (for example, several cancellations / additional points).
- ▶ when there are errors in the operating order.

An operating order must contain information on:

- ▶ who issued the operating order (person, company, and phone number).
- ▶ who should receive the operating order.
- ▶ who has checked the operating order.
- ▶ eldriftledare² in question or the switching responsible person.
- ▶ if need of an electrical coordinating manager, contact details of that person should be available.
- ▶ the parts of the installation, including boundaries, that are included in the work activity.
- ▶ the scope of work and working procedure.
- ▶ duration of the outage and the working hours, day, date and clock time.
- ▶ who elsäkerhetsledare³ is (are).
- ▶ the preconditions that must be met before the switching operations can begin.

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▶ numbered actions, normally with one action under each point:

- ▷ voltage regulation, if any.
- ▷ switching.
- ▷ blocking.
- ▷ earthing for work, if any.
- ▷ if the automatic reclosing system must be out of operation.
- ▷ permit-to-work.
- ▷ certificate of commissioning.
- ▷ tests.

The current diagram and any diagram changes must be attached to the operating order.

The operating order and switching schedule must be based on maps, operating diagrams or similar.

Information that will make work easier for the personnel concerned, should be given under the “General” heading of the operating order, stating, for example:

- ▶ diagram changes.
- ▶ announcement and notification of the outage.
- ▶ production limitations.
- ▶ if the installation is subject to hazardous induction and influence from lines running parallel.
- ▶ contact channels.

Conditions, that must be met for the switching operations to be carried out, are to be stated under the heading “Preconditions” in the operating order and are, for example:

- ▶ lightning warnings that affect the execution of the operating order.
- ▶ operating setup that must exist before the switching operation is allowed to begin.
- ▶ actions that must have been completed in accordance with another operating order or switching schedule.

Note: Actions involving switching operations, blockings or confirmations must not be listed under “Preconditions”.

Permits can be inserted in the operating order.

An action point in an operation order may consist of more than one manual operation on a device. These manual operations must be clearly described in a local instruction.

A local instruction can be:

- ▶ a written text.
- ▶ selected points in a written text.
- ▶ labelling on a device which explains how to operate it step-by-step in order to carry out the point.

Example of an operation order, see *appendix 2*.

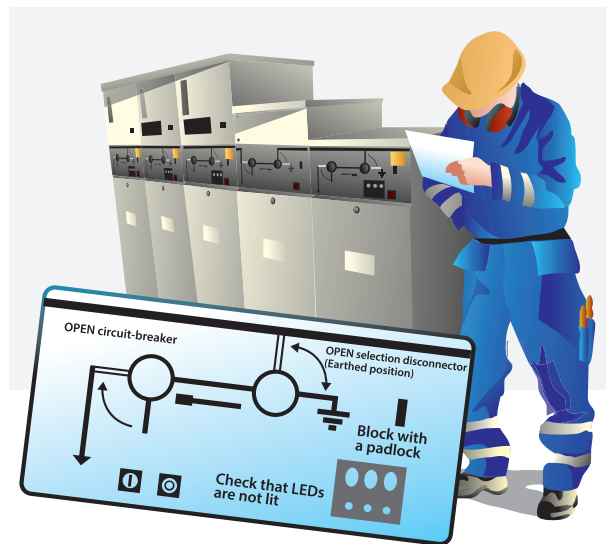


Figure 11. Example of switchgear with a selection disconnect.

Switching schedule

A switching schedule should be drawn up when there is no operation order. A switching schedule should be checked and signed by another person with the required competence.

It is important to use a written directive in the event of disturbances or operational reorganisations. This is then suitably transferred by teleferm. Switching schedules may take the form of written instructions drawn up in advance.

A switching schedule must state:

- ▶ who drew it up.
- ▶ which parts of the installation are covered by the work activity, including boundaries.
- ▶ numbered actions, normally with one action under each point.

Example of a switching schedule, see *appendix 3*

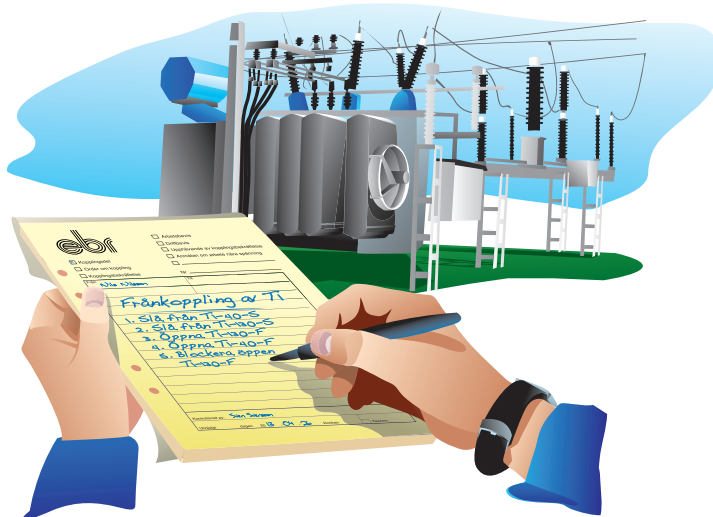


Figure 12. Example of a switching schedule.

Switching confirmation

According to the definition, a switching confirmation is a confirmation that one or more ordered actions have been carried out or that parts of the installation are in the specified switching status.

A written switching confirmation must be submitted on switching that is the basis of safety for work:

- ▶ when a disconnecter has been blocked.
- ▶ when a withdrawable unit (truck) has been blocked in the disconnected position.
- ▶ when fuses and connecting pieces have been removed and blocked.
- ▶ when jumpers have been removed for work and have been secured.
- ▶ when earthing for work has been attached.
- ▶ when the automatic reclosing system (ar, far, dar or anr) is out of operation locally.
- ▶ when switching is carried out between different switching areas.

Apart from the above, switching confirmation can be verbal.

A written switching confirmation means that the switching status must be maintained until the confirmation is cancelled in writing. A switching confirmation within the switching area can also be cancelled by a written order for new switching.

The switching operator is responsible for that the content of the switching confirmation corresponds with the actions taken.

Example of a switching confirmation, see *appendix 4*.

Exchange of permit

Responsibility for the exchange of permit at switching and at work lies with the person who has the switching responsibility, *elsäkerhetsledare*³ and *eldriftledare*² (at delegated switching responsibility, the switching supervisor).

Message transmission - telefem

Message transmitted by telephone, radio or electronically.

Verbal communication

A message transferred by telephone or radio must be written down and dictated by the sender and must be written down and read back by the recipient.

Fax

A written message. The content must be confirmed.

Electronic communication

A message transmitted by data communication, SMS, SDS, etcetera has the same validity as a written message. The content must be confirmed.



Figure 13. Example of a switching order, telefem.

Permit-to-work

The person who has the switching responsibility submits a permit-to-work and is responsible for that the content of the permit-to-work corresponds to the actions taken. A permit-to-work is always given to *elsäkerhetsledare*³.

The permit-to-work is a confirmation that safety measures have been taken for *Dead working*, *Work in the vicinity of live parts* or *Live working* on a part of the installation to the extent stated in the permit.

The permit-to-work means that the measures will remain in place until the certificate of commissioning has been submitted by *elsäkerhetsledare*³.

A permit-to-work must be in writing.

A permit-to-work is not required when *elsäkerhetsledare*³ and the switching supervisor is one and the same.

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Permit-to-work must state:

- ▶ who issued it.
- ▶ who received it.
- ▶ which parts of the installation are covered by the permit-to-work including boundaries.
- ▶ measures, if any, against hazardous induction from parallel-running lines.
- ▶ earthing for work that has been attached, if any.

Example of a permit-to-work, see *appendix 5*.

Certificate of commissioning

A certificate of commissioning must be submitted to the person responsible for the switching by the holder of the permit-to-work.

A certificate of commissioning confirms that, as far as the person issuing the certificate is concerned, the part of the installation in question is ready for operation with the changes stated in the certificate.

A certificate of commissioning must state:

- ▶ who submitted the certificate of commissioning.
- ▶ which parts of the installation are covered by the certificate.
- ▶ any changes to the installation and its switching status.
- ▶ switching status of equipment operated during the work activity.

Example of a certificate of commissioning, see *appendix 6*.

Return of permit-to-work

If *elsäkerhetsledare*³ no longer can be responsible for the electrical safety at the work location, or when an electrical installation is demolished or dismantled, he or she can, where appropriate, return the permit-to-work to the holder of switching responsibility with information on cause and/or changes, if any, that may apply to the electrical installation.

Where appropriate, the employer must appoint a new *elsäkerhetsledare*³ who then receives a permit-to-work according to standard practice. The employer must notify *eldriftledare*² about the new *elsäkerhetsledare*³.

Re-energizing

The switching responsible person deals with re-energizing after receiving all certificates of commissioning that correspond to the issued permits-to-work.

The commissioning of a new part of an installation and demolition or dismantling must be carried out in accordance with directives issued by *elanläggningsansvarig*¹.

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8. Contractor work

Contracts – procurement

It is important to create good basic conditions for safety at the work location. Clear demands must therefore be imposed on the contractor at the procurement stage.

A number of points which affect electrical safety and which should be taken into consideration at the procurement stage are listed below.

The contractor must:

- ▶ have sufficient experience of similar work.
- ▶ make sure that his or her own personnel have good competence and have undergone the necessary electrical safety training.
- ▶ have a suitable organization for the assignment.
- ▶ use documented working procedures and instructions.
- ▶ communicate in a language specified in the contract.
- ▶ have a clear definition of his or her assignment.

Contractor

The contractor is responsible for the management of his or her own personnel.

Because of the great responsibility borne by the proprietor of electrical installations, it is necessary, from the point of view of safety, that the proprietor strictly regulates his or her relations with the contractor.

Hired manpower is a person or persons made available by another employer to carry out work under the management of the person who hired him, her or them.

Note: It is important not to mix up contractor with hired manpower.

Contractor with skilled personnel/person

A company which is regarded to have personnel that meets all the requirements listed below for the contract in question:

- ▶ the necessary electrical training for the work activity.
- ▶ training and competence of the safety instructions according to the *Swedish National Electrical Safety Board* and ESA.
- ▶ experience of work at an electrical installation.
- ▶ knowledge of the type of electrical installation at which the contract is to be carried out.
- ▶ knowledge of the risks that may arise during the work activity and the safety measures that must be put in place.

Contractor with instructed personnel/person

A company, which is regarded not meeting all the requirements under the heading “Contractor with skilled personnel/person” above.

An instructed person must have training and competence in relevant parts of ESA and be given instructions on the installation in question and the risks that exist for the task.



Figure 14. Example of an instructed person.

9. Operating measures

General

Operating measures are switching operations, fuse changes, measurements, tests, troubleshooting, inspections and other similar actions that can be carried out safely and with the adequate equipment.

Operating measures must be carried out in agreement with eldriftledare² in order to see if the measures can be carried out safely under the existing circumstances.

A risk management must always be carried out before starting any operating measures



If the operating measures cannot be carried out in a safe way, and there is a risk of anyone coming within the live working zone, they must be planned and carried out according to one of the working procedures *Dead working*, *Work in the vicinity of live parts* or *Live working*.

Switching

Switching is one or more actions that result in a change of switching status or the attachment or the removal of earthing for work.

Switching must be done with the equipment that provides a satisfactory safety for the person carrying out the switching.

The person who carries out switching or who checks a switching status in an installation must:

- ▶ have the knowledge of the installation and equipment that is necessary in order to be able to perform the action.
- ▶ have performed risk management.
- ▶ use a written directive.
- ▶ inform the individuals in question that switching is about to take place.
- ▶ carry out actions at a direct order and in the sequence stated in the written directive.
- ▶ check that the intended switching status has been reached.

Switching order

A switching order must be given by the person with switching responsibility. Example of a switching order, if there is no operating order, is shown in *appendix 7*.

Switching with a disconnecter

Switching with a disconnecter can be carried out with the system dead, or energized and with no load. This depends entirely on the rated data of the device. There must be an instruction stating how the device may be operated.

A disconnecter must have a visible break or a reliable position indicator. When the device has been operated for work, it must be blocked to prevent unintentional operation.

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Switching with a switch disconnector, a fuse-switch-disconnector

Switching with a switch disconnector or a fuse-switch-disconnector can be carried out with the system energized and with load. This depends entirely on the rated data of the device. There must be an instruction stating how the device may be operated.

Switching with a withdrawable unit

Switching with a withdrawable unit is carried out under disconnected or open conditions. When the device has been operated for work, it must be blocked to prevent unintentional operation.

Switching with a fuse up to and including 1 kV

Switching with single-pole blade fuses must be carried out under no-load conditions and with a standardised fuse puller device that fills the required standard. Both blade fuses and plug-type fuses must be completely removed.

The plug-fuse cap must be screwed back and blocked (and a sign put up) or replaced with a blocking device with a sign.



Figure 15. Example of switching in a cable compartment.

Switching with a fuse over 1 kV

Operating with a fuse must be carried out with adequate equipment.

The operation is normally carried out under de-energized conditions.

Operation can be carried out with the system energized but with no load if the installation is designed so that it can be carried out in a safe way.

After the device has been operated for work, the device or the compartment must be blocked and a sign put up to prevent unintentional operation.

Switching by using a jumper wire etcetera

Switching must be carried out by removing and connecting a jumper wire, connecting clamp, connecting piece etcetera, with the equipment de-energized. Switching can also be carried out according to the working procedures *Dead working* or *Live working*.

A jumper wire must be secured after switching.

A local instruction may be needed for this type of installation, with a system voltage over 1 kV.

Switching with a touch-protected connector (shielded cable termination)

Switching must be carried out according to the applicable instruction.

This type of switching is intended for not directly earthed grids, maximum 36 kV.



Figure 16. Touch-protected connector.

Connecting terminal in a cable cabinet not more than 1 kV

Connecting terminal in a cable cabinet, with a system voltage of not more than 1kV, with degree of protection IP20, may be attached or removed under no-load conditions.

Switching with a disconnecting circuit-breaker

Switching with a disconnecting circuit-breaker, that is a switching device with adequate isolating distance and without visual break, may be carried out with load. A disconnecting circuit-breaker must have a reliable positioning indication. There must be an instruction stating how the device may be operated.

Blocking can be carried out either by fitting a latch, either manually on the switching device or by remote operation of a mechanical blocking device fitted with a sign, whereby all operation of the switching device must be prevented. In the case of blocking by remote control, an indication must appear at all locations from which operation is possible.

A malfunctioning disconnecting circuit-breaker or one that has a low gas pressure must be operated as a point of disconnection without adequate isolating distance.

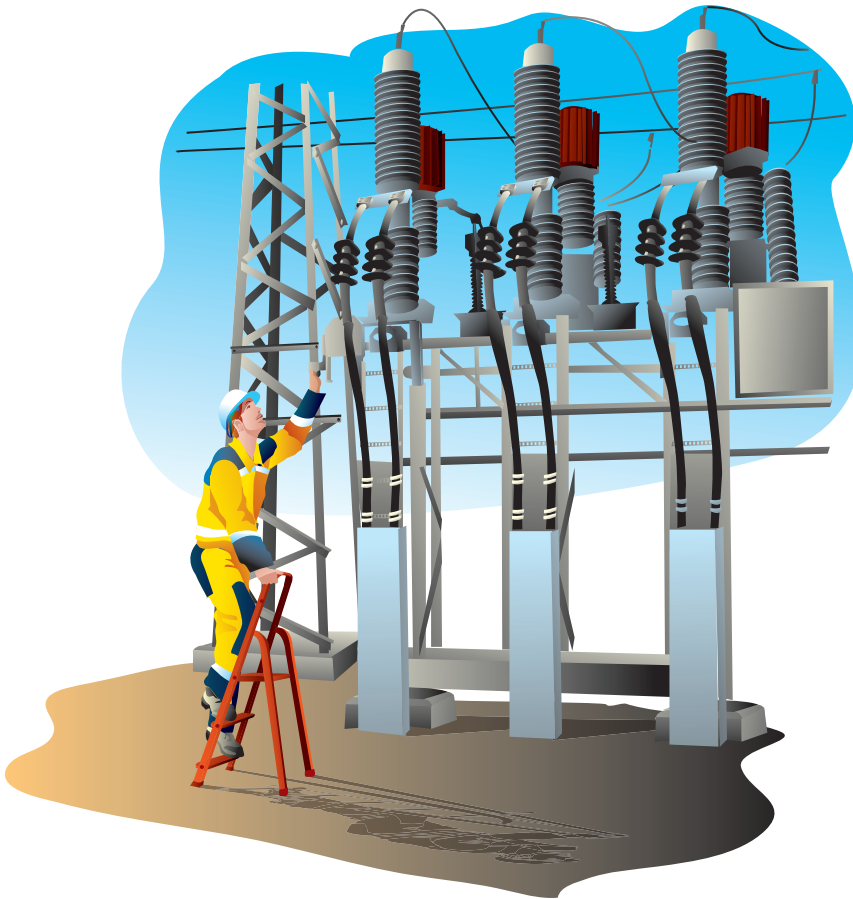


Figure 17. Blocking of a disconnecting circuit-breaker.

Measurement

The basis of safety when making measurements in heavy-current circuits is thorough planning, the right measuring equipment and good knowledge of the measurement procedure by the person who plans and/or carries out the measurements.



Figure 18. Voltage measuring in a low-voltage installation.

Before connecting measuring instruments and aids, they must be checked to ensure that:

- ▶ they are approved by the employer for the measurement in question.
- ▶ instruments and test leads are complete, dry, clean and sound.
- ▶ the correct measuring range is set.

Safety will be increased if separate instruments are used to measure current and voltage, or universal instruments with interlocking against measurement in the wrong measuring range.

Safety will also be increased if, for example, insulating gloves and a visor are used.

Measuring instruments

Here, measuring instruments means portable electrical measuring instruments and similar aids for measurement on and in heavy-current circuits.

Instruments for direct measurement of currents in the secondary circuit of a current transformer must not have a switching device or a fuse. Among other things, the instrument must be thermally capable of withstanding overcurrent that may occur (usually 20 times the rated secondary current).

Since the ability of measuring instruments to withstand overvoltage and overcurrent is normally limited, special care should be taken when choosing instruments. Measuring instruments and measuring leads, should conform to current standards.

Instruments and measuring aids must be checked regularly in accordance with the manufacturer's instructions and with regard to safety.

Note: Some instruments contain a precision fuse which is normally not capable of interrupting the short-circuit currents that may occur. High-power fuses should be used so that these currents can be interrupted.

Planning

When planning measurement work, the employer must, in his or her risk management, make sure that the suitable measuring equipment is used, adequate safety measures applied and that personnel with the right competence is engaged.

Prior to every measurement, elsäkerhetsledare³ must perform a written risk management, in which the following points must be made clear:

- ▶ what is to be measured.
- ▶ what measurement results are expected.
- ▶ what measurement performance is required.
- ▶ what measuring instruments and aids are to be used.



Figure 19. Example of measuring instruments.

3 nominated person in control of a work activity

- ▶ whether transient overvoltage can occur at the measurement point and how high these may be, so that instruments of the right category are used.
- ▶ whether the measurement involves other risks.
- ▶ what the consequences of a failed measurement might be.
- ▶ what is needed in form of measuring leads, fuses, strengthening isolation and other aids.
- ▶ that the instruments and aids have been checked regarding function, measurement performance and safety.
- ▶ what the location where the measuring takes place looks like.
- ▶ how the measuring equipment should be connected.
- ▶ that the safety distance is established.



Figure 20. Important to remember.



Main rule for voltage measurement: Use instruments with current-limiting measuring probes, or alternatively, high-power fuses in measuring leads or built into instruments.

Measurement in the secondary circuit of a current transformer

Current measurement in the secondary circuit of a current transformer is performed as described earlier, with the following supplementary points:

- ▶ overvoltage protection in the measuring circuit is recommended.
- ▶ the measuring circuit must not include a switching device or fuse.
- ▶ the secondary circuit must not be interrupted during measurement (e.g. to change the measuring range, to connect/disconnect measuring leads, etc.).
- ▶ safety will be increased by using a clip-on ammeter.

Measurement in magnetization circuits

The requirements for measuring in magnetization circuits are the same as in the previous section. In addition, the measuring equipment must be dimensioned both for the higher overcurrent that may occur and for the voltage level with respect to earth and the operator.

Measurement with an oscilloscope

When using an oscilloscope for measurement, the chassis of the oscilloscope (which forms the reference for the measurement signal), must be connected to earth. This also applies to double-insulated or battery-powered oscilloscopes that have no protective earth wire in the mains lead. The chassis of the oscilloscope must never be connected to a live part.

If it is necessary to measure the voltage between two live parts separated from earth, this must be done by differential measurement (this requires at least two channels, inversion of one channel and vector addition) or by galvanic separation (isolating transformer, isolating amplifier or similar).

A measurement voltage above 250 V should not be connected directly to the BNC connectors of the oscilloscope.

Inspection, photographing, cable allocation and thermal imaging

In general, these measures must be taken on an exposed live current-carrying device or part of an installation. Usually this means working with the compartment door open. It is important to make a risk management when physical barriers are removed and to establish a safety distance.

Troubleshooting

During troubleshooting, the risks of entering the live working zone are considerable. The same routines should be followed for troubleshooting as for measurement.

A risk management must be carried out before every single step of troubleshooting.

Switching at troubleshooting

Switching at troubleshooting must be planned, carried out and documented. The result of the switching forms the basis for the next step of: planning – performance – documentation of completed action.



Figure 21. Switching at troubleshooting.



When troubleshooting results in an action to correct a fault in the installation, the action must be carried out as work in accordance with one of the following working procedures: *Dead working*, *Working in the vicinity of live parts* or *Live working*.

Testing/commissioning

During the construction of an installation the electrical hazards are limited. The electrical hazard increases at the stage when the installation is connected to the supplying grid for testing.

A risk management must be done before every step of the testing /commissioning.

If testing and commissioning of the installation cannot be done with devices, tools or equipment designed to prevent any hazard when properly used, testing and commissioning must be carried out in accordance with one of the following working procedures: *Dead working*, *Working in the vicinity of live parts* or *Live working*.

It is of the utmost importance always to take great care when testing and commissioning, especially where it is not possible to see the entire installation from the work location.

When a new installation is ready for commissioning, all signs, such as identification signs and warning signs, must be put into place. All the documentation about the operation of the installation must be available at that time.



Figure 22. Example of using a check list.

The documentation must, among other things, contain:

- ▶ the complexity of the installation.
- ▶ the full extent of the installation.
- ▶ the included components and more.

Documents that must be a part of the documentation, among others, are:

- ▶ diagrams.
- ▶ tables.
- ▶ location plans.
- ▶ instructions.

It is important to check that the installation fills all the safety requirements before commissioning.


Inspection from helicopter

When inspecting from a helicopter, it is not normally needed to take the automatic reclosing system (ar) out of operation. The employer decides in his or her risk management whether or not the automatic reclosing system (ar) needs to be taken out of operation.

10. Appendices

Appendix 1

Example of a request for permit-to-work



REQUEST FOR PERMIT-TO-WORK No 0099

Project supervisor **Martin Flink** Date of registration **2014.02.12**

| | |
|----------------------------------|--|
| From Employer Eltjänst | To Eldriftledare ² Operation planning Elnät |
| Name Carl Persson | Name Torsten Brönmark |

SWITCHGEAR/BOUNDARIES

10 kV FSÖ bay 25, part LF3 in N115356-LF3 in FSÖ-010
 Boundaries:
 LF3 in N115356 and LF3 in FSÖ-010

WORK INVOLVES / PART OF THE INSTALLATION

Commissioning of a new substation N142350 Kullberg between N115356 and FSÖ-010

WORK A

Working time
20 februari at 09.30-15.30

Elsäkerhetsledare³ Tel / Radio for permit-to-work
Per Gren **070-123 45 67**

Address
Förrådsgatan 6, 575 36 Eksjö

WORK B

Working time

Elsäkerhetsledare³ Tel / Radio for permit-to-work

Address

WORK C

Working time

Elsäkerhetsledare³ Tel / Radio for permit-to-work

Address

WORK D

Working time

Elsäkerhetsledare³ Tel / Radio for permit-to-work

Address

Precondition for carrying out the work activity

Not under -5°C

The work activity also involves a risk of Working in the vicinity of live parts

NOTES OF THE OPERATION DEPARTMENT

Comment, notification, etc

MESSAGE TO THE CONTROL CENTRE

New customer connected 21 February

Eldriftledare²
CC
 Operating order/Switching schedule drawn up by
Torsten Brönmark

HANDED OVER

Date Signature Signature

12 February **Carl Persson**

| | |
|-------------------------------------|----------|
| | Personal |
| | By phone |
| <input checked="" type="checkbox"/> | By post |




A request for permit-to-work must, among other things, contain details of:

- ▶ parts of the installation affected by the work activity.
- ▶ information on how to contact the person who submitted the request for permit-to-work.
- ▶ boundaries of the work location. A sketch, diagram or map should be supplied.

² nominated person in control of an electrical installation during work activities

³ nominated person in control of a work activity

Example of a request for permit-to-work, Swedish version.

| | | | |
|---|--|----------------------------------|--|
|  | | ARBETSBEGÄRAN Nr 0099 | |
| Projektansvarig Martin Flink | | Registreringsdatum 2014.02.12 | |

| | |
|--------------------------------------|---|
| Från Arbetsgivare Eltjänst | Till Eldriftledare Driftplanering Elnät |
| Namn Carl Persson | Namn Torsten Brönmark |

STÄLLVERK / AVGRÄNSNINGAR

10 kV FSÖ fack 25, delen LF3 i N115356-LF3 i FSÖ-010
 Avgränsningar:
 LF3 i N115356 och LF3 i FSÖ-010

ARBETE AVSER / ANLÄGGNINGSDDEL

Inkoppling av ny nätstation N142350 Kullberg mellan N115356 och FSÖ-010

ARBETE A

Arbetsid
 20 februari kl 09.30-16.30

Elsäkerhetsledare Tel / Radio för arbetsbevis
 Per Ören 070-123 45 67

Adress
 Förrådgatan 6, 575 36 Eksjö

ARBETE B

Arbetsid

Elsäkerhetsledare Tel / Radio för arbetsbevis

Adress

ARBETE C

Arbetsid

Elsäkerhetsledare Tel / Radio för arbetsbevis

Adress

ARBETE D

Arbetsid

Elsäkerhetsledare Tel / Radio för arbetsbevis

Adress

Förutsättning för genomförande av arbete

Ej under -5°

Arbetet innebär även risk för Arbeta Nära Spänning:

DRIFTENS NOTERINGAR

Anm, avisering o dyl

Eldriftledare
DC
 Driftorder/Kopplingsedel uppr av
Torsten Brönmark

MEDDELANDE TILL DRIFTCENTRALEN


Ny kund inkopplas 21 februari

| | | |
|-------------------|-----------------------------|-------------|
| ÖVERLÄMNAT | | |
| Datum 12/2 | Underskrift Carl Persson | Underskrift |

| |
|--|
| <input type="checkbox"/> Personligt |
| <input type="checkbox"/> Per telefon |
| <input checked="" type="checkbox"/> Per post |

Appendix 2

Example of an operating order



OPERATING ORDER DC-001.14

From

CC

2014-02-14

Sheet/of

1(3)

| | | |
|--|---|---------------|
| <p>Issued for action</p> <p>CC PER GREN/ELTJÄNST</p> | <p>Our reference</p> | <p>KL-no.</p> |
| <p>Issued for information</p> <p>OLLE PERSSON/INSTALLATION LARS JÖNSSON/OPERATION CARL PERSSON/ELTJÄNST</p> | <p>General</p> | |
| | <p>Drawn up by</p> <p>TORSTEN BRÖNMARK</p> | |
| | <p>Checked by</p> <p>ULF MELIN</p> | |
| | <p>Eldriftedare²</p> <p>CC</p> | |

Part of installation: 10 kV FSÖ BAY 25, PART LF3 in N115356-LF3 in FSÖ-010

Operation reorganisation time: THURSDAY 20 FEBRUARY AT 09.00-16.00

Customer outage time: THURSDAY 20 FEBRUARY AT 09.30-15.30

Telephone: DC 020-20 99 00
 PER GREN 070-123 45 67

General: CUSTOMERS ARE NOTIFIED

WORK


Work involves: COMMISSIONING OF A NEW SUBSTATION N142350 KULLBERG

Working time: THURSDAY 20 FEBRUARY AT 09.30-15.30

Elsäkerhetsledare³: PER GREN

² nominated person in control of an electrical installation during work activities
³ nominated person in control of a work activity

Example of an operation order, Swedish version.

| | | | |
|---|------------|-------------------|------------------|
|  | | DRIFTORDER | DC-001.14 |
| Från | | Blad/av | |
| DC | 2014-02-14 | 1(3) | |

| | | |
|---|---|--------|
| Delgives för åtgärder DC PER GREN/ELTJÄNST | Vår ref. | KL-nr. |
| | Allmänt | |
| Delgives för kännedom OLLE PERSSON/ANL LARS JÖNSSON/DRIFT CARL PERSSON/ELTJÄNST | Upprättad av TORSTEN BRÖNMARK | |
| | Kontrollerad av ULF MELIN | |
| | Eldriftledare DC | |

| | |
|-----------------------------|---|
| Anläggningsdel: | 10 kV FSÖ FACK 25, DELEN LF3 i N115356-LF3 i FSÖ-010 |
| Driftomläggningstid: | TORSDAGEN DEN 20 FEBRUARI KL 09.00-16.00 |
| Kundavbrottstid: | TORSDAGEN DEN 20 FEBRUARI KL 09.30-15.30 |
| Telefon: | DC 020-20 99 00 PER GREN 070-123 45 67 |
| Allmänt: | KUNDER ÄR AVISERADE |
| ARBETE | |
| Omfattning: | INKOPPLING AV NY NÄTSTATION N142350 KULLBERG |
| Arbetstid: | TORSDAGEN DEN 20 FEBRUARI KL 09.30-15.30 |
| Elsäkerhetsledare: | PER GREN |

Example of an operating order



OPERATING ORDER DC-001.14

From

Cheet/of

CC

2014-02-14

2(3)

| | | Done | |
|---|---|------|------|
| | | Time | Sign |
| | <p>Preconditions:</p> <p>NORMAL SWITCHING ON THE PARTS OF THE INSTALLATION IN QUESTION</p> <p>DISCONNECTION OF 10 kV FSÖ BAY 25, PART LF3 IN N115356-LF3 IN FSÖ-010</p> <p>THURSDAY 20 FEBRUARY AT 09.00</p> | | |
| 1 | CC CHECK THE PRECONDITIONS | | |
| 2 | PER GREN N115356 BLOCK LF3 IN OPEN POSITION | | |
| | AT 09.30 | | |
| 3 | PER GREN FSÖ-010 OPEN LF3 | | |
| 4 | PER GREN FSÖ-010 BLOCK LF3 IN OPEN POSITION | | |
| 5 | PER GREN <p>GIVE SWITCHING CONFIRMATION TO CC FOR</p> <p>-LF3 BLOCKED IN THE OPEN POSITION IN N115356</p> <p>-LF3 BLOCKED IN THE OPEN POSITION IN FSÖ-010</p> | | |
| 6 | CC <p>GIVE A PERMIT-TO-WORK TO PER GREN FOR</p> <p>-10 kV FSÖ BAY 25, PART LF3 IN N115356-LF3 IN FSÖ-010</p> <p>BOUNDED BY</p> <p>-LF3 IN N115356</p> <p>-LF3 IN FSÖ-010</p> | | |
| | <p>ENERGIZING OF 10 kV FSÖ BAY 25, PART LF3 IN N115356-LF3 IN FSÖ-010</p> <p>THURSDAY 20 FEBRUARY AT 15.30</p> | | |
| 7 | PER GREN <p>SUBMIT A CERTIFICATE OF COMMISSIONING FOR</p> <p>-10 kV FSÖ BAY 25, PART LF3 IN N115356-LF3 IN FSÖ-010</p> <p>-NEW CABLE TRAIL WITH SUBSTATION N142350</p> <p>-SUBSTATION N142350 IS INSPECTED AND</p> <p>READY FOR OPERATION</p> | | |
| 8 | PER GREN N115356 REMOVE BLOCKING ON LF3 | | |

Example of an operation order, Swedish version.



DRIFTORDER

DC-001.14

Från

Blad/av

DC

2014-02-14

2(3)

| | | Verkställd | |
|---|--|------------|------|
| | | Kl | Sign |
| | <p>Förutsättningar:</p> <p>NORMAL KOPPLING PÅ BERÖRDA ANLÄGGNINGSDELAR</p> <p>FRÄNKOPPLING AV 10 kV FSÖ FACK 25, DELEN LF3 i N115356-LF3 i FSÖ-010</p> <p>TORSDAGEN DEN 20 FEBRUARI KL 09.00</p> | | |
| 1 | DC KONTROLLERA FÖRUTSÄTTNINGARNA | | |
| 2 | PER GREN N115356 BLOCKERA LF3 i ÖPPET LÄGE | | |
| | KL 09.30 | | |
| 3 | PER GREN FSÖ-010 ÖPPNA LF3 | | |
| 4 | PER GREN FSÖ-010 BLOCKERA LF3 i ÖPPET LÄGE | | |
| 5 | PER GREN LÄMNA DC KOPPLINGSBEKRÄFTELSE FÖR -LF3 BLOCKERAD i ÖPPET LÄGE i N115356 -LF3 BLOCKERAD i ÖPPET LÄGE i FSÖ-010 | | |
| 6 | DC LÄMNA ARBETSBEVIS TILL PER GREN FÖR -10 kV FSÖ FACK 25, DELEN LF3 i N115356-LF3 i FSÖ-010 AVGRÄNSAD AV -LF3 i N115356 -LF3 i FSÖ-010 | | |
| | TILLKOPPLING AV 10 KV FSÖ FACK 25, DELEN LF3 i N115356-LF3 i FSÖ-010 TORSDAGEN DEN 20 FEBRUARI KL 15.30 | | |
| 7 | PER GREN LÄMNA DC DRIFTBEVIS FÖR -10 kV FSÖ FACK 25, DELEN LF3 i N115356-LF3 i FSÖ-010 -NY KABELSLINGA MED NÄTSTATION N142350 -NÄTSTATION N142350 ÄR BESIKTIGAD OCH KLAR FÖR DRIFT | | |
| 8 | PER GREN N115356 UPPHÄV BLOCKERING PÅ LF3 | | |

Example of an operating order



An operating order must, among other things, contain details of:

- ▶ who issued the operating order.
- ▶ the scope of work and working procedure.
- ▶ the name of elsäkerhetsledare³.
- ▶ a current diagram must be included in the operation order.

3 nominated person in control of a work activity

[illegible]

Appendix 3

Example of a switching schedule

ebri

☒ Switching schedule

☐ Switching order

☐ Switching confirmation

☐ Cancellation of switching confirmation

☐ Permit-to-work

☐ Certificate of commissioning

☐ Delegation of switching responsibility

☐ Return of switching responsibility

☐ _____

No _____

From

Eldriflédare² Karl Blixt

To

CC

Operation reorganisation and work due to defective cable between 123 Town and 12345 Church

1. CC check disconnected L12-S in 123 Town

2. CC open EF1 in 12345 Church (switching operator)

3. CC block the open EF1 in 12345 Church (switching operator)

4. CC close EF2 in 12345 Church (energizing) (switching operator)

5. CC check voltage in 12345 Church (switching operator)

6. CC open L12-F2 in 123 Town

7. CC block the open L12-F2 in 123 Town

8. CC hand over permit-to-work for the disconnected L12 section 123 Town - 12345 Church to Oskar Elm

Boundary for work L12-F2 in 123 Town and EF1 in 12345 Church

Exchanged

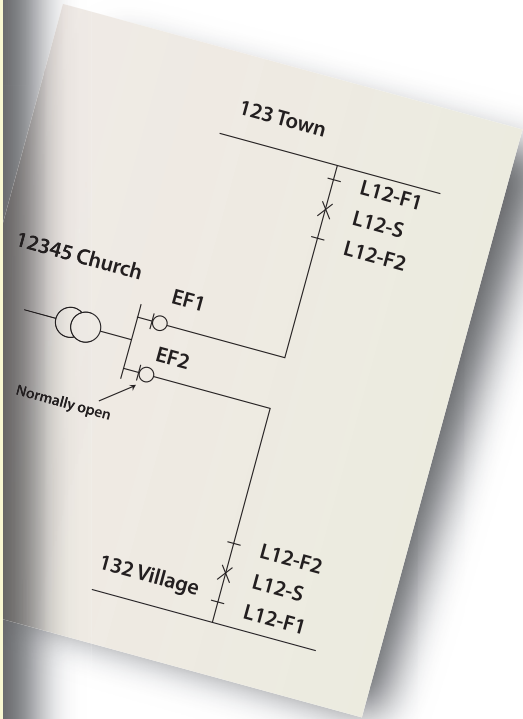
day the

-

-

Clock time

☐ Teleferm



!

A switching schedule must, among other things, contain details of:

- ▶ who drew it up.
- ▶ which parts of the installation, including boundaries, the work activity refers to.

2 nominated person in control of an electrical installation during work activities

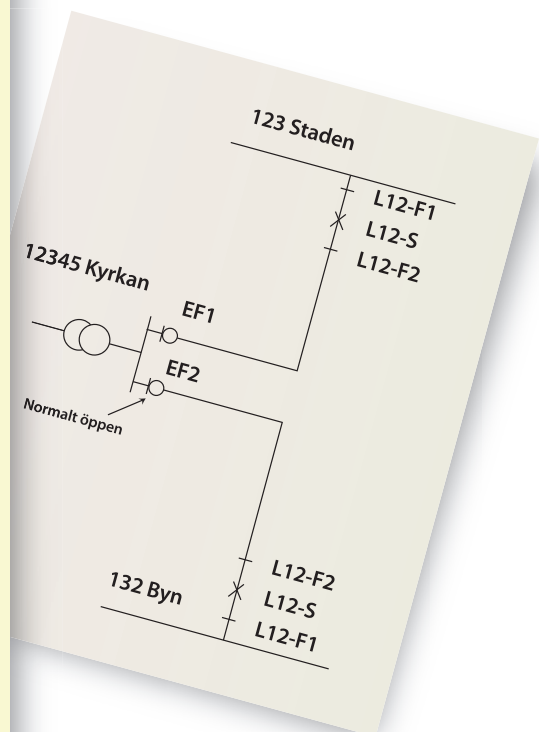
Example of a switching schedule, Swedish version.

ebr

☒ Kopplingsedel ☐ Arbetsbevis
☐ Order om koppling ☐ Driftbevis
☐ Kopplingsbekräftelse ☐ Överlämning av kopplingsansvar
☐ Upphävande av kopplingsbekräftelse ☐ Återlämning av kopplingsansvar
☐ _____

Nr _____

| | |
|---|---|
| Från <i>Eldriftledare, Karl Blixt</i> | Till |
| <i>DC</i> | |
| <i>Driftomläggning och arbete på grund av fel på kabel mellan 123 Staden och 12345 Kyrkan</i> | |
| 1. DC kontrollera fränslagen L12-S i 123 Staden | |
| 2. DC öppna EF1 i 12345 Kyrkan (kopplingsbiträde) | |
| 3. DC blockera öppna EF1 i 12345 Kyrkan (kopplingsbiträde) | |
| 4. DC sluta EF2 i 12345 Kyrkan (spänningssättning)(kopplingsbiträde) | |
| 5. DC kontrollera spänning i 12345 Kyrkan (kopplingsbiträde) | |
| 6. DC öppna L12-F2 i 123 Staden | |
| 7. DC blockera öppna L12-F2 i 123 Staden | |
| 8. DC lämna Oskar Ehn arbetsbevis för fränkopplad L12 sektion 123 Staden - 12345 Kyrkan | |
| <i>Gräns för arbetet L12-F2 i 123 Staden och EF1 i 12345 Kyrkan</i> | |
| Utväxlat | dagen 20 - - klockan <input type="checkbox"/> Telefem |



Appendix 4

Example of a switching confirmation

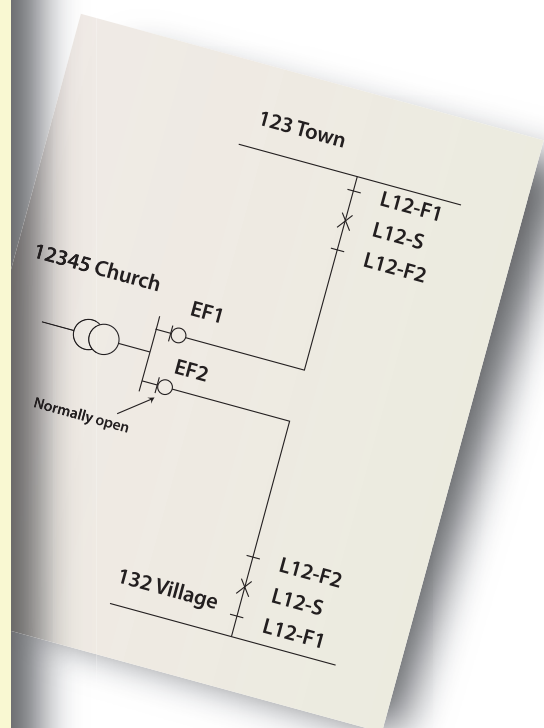
ebr

☐ Switching schedule
☐ Switching order
☒ Switching confirmation
☐ Cancellation of switching confirmation

☐ Permit-to-work
☐ Certificate of commissioning
☐ Delegation of switching responsibility
☐ Return of switching responsibility
☐ _____

No _____

| | |
|--|---|
| From Switching operator, Per Persson | To Eldriftledare ² , Karl Blixt |
| 070- 123 45 67 | CC |
| EF1 in 12345 Church is open and blocked | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| Exchanged Mon day 20 14 - 09 - 01 | Clock time 09:15 |
| <input checked="" type="checkbox"/> Teleferm | |



A switching confirmation is a confirmation that one or more ordered actions have been carried out or that parts of the installation have the switching status given in the confirmation.

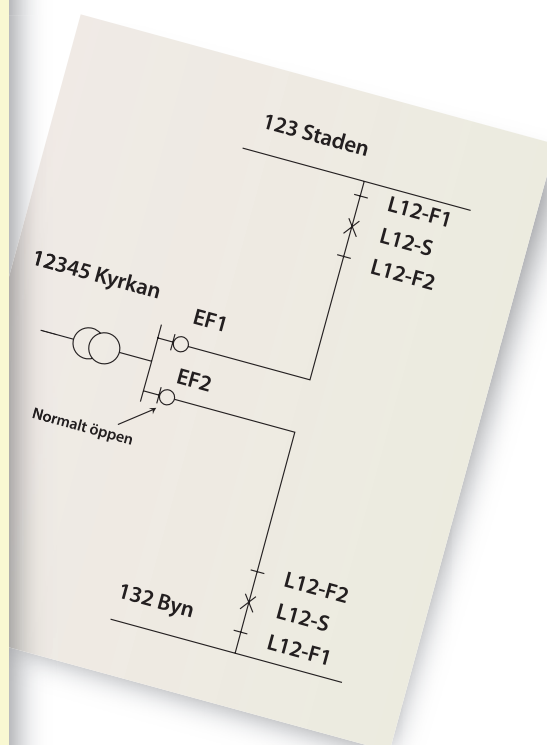
Example of a switching confirmation, Swedish version.

ebr

☐ Kopplingssedel ☐ Arbetsbevis
☐ Order om koppling ☐ Driftbevis
☒ Kopplingsbekaftelse ☐ Överlämning av kopplingsansvar
☐ Upphävande av kopplingsbekaftelse ☐ Återlämning av kopplingsansvar
☐ _____

Nr _____

| | |
|--|--|
| Från <i>Kopplingsbiträde, Per Persson</i> | Till <i>Eldriftledare, Karl Blixt</i> |
| <i>070-123 45 67</i> | <i>DC</i> |
| <i>EF1 i 12345 Kyrkan är öppen och blockerad</i> | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| Utväxlat <i>Måndagen 20 14 - 09 - 01</i> | klockan <i>09:15</i> <input checked="" type="checkbox"/> Telefem |



Appendix 5

Example of a permit-to-work

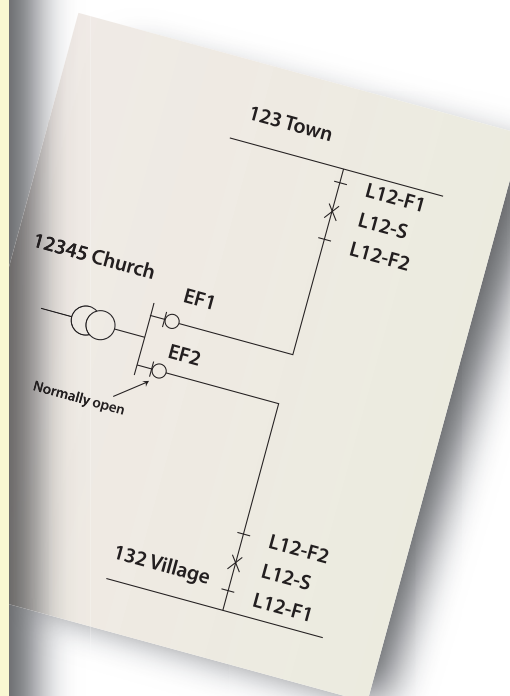
ebr

☐ Switching schedule
☐ Switching order
☐ Switching confirmation
☐ Cancellation of switching confirmation

☒ Permit-to-work
☐ Certificate of commissioning
☐ Delegation of switching responsibility
☐ Return of switching responsibility
☐ _____

No _____

| | |
|---|---|
| From <i>Eldriftsledare², Karl Blixt</i> | To <i>Elsäkerhetsledare³, Oskar Ehn</i> |
| <i>CC</i> | <i>070-234 56 78</i> |
| <i>L12 section 123 Town - 12345 Church is disconnected</i> | |
| <i>Boundary for work : L12-F2 in 123 Town and EF1 in Church</i> | |
| | |
| | |
| | |
| | |
| | |
| Exchanged <i>Mon day 20 14 - 09 - 01</i> Clock time <i>09:20</i> <input checked="" type="checkbox"/> Teleferm | |



A permit-to-work must, among other things, contain details of:

- ▶ who drew it up and who received it.
- ▶ which parts of the installation, including boundaries, the permit-to-work refers to.

² nominated person in control of an electrical installation during work activities

³ nominated person in control of a work activity

Example of a permit-to-work, Swedish version.

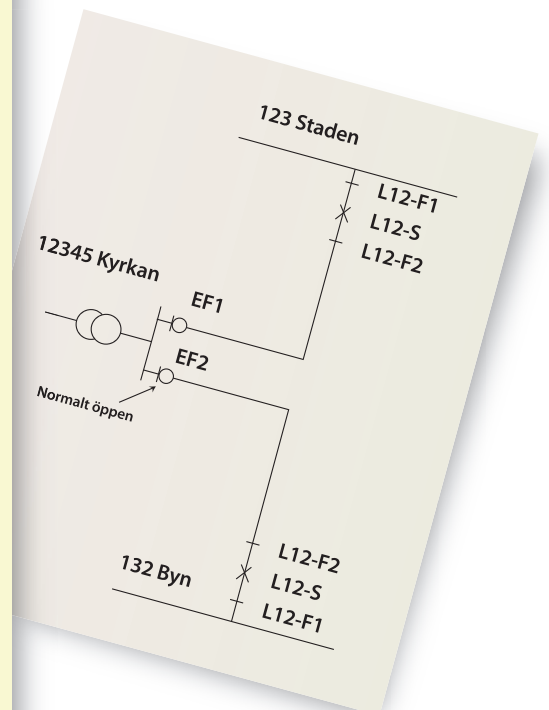
ebr

☐ Kopplingsedel
☐ Order om koppling
☐ Kopplingsbekräftelse
☐ Upphävande av kopplingsbekräftelse

☒ Arbetsbevis
☐ Driftbevis
☐ Överlämning av kopplingsansvar
☐ Återlämning av kopplingsansvar
☐ _____

Nr _____

| | |
|---|--|
| Från <i>Eldriftsledare, Karl Blixt</i> | Till <i>Elsäkerhetsledare, Oskar Ehn</i> |
| <i>DC</i> | <i>070-234 56 78</i> |
| <i>L12 sektionen 123 Staden - 12345 Kyrkan är fränkopplad</i> | |
| <i>Gräns för arbete: L12-F2 i 123 Staden och EF1 i Kyrkan</i> | |
| | |
| | |
| | |
| | |
| Utväxlat <i>Mån dagen 20 14 - 09 - 01</i> | klockan <i>09.20</i> <input checked="" type="checkbox"/> Telefer |



Appendix 6

Example of a certificate of commissioning

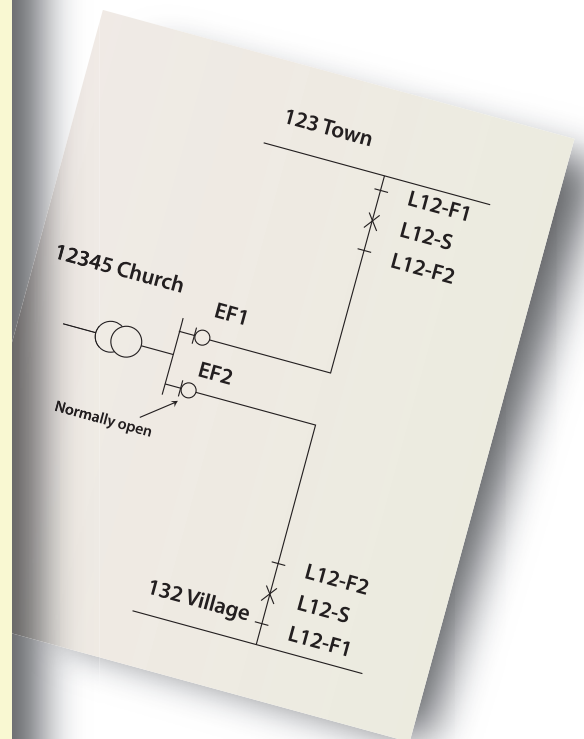
ebr

☐ Switching schedule
☐ Switching order
☐ Switching confirmation
☐ Cancellation of switching confirmation

☐ Permit-to-work
☒ Certificate of commissioning
☐ Delegation of switching responsibility
☐ Return of switching responsibility
☐ _____

No _____

| | |
|---|--|
| From <i>Elsäkerhetsledare³, Oskar Ehn</i> | To <i>Eldriftledare², Karl Blixt</i> |
| <i>070-234 56 78</i> | <i>CC</i> |
| <i>L12 section 123 Town - 12345 Church is for my part ready for operation.</i> | |
| <i>The cable is temporarily repaired and must be changed at a later occasion</i> | |
| Exchanged <i>Mon day 20 14 - 09 - 01</i> Clock time <i>15:00</i> <input checked="" type="checkbox"/> Teleferm | |



A certificate of commissioning must, among other things, contain details of:

- ▶ who submitted the certificate of commissioning.
- ▶ which parts of the installation the certificate of commissioning refers to.
- ▶ changes of the installation and the switching status.

2 nominated person in control of an electrical installation during work activities
 3 nominated person in control of a work activity

Example of a certificate of commissioning, Swedish version.

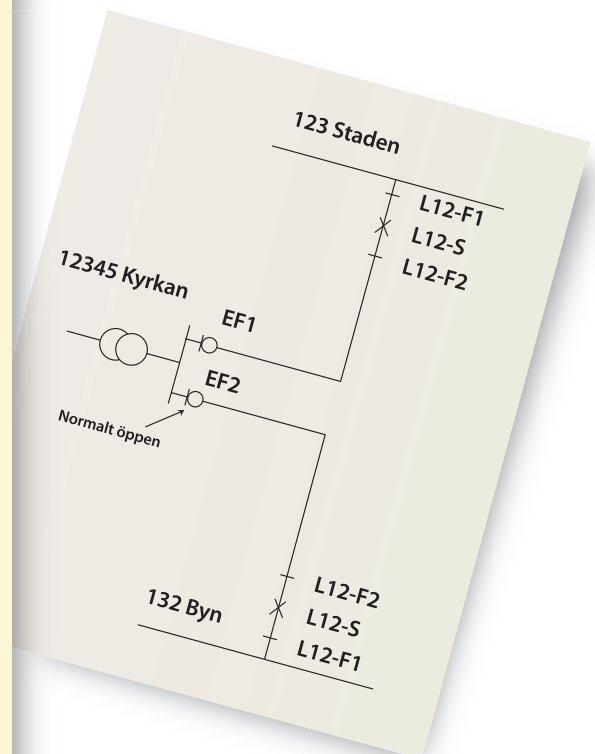
ebr

☐ Kopplingsedel
☐ Order om koppling
☐ Kopplingsbekräftelse
☐ Upphävande av kopplingsbekräftelse

☐ Arbetsbevis
☒ Driftbevis
☐ Överlämning av kopplingsansvar
☐ Återlämning av kopplingsansvar
☐ _____

Nr _____

| Från | Till |
|--|---|
| Elsäkerhetsledare, Oskar Ehn | Eldriftledare, Karl Blixt |
| 070-234 56 78 | DC |
| L12 sektionen 123 Staden - 12345 Kyrkan är för min del klar för drift. | |
| Kabeln är provisoriskt reparerad och ska bytas vid ett senare tillfälle. | |
| | |
| | |
| | |
| | |
| Utväxlat | Mån dagen 20 14 - 09 - 01 klockan 15:00 |
| <input checked="" type="checkbox"/> Telefem | |



Appendix 7

Example of a switching order

ebr

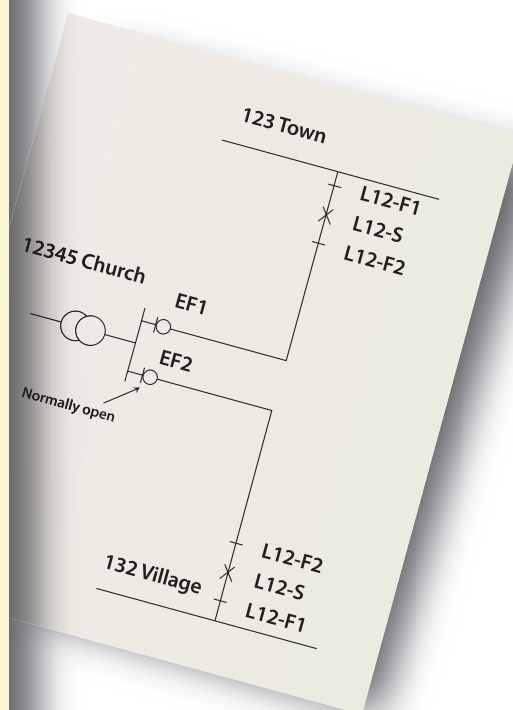
☐ Switching schedule
☒ Switching order
☐ Switching confirmation
☐ Cancellation of switching confirmation

☐ Permit-to-work
☐ Certificate of commissioning
☐ Delegation of switching responsibility
☐ Return of switching responsibility
☐ _____

No _____

| | |
|--|--|
| From <i>Eldriftledare², Karl Blixt</i> | To <i>Switching operator, Per Persson</i> |
| <i>CC</i> | <i>070-123 45 67</i> |
| 1. <i>CC open EF1 in 12345 Church</i> | |
| 2. <i>CC block EF2 in 12345 Church</i> | |
| 3. <i>DC close EF2 in 12345 Church (energizing)</i> | |
| | |
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| | |

Exchanged *Mon day 20 14 - 09 - 01* Clock time *09:00* ☒ Teleferm



An order for switching is given by eldriftledare² or, if the switching responsibility has been delegated, by the switching supervisor.

2 nominated person in control of an electrical installation during work activities

ebr

Kopplingsedel
☒ Order om koppling
Kopplingsbekräftelse
Upphävande av kopplingsbekräftelse

Arbetsbevis
Driftbevis
Överlämning av kopplingsansvar
Återlämning av kopplingsansvar

Nr _____

| Från | Till |
|---|-------------------------------|
| Eldriftledare, Karl Blix | Kopplingsbiträde, Per Persson |
| DC | 070-123 45 67 |
| | |
| 1. DC öppna EF1 i 12345 Kyrkan | |
| 2. DC blockera EF1 i 12345 Kyrkan | |
| 3. DC slut EF2 i 12345 Kyrkan (spänningssättning) | |
| | |
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| | |

Utväxlat Måndagen den 20 Maj - 09 - 01 klockan 09:00 ☒ Telefem

11. References

EBR Publications

SS-EN 50110-1

SS-EN 20110-2

The Electricity Act

The Heavy-Current Ordinance

Regulations from the Swedish National Electrical Safety Board

The Work Environment Act

Provisions from the Swedish Work Environment Authority

SS-ISO 31000

12. Glossary

Glossary with common words to use when filling in a form.

| English to Swedish | |
|--|------------------------------------|
| English | Swedish |
| Cancellation of switching confirmation | Upphävande av kopplingsbekräftelse |
| Certificate of commissioning | Driftbevis |
| Delegation of switching responsibility | Överlämning av kopplingsansvar |
| Electrical coordinating manager | Elsamordningsledare |
| Elanläggningsansvarig ¹ | Elanläggningsansvarig |
| Eldriftledare ² | Eldriftledare |
| Elsäkerhetsledare ³ | Elsäkerhetsledare |
| Operating order | Driftorder |
| Permit-to-work | Arbetsbevis |
| Return of switching responsibility | Återlämning av kopplingsansvar |
| Request for permit-to-work | Arbetsbegäran |
| Safety observer | Säkerhetsman |
| Switching confirmation | Kopplingsbekräftelse |
| Switching operator | Kopplingsbiträde |
| Switching order | Order om koppling |
| Switching schedule | Kopplingssedel |
| Switching supervisor | Kopplingsledare |
| Worker | Arbetare |

| Swedish to English | |
|------------------------------------|--|
| Swedish | English |
| Arbetare | Worker |
| Arbetsbegäran | Request for permit-to-work |
| Arbetsbevis | Permit-to-work |
| Driftbevis | Certificate of commissioning |
| Driftorder | Operating order |
| Elanläggningsansvarig | Elanläggningsansvarig ¹ |
| Eldriftledare | Eldriftledare ² |
| Elsamordningsledare | Electrical coordinating manager |
| Elsäkerhetsledare | Elsäkerhetsledare ³ |
| Kopplingsbekräftelse | Switching confirmation |
| Kopplingsbiträde | Switching operator |
| Kopplingsledare | Switching supervisor |
| Kopplingssedel | Switching schedule |
| Order om koppling | Switching order |
| Säkerhetsman | Safety observer |
| Upphävande av kopplingsbekräftelse | Cancellation of switching confirmation |
| Återlämning av kopplingsansvar | Return of switching responsibility |
| Överlämning av kopplingsansvar | Delegation of switching responsibility |

1 person responsible for an electrical installation

2 nominated person in control of an electrical installation during work activities

3 nominated person in control of a work activity
