

Requirement	The Statkraft Way	
Open	Instruction for electrical safety	

## Innhold

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**ELECTRICAL SAFETY – GENERAL GUIDELINES REGULATING SAFETY WORK IN ALL ELECTRICAL INSTALLATIONS WHERE SKAGERAK KRAFT AS (SK) AND STATKRAFT ENERGI AS (SE) HAVE OPERATIONAL RESPONSIBILITY.**

## 1 PURPOSE

The guidelines are to ensure that the system for overall planning and work in and on our electrical installations is properly carried out in accordance with applicable safety regulations and guidelines.

## 2 SCOPE

The guidelines apply to all electrical installations where one of the companies Skagerak Kraft AS or Statkraft Energi AS (Norwegian installations) has Operations Manager HV (high-voltage installations) or Operations Manager LV (low-voltage installations).

Authorisations apply within the Operations Managers' area of responsibility.

## 3 RESPONSIBILITY

The Executive Vice President PG (SE) has delegated to the Regional Vice President for appointing Operations Manager HV and Operations Manager LV in the respective regions.

The Board (SK) is responsible for appointing an Operations Manager HV and Operations Manager LV.

List of Operations Managers HV/LV and deputies<sup>1</sup>.

The Operations Manager HV and Operations Manager LV are responsible for operation and maintenance of the electrical installations in accordance with FSE 2006.

Only the Operations Manager HV and Operations Manager LV have the authority to give deviation permit.

Anyone who is granted access to electrical installations or systems is responsible for following this instruction.

The Operations Manager HV/LV is responsible for the preparation and updating of these instructions.

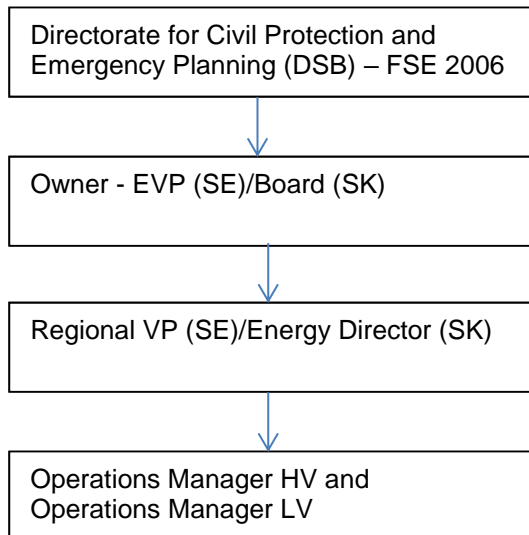
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<sup>1</sup> See the reference list at the bottom of the document – SE 5.2.1.

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## 4 PROCEDURE

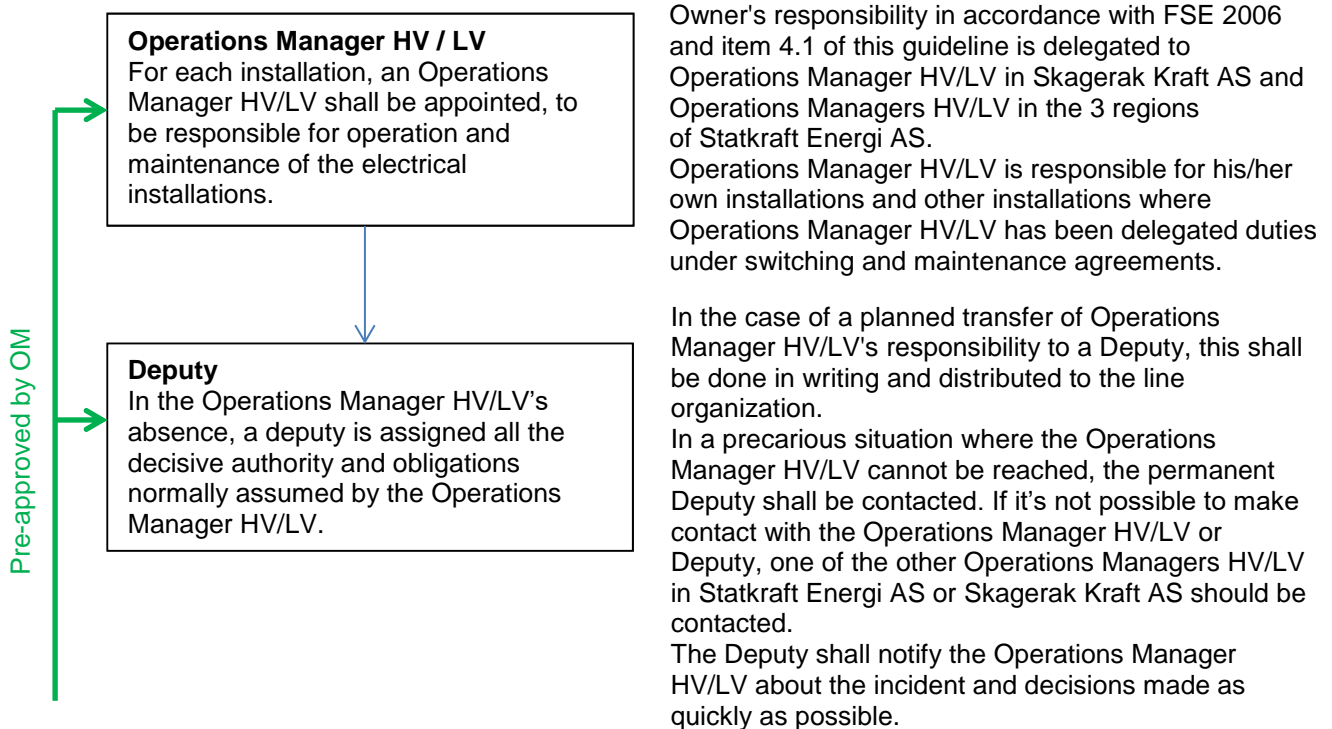
### 4.1 Organisation




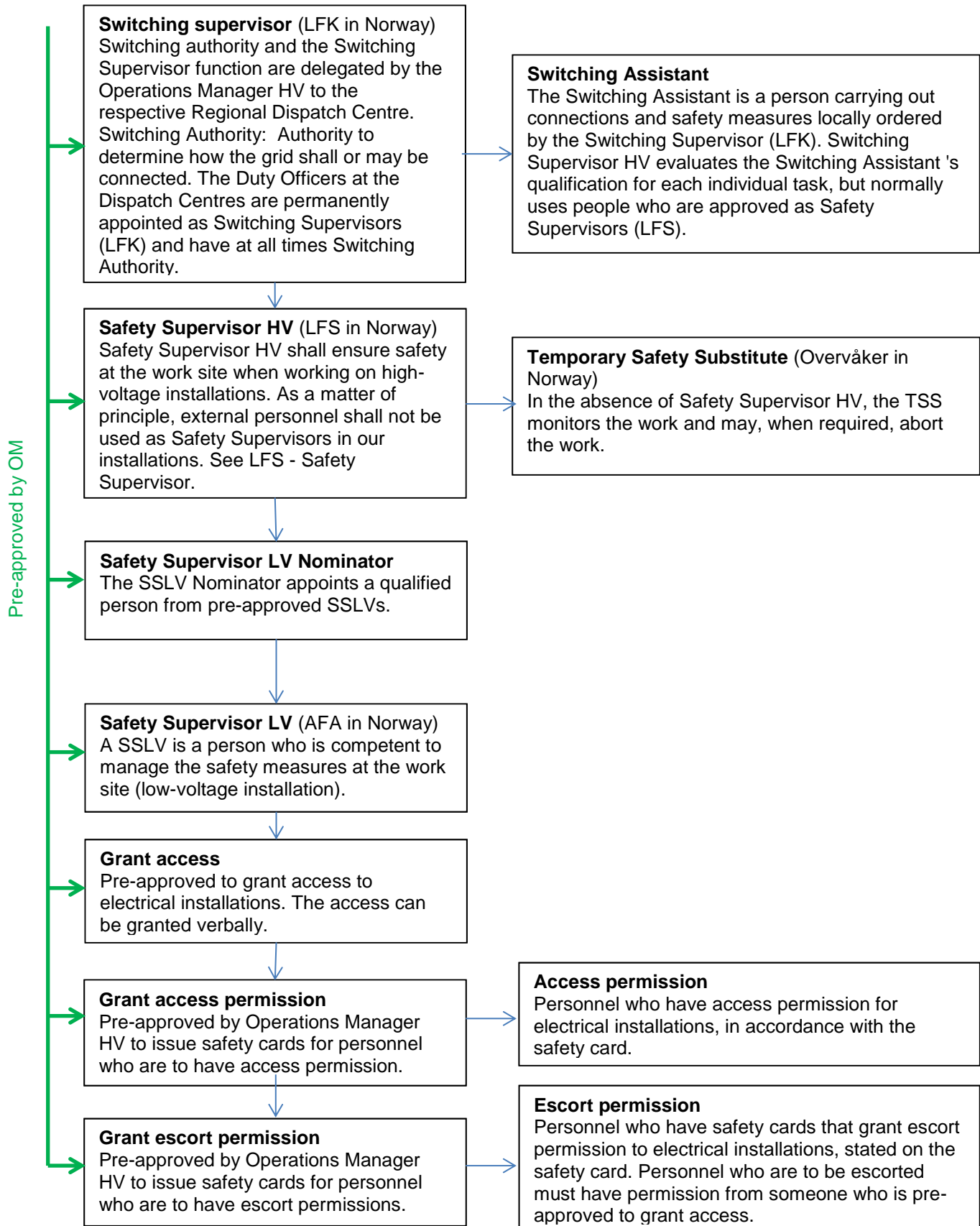
In accordance with FSE, the owner's responsibility is delegated to an Operations Manager in Skagerak Kraft AS and Operations Managers in the 3 regions in Statkraft Energi AS.

### 4.2 Organisation of responsibility in accordance with FSE 2006

All persons appointed roles in this chapter are supposed to fulfil demands according to FEK 2013.



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#### 4.2.1 Operation and maintenance

Operation and maintenance of the electrical installations are delegated to the Plant Manager/Unit Manager in accordance with laws, regulations, standards and internal instructions, incl. the procedure for Work Permit in P.

New installations and reconstructions shall be adapted for LOTO. When establishing safety measures, LOTO must always be used where possible.

The Unit Manager/Power Plant Manager is responsible and will ensure that energy control, when isolating energy sources with LOTO, is planned and established for all plants, equipment and components in their own unit.

- LOTO locks for electric safety measures must not be mistaken for other locks.
- Customized LOTO equipment must be used.
- It shall be possible to establish unlimited number of locks per LOTO point.

Where several working teams use common security measures, each working team shall have their own marking signs/locks (LOTO). This also applies to other parallel activities, for example in the waterway.

##### **Skagerak Kraft AS:**

Coordination of operation and maintenance on control systems is performed in the same manner as coordinating operations and maintenance on high voltage systems.

Operation, maintenance and inspection of electrical installations, operational control systems and security equipment are documented in the maintenance system.

##### **Statkraft Energi AS:**

Operation and maintenance of control systems from the collection unit in the power plant, including process equipment and associated equipment, are delegated to the ICT Security Coordinator. In this Context, operational control systems mean systems that affect/control components in the Power Plants.

The ICT Security Coordinator administrates access rights for all personnel working on operational control systems. Physical access/access rights out in the power plants are administrated by the relevant Plant Manager/Unit Manager.

Operation, maintenance and inspection of electrical installations, operational control systems and security equipment are documented in the maintenance system.

The Plant Manager/Unit Manager/ICT Security Coordinator is responsible for necessary training of all personnel working on operational control systems.

Regular meetings are to be held between the Operations Manager forum and the ICT Security Coordinator to coordinate activities.

#### 4.3 Reporting of incidents/near misses

Reporting of incidents resulting in injuries to persons is to be performed in accordance with emergency plans and FSE 2006.

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Operations Manager HV/LV shall be notified of incidents, near misses, dangerous conditions and suggestions for improvements in electrical installations. The owner of the deviation is responsible for notifying the Operations Manager HV/LV.

Reporting on incidents and near misses in accordance with FSE 2006 is to be reported in the deviation system. A copy is to be sent to Operations Manager HV/LV.

In the event of incidents in electrical installations, the relevant notification plan in Skagerak Kraft/Statkraft is to be followed.

For investigation of incidents in electrical installations, Operations Manager HV/LV shall be in the investigative group.

Operations Manager HV/LV sends a report on the incident/near miss to DSB within the deadline, with copies to other Operations Managers HV/LV.

#### 4.4 In the event of electric shock

Electric shock/electrocution shall be promptly informed to the emergency medical number 113.

#### 4.5 Access control

External personnel who are granted independent access to electrical installations must have received training in accordance with item 4.7.

The Plant Manager/Unit Manager/Project Manager shall ensure that personnel receive the necessary instruction and training.

##### High-voltage installations:

All power plants and outdoor installations must be locked, and entry regulated by an access control system. To get a key you need check-off for Access Permission in your Safety Card.

Independent access to high-voltage installations is granted by Operations Managers HV and persons with written access permission regulated through the safety card system. Authority to grant access is delegated in accordance with safety cards system.

Personnel with escort permission may only escort persons into high-voltage installations when approved by personnel with "Grant access" authority.

Escorting may only be done by personnel who are pre-approved for such tasks in accordance with a safety card. The person granted escort permission is responsible for (may not leave) that the person being escorted is not being exposed to danger during their presence in the vicinity of electrical installations.

In the event of several Operations Managers HV in the installation, access to the installation is regulated in switching agreements or in a separate access agreement.

##### Low-voltage installations:

Only authorized or instructed personnel have access to low-voltage installations. The exception is touch-proof low-voltage installations with a minimum of IP2xC protection, with a maximum of 125 A for outgoing circuits and 250 A for incoming.

In the event of several Operations Managers LV in the installation, access to the installation is regulated in switching agreements or in a separate access agreement.

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## 4.6 Safety cards and keys

### Skagerak Kraft AS:

Authority is delegated by Operations Manager HV to issue safety cards and dispense keys in accordance with annex "V1 – FSE no 1: Guidelines for issuing of safety cards and dispensing of operational keys in Skagerak Kraft AS."

All delegations that are not issued under applicable instructions are documented on the safety card. A list of safety cards is documented in a database on Fyret (Skagerak's Intranet).

Documentation that everyone who has been issued a safety card has undertaken an annual statutory course, either through direct attendance or electronically, on security regulations and first aid is documented in Skagerak's database KompetanseWEB. Ref. FSE 06, §7.

### Statkraft Energi AS:

Operations Manager HV/LV delegates to Plant Manager authority to dispense keys that provide access to electrical installations. For high-voltage installations, access is regulated by the safety card. Dispensing of keys must be documented.

Operations Manager HV/LV issues safety cards to his/her own permanent employees.

External personnel who are to have "Access permits" and "Escort permits" may obtain these for up to 12 months from an employee who is given such authority in a safety card.

Those who have been granted authority and/or a permit must at all times and for each installation assess their own competence to perform the function.

Operations Manager HV/LV uses a database card system from Energi Norge/Trainor for delegation of authority in the installations.

## 4.7 Training / Practice / Instruction

Personnel in SK and SE shall have access to and be familiarised with installations, relevant regulations, instructions, routines etc. and shall have their skills continuously updated.

For own employees, personnel managers for the respective department/power plant group (for example Plant Manager/Unit Manager/Station Manager/Technical Manager) shall supervise training and send a summary of training and recommendations to Operations Manager HV/LV, who approves or rejects the report.

Deadline for submission/registration of statutory training is April 01.



































For external personnel the Manager for actual unit/power plant group/project (i.e. Power Plant Manager/Project Manager/Technical Section Leader) shall see to that necessary education, familiarization tour, training and documentation are according to requests.

The Norwegian regulations FEK (Regulations for electrical enterprises and qualification requirements for work related to electrical installations and electrical equipment) set competence requirements for anyone working independently on the construction and repair of electrical installations, including a requirement that foreign fitters are approved by DSB.

Training in electrical safety of internal/external personnel in Skagerak Kraft AS and Statkraft Energi AS is performed in accordance with the table below:

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<p>Implementation plan for training, instruction and practice in SK and SE.</p> <p> To be performed at least once a year</p> <p> To be performed at least every five years</p> <p> To be performed as needed</p> <p>or in the event of significant amendments to associated regulations.</p> <p>Personnel managers in the power plant groups/operating areas are responsible for necessary coordination of training for all personnel from SK and SE in their areas. Personnel managers are to notify other departmental managers of planned courses.</p>												
	FSE and NEK EN 50110 – high and low-voltage	FSE and NEK EN 50110 – high and low-voltage	Introduction to SK's and SE's instructions	Technical review of relevant installation	First aid training with focus on injuries in electrical plants and practical CPR	Supplementary training for approved LFS, LFK and AFA (forms, switching agreements and similar)	Supplementary training in descending (belaying)	Course in FEF and associated standards	Course in FEL and associated standards	Training in low-voltage live working	Review of activities close to power lines and cables	
	Minimum time spent on training	2.5 hrs	5.5 hrs	2.0 hrs	1.0 hr	3.0 hrs	2.0 hrs	4.0 hrs	15 hrs	15 hrs	7.5 hrs	2.0 hrs
	All personnel having independent access to high-voltage installations <sup>2 3</sup>											
	All personnel performing work on or in the vicinity of high-voltage installations <sup>3</sup> (see 4.12)											
	All personnel performing work on low-voltage installations <sup>3</sup> (see 4.12)											
	All personnel approved as Safety Supervisor HV, Switching Supervisor, Switching Assistant and Safety Supervisor LV											
	All personnel performing or assisting with line work/mast work and work in radiomasts											
	All personnel working with/project planning for electrical installations											
	All personnel performing live work on low-voltage installations											
All personnel performing work closer than 30 m to power lines and cables												

Plan for implementation of education, instruction and training in SK and SE.

<sup>2</sup>Course participation for own employees, who only have authority in the form of **access** and **escort permission**, can be performed as a web-based one-hour course every other year.

<sup>3</sup>Regulatory reviews for external parties (except Safety Supervisor HV/LV), who shall work in electrical installations or have authority in the form of access and escort permission, can be approved by at least a 2.5 hour's web-based course on regulations. This requires a thorough review of the workplace in question by local personnel.

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## 4.8 Instructed personnel

Definition of instructed person:

An instructed person is a person who is sufficiently instructed and possibly supervised by a competent person so that he or she is able to perceive risks and to avoid hazards caused by electricity.

Person with a certificate within a relevant electrotechnical subject is considered authorized.

Instructed personnel are to be used to the least possible extent.

An instructed person is a person who has been trained to do simple operations and maintenance tasks such as changing fuses, reset motor protection devices, in an attempt to maintain the required operation until authorized electricians arrive at site to search for eventual faults and correct these.

An instructed person shall be instructed by an authorized person on the equipment to be operated. The purpose of the operation is to maintain operation. Designated Instructed Person shall ensure that the operation is performed according to the requirements of Safety Regulations for Work and Operation of Electrical Equipment (FSE 2006). The authorized person shall ensure that the instructed person is able to comply with requirements applicable for instructed person, ref. definition. The instruction and training shall be reviewed annually.

The authorized person shall together with administrative manager risk assess whether the operation can be performed by an instructed person. Types of risk areas can be electric arc, touch danger, step voltage, etc.

There shall be written instructions that clearly describe the scope of the work that the instructed person can perform.

Operations Manager HV/LV shall approve eventual instructions for instructed personnel.

## 4.9 Apprentices

Apprentices are looked on as unskilled personnel with regard to work on electrical installations, just like any other unskilled personnel without relevant certificate. All unskilled personnel employed or hired by Skagerak or Statkraft, shall have directly follow-up, reference FEK §6.

## 4.10 Work planning

Work or activity that requires switching or securing high-voltage installations must be notified to the Region Dispatch Centre in advance. This prior notice must clearly state the scope of the work and necessary safety measures.

## 4.11 Use of external personnel

Normally, external personnel shall not be used as Safety Supervisors HV/LV or Temporary Safety Substitute in our installations. The Operations Manager assesses external personnel in each individual case.

For work in open-air installations, Temporary Safety Substitute from external firms shall not be used.

For individual installations, use of external Switching Assistants regulated through an agreement may be acceptable. This is conditional on the Switching Assistant having the necessary qualifications and training for the controls in question.

Everyone in a work team must be able to communicate clearly with the Safety Supervisor HV/LV.

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#### 4.12 Requirement on work team members when working on or in the vicinity of electrical installations, i.e. where a Safety Supervisor HV or a Safety Supervisor LV has been appointed.

There must be a minimum of 2 persons present when working in high voltage systems and low voltage power lines. There must also be a minimum of 2 persons present at low voltage live work, unless a risk assessment indicates that Safety Supervisor LV can do the work alone without danger (see P-23/136 Live working section 4.2).

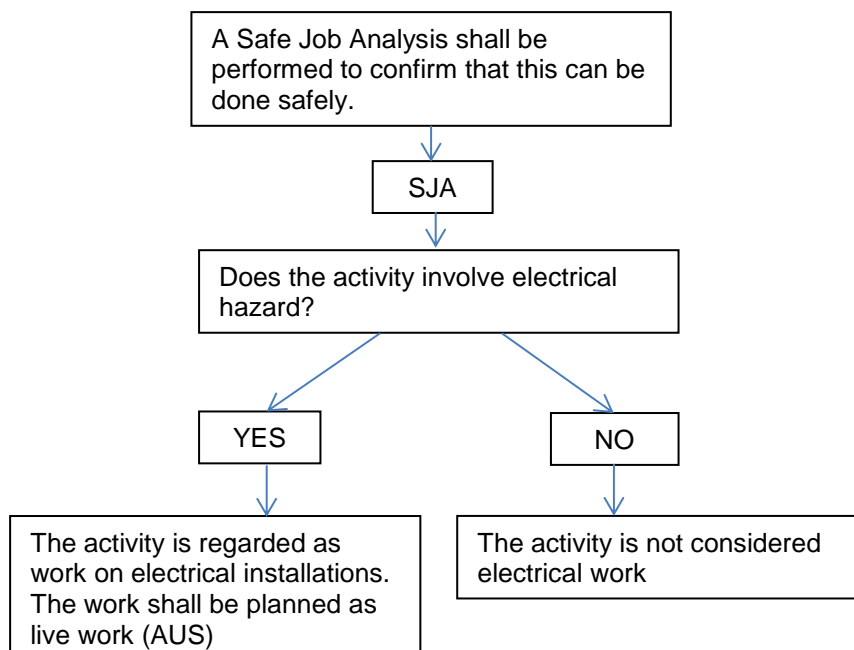
When working on electrical installations, at least one person in the work crew must satisfy the professional qualification requirements in the Norwegian regulations on qualifications for electrical professionals.

The following minimum requirements apply to the work crew:

- Possess knowledge of the installation and be familiar with the risk factors.
- Annual course in Safety regulations related to the maintenance and operation of electrical installations. (FSE 2006).
- Annual course in relevant electrical safety instructions
- Annual course in first aid with focus on electrical injuries and practical CPR.
- Course in lowering for everyone in the team during line work.
- Ability to communicate directly and clearly with the Safety Supervisor HV/LV.

The Safety Supervisor HV/LV is subject to further requirements.

#### 4.13 Flowchart for further reviews for troubleshooting, testing and measurement of low voltage equipment and refilling of water in battery installations.



Any type of electrical and non-electrical activity where there is a possibility of electrical danger, is defined as work in an electrical installation.

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#### 4.14 Inspection of high-voltage installations

- Before opening cell doors for inspection of high-voltage installation, a SJA must be performed.
- In particular, the need for appointing a Safety Supervisor HV before the inspection is started must be assessed.

#### 4.15 Controlling follow-up of electrical installations

Faults or defects in the installations must always be notified and registered in the maintenance system.

Inspection and control of operation, maintenance and condition of electrical installations must be catered for through:

##### 4.15.1 Condition monitoring

Must be defined in the system for maintenance follow-up in accordance with RCM analyses/statutory requirements. Condition monitoring may also be performed in connection with project promotion.

Inspection means use of your senses, look, smell, listen, etc.

Check means verification of the installations by using measuring equipment, megging, check for earth fault, etc.

- Annual inspection of all electrical installations and associated rooms/buildings.
- Annual check of grid stations, neutral point protection and power lines.
- Annual check of earthing apparatus, earthing rods, voltage testers, shielding plates, insulated tools (live work tool case) etc.
- Check of relay protections in accordance with guidelines<sup>4</sup>.
- Five-yearly check of installations in office buildings, warehouses, workshops, garages and housing etc.
- First rot control after 20 years, than locally adjustment based on condition, but not longer than 10 years.
- Six-yearly check of voltage testers performed by supplier.
- Ten-yearly check of power lines (top control) and earthing systems.

##### 4.15.2 Inspections in connection with faults in the installations or risks to third parties

- Inspections in connection with re-establishing operations.
- Lines are to be surveyed after abnormal stresses or when there is a risk of snowfall reducing the distance to energized lines.

##### 4.15.3 Internal inspection performed by the Operations Manager HV or person authorized by him

The inspections must be defined in the maintenance system.

- General systematic seven-yearly inspections of the installations in stations, buildings, regulation areas and on lines. The inspections are to be performed by the Operations Manager HV or someone authorised by him.
- The Maintenance Manager notifies the Operations Manager HV when the maintenance system raises a job.

<sup>4</sup> See the reference list at the bottom of the document SE 5.2.3.

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#### **4.16 Use of cranes, lifts or concrete pumps close to live high-voltage installations**

Where there is an extra remote-controlled emergency stop, this must be in the Safety Supervisor HV's (LFS) possession when the crane/lift/concrete pump is in operation.

The risk assessment must determine whether it will be necessary to work on disconnected installations.

#### **4.17 Risk assessment and declaration of conformity**

A risk assessment<sup>5</sup> must be performed and documented for new installations and refurbishments. Alterations, component swaps and similar that entail amendments to the documentation require a risk assessment to be performed.

A declaration of conformity<sup>6</sup> is to be issued for new installations and refurbishments. Alterations, component swaps and similar that entail amendments to the documentation require a declaration of conformity.

The Operations Manager HV/LV may delegate signing authority for the declaration of conformity to an authorized person.

#### **4.18 Prior notification of new installations**

New installations and provisional installations must be notified to Operations Managers HV/LV in reasonable time before final plans are completed. This also applies for demolition and decommissioning of old and temporary installations.

#### **4.19 Competence requirement for project planners**

The project planners of electrical installations working on behalf of Operations Managers must have the necessary competence for calculating and dimensioning installations, meaning at least two years of technical college with relevant certificates. See the Regulations for electrical enterprises and qualification requirements for work related to electrical installations and electrical equipment. FEK 2013 §7. "Qualifications requirements for persons having the professional liability of an electrical installation".

<sup>5</sup> See the reference list at the bottom of the document SE 5.2.11 and 5.2.13

<sup>6</sup> See the reference list at the bottom of the document SE 5.2.11 and 5.2.12

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## 5 REFERENCES AND DEFINITIONS

### 5.1 Internal references, Skagerak Kraft AS

5.1.1 Manuals Operations Manager SK Kraft General instructions FSE instruction no. 1	5.1.1 Håndbøker Driftsleder SK Kraft Generell instruks FSE instruks nr. 1
5.1.2 Excel – my templates Project Form for risk assessment - Risk analysis Project (SK Energi)	5.1.2 Excel – mine maler Prosjekt Skjema for risikovurdering - Risikoanalyse Prosjekt (SK Energi)
5.1.3 Manuals HSE manual SK Kraft Form for declaration of conformity	5.1.3 Håndbøker HMS-bok SK Kraft Skjema for samsvarserklæring
5.1.4 Manuals Operations Manager SK Kraft Instructions for AFA (work leaders) - FSE - Instruction no. 5	5.1.4 Håndbøker Driftsleder SK Kraft Instruks for AFA - FSE - Instruks nr. 5
5.1.5 Manuals Operations Manager SK Kraft Instructions for LFS (safety supervisors) - FSE - Instruction no. 4	5.1.5 Håndbøker Driftsleder SK Kraft Instruks for LFS - FSE - Instruks nr. 4
5.1.6 Manuals Operations Manager SK Kraft Instructions for LFK (switching supervisors) - FSE - Instruction no. 3	5.1.6 Håndbøker Driftsleder SK Kraft Instruks for LFK - FSE - Instruks nr. 3
5.1.7 JobTech Inspection – operation and maintenance of electrical installations	5.1.7 JobTech Tilsyn – drift og vedlikehold av elektriske anlegg
5.1.8 "Under Arbeid" (JobTech) Checklist for checking work on electrical installations	5.1.8 Under Arbeid (JobTech) Sjekkliste for kontroll av arbeid på elektriske anlegg
5.1.9 Manuals HMS manual SK Kraft Risk assessment – Methods (in preparation by HSE dept.)	5.1.9 Håndbøker HMS-bok SK Kraft Risikovurdering – Metode (Under arbeid v/ HMS-avd.)
5.1.10 Manuals HMS manual SK Kraft For for risk mapping - Risikoanalyse (in preparation by HSE dept.)	5.1.10 Håndbøker HMS-bok SK Kraft Skjema for risikokartlegging -Risikoanalyse (Under arbeid v/ HMS-avd.)

### 5.2 Internal references, Statkraft Energi AS

5.2.1 List of operations managers/operations officers and deputies	5.2.1 Liste over driftsledere/driftsansvarlige og stedfortredere
5.2.2 Governing document P-23 Supervision-operation and maintenance of electrical plants	
5.2.3 Governing document P-23/020 Protection systems, planning and maintenance	5.2.3 Styrende dokument P-23/020 Planlegging og vedlikehold av vern
5.2.4 Governing document P-23/135 Safety Supervisor LV and Safety Supervisor LV Nominators EN	5.2.4 Styrende dokument P-23/135 Ansvarlig For Arbeid (AFA) og utpeker av AFA
5.2.5 Governing document P-23/136 Live working	5.2.5 Styrende dokument P-23/136 Arbeid Under Spenning (AUS)
5.2.6 Governing document P-23/140 Instructions for Switching Supervisors	5.2.6 Styrende dokument P-23/140 Instruks for Leder for Kobling (LFK).
5.2.7 Governing document P-23/141 Switching Assistant	5.2.7 Styrende dokument P-23/141 Instruks for kobler
5.2.8 Governing document P-23/145 Instructions for Safety Supervisors HV	5.2.8 Styrende dokument P-23/145 Instruks for Leder for Sikkerhet (LFS)
5.2.9 Governing document P-23/146 Temporary Safety Substitute (TSS)	5.2.9 Styrende dokument P-23/146 Instruks for overvåker i høyspenningsanlegg
5.2.10 Governing document P-23/147 Form for appointment of Temporary Safety Substitute (TSS) in high-voltage installations	5.2.10 Styrende dokument P-23/147 Skjema for utpeking av overvåker

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5.2.11 Governing document P-23/170 Risk assessment – Declaration of conformity – Reporting to Transmission System Operator	5.2.11 Styrende dokument P-23/170 Risikovurdering – Samsvarserklæring – Innmelding til systemansvarlig
5.2.12 Governing document P-23/171 Form for declaration of conformity	5.2.12 Styrende dokument P-23/171 Skjema for samsvarserklæring
5.2.13 Governing document P-23/172 Form for risk assessment	5.2.13 Styrende dokument P-23/172 Skjema for risikovurdering
	5.2.14 Styrende dokument Doc-no 20-2 Isolering av energikilder med LOTO
	5.2.15 Styrende dokument Doc-no 18-91 Prosess for Arbeidstillatelse i Norge for P
5.2.16 Governing document I-40/200 Process Control Architecture Requirements	
5.2.17 Governing document H-10/500 Personal Protective Equipment (PPE)	
5.2.18 Statkraft's system for maintenance.	5.2.18 Vedlikeholdssystem Statkraft Energi AS

### 5.3 External references

5.3.1 FSE 2006 Safety regulations related to the maintenance and operation of electrical installations	5.3.1 FSE 2006 Forskrift om sikkerhet ved arbeid i og drift av elektriske anlegg
5.3.2 FEF 2006 Regulation on electrical supply installations	5.3.2 FEF 2006 Forskrift om elektriske forsyningsanlegg
5.3.3 FEL 1998 Regulation on electrical low-voltage installations	5.3.3 FEL 1999 Forskrift om elektriske lavspenningsanlegg
5.3.4 FEK 2013 Regulations for electrical enterprises and qualification requirements for work related to electrical installations and electrical equipment	5.3.4 FEK 2013 Forskrift om elektroforetak og kvalifikasjonskrav for arbeid knyttet til elektriske anlegg og elektrisk utstyr
5.3.5 FoS 2002 Regulations on System Operation	5.3.5 FoS 2002 Forskrift om systemansvaret
5.3.6 FIKS Functional requirements in the power system	5.3.6 FIKS Funksjonskrav i kraftsystemet
5.3.7 BFK Beredskapsforskriften (Emergency preparedness regulations).	5.3.7 BFK Beredskapsforskriften
5.3.8 Reporting of installation data to Statnett's operational data division	5.3.8 Innmelding av anleggsdata til Statnetts driftsdatakontor (DDK)