

Procedure

Electrical safety procedural works

Document ID: [SDOK-515-73](#), revision: 7.0

Confidentiality: K0 Statnett open information, can be shared with everyone

This copy was downloaded 16.08.2024 by [Jon Halvor Holtet](#).

The original document may have been published in a new revision or revoked since this copy was downloaded.

The current revision of this document can be downloaded here:

<https://samhandling.statnett.no/styrendedok/Dok.aspx?id=SDOK-515-73&language=1033>

Team: [Elsikkerhet](#)

Responsible: [Jon Halvor Holtet](#)

Document owner: [Endre Johan Hoel](#)

Verified: 16.08.2024 by [Jon Halvor Holtet](#)

Approved: 16.08.2024 by [Endre Johan Hoel](#)

Planned review by: 16.08.2027

Keywords: EI-sikkerhet

Contents

1	Purpose and validity	2
2	Intended audience	2
3	Access to Statnett's electrical installations	2
3.1	Locking up electrical installations	2
3.2	Issuing access cards and keys to electrical installations	2
3.3	Use of SMS notification by personnel in high-voltage installations.....	3
3.4	Following up SMS notifications for Regional Control Centre	4
4	Work Controller and Operation Controller	6
4.1	Communication between the Work Controller and the Operation Controller	6
4.2	Using Safety Observers within Statnett.....	7
4.3	Keeping records in substation installations and power-line installations	8
4.4	Voltage testing	9
4.5	Substation installations where BKK is the owner and has appointed its own Installation Manager on the busbar to be worked towards.....	10
4.6	Appointing Work Controller for work on disconnected or in the vicinity of high-voltage installations, and appointing Work Controller for work on or in the vicinity of low-voltage installations	11
4.7	Approval of external personnel for the role as low-voltage Work Controller at substation installations	16
4.8	Approval of external personnel for the role as high-voltage Work Controller at substation installations	17
4.9	Approval of external personnel for the role as Work Controller at transmission line installations.....	19
4.10	Disconnected power lines must always be earthed at both ends	20
5	Special operations	21
5.1	Construction, demolition and removal of disconnected high-voltage transmission lines and substations	21
5.2	Work on earthed and short-circuited cables.....	23
5.3	Work on circuit breakers in fields with double circuit breakers and double current transformers	23
5.4	Work in the secondary circuit on current transformers with the primary side disconnected	24
5.5	Use of camera on insulation rod	26
5.6	Impedance measurements/earthing plate measurements	27
5.7	Removal of ice on disconnected and earthed transmission line	28
5.8	Firefighting in and in the vicinity of Statnett's electrical installations	30
5.9	The execution of measurements with external voltage source in SF ₆ installations.....	31
5.10	Statnett's Klæbu training facility	36
5.11	Operation of busbar protection during rebuilding/new construction	37
6	Fault management at Statnett's installations	39
6.1	Faults at Statnett's installations.....	39
7	Maintenance and follow-up of Statnett's electrical installations	44
7.1	Statnett's electrical distribution systems	44
7.2	Statnett's low-voltage electrical installations that are not part of distribution systems	46
7.3	Follow-up of short-circuit currents in Statnett's high-voltage installations.....	47
8	Follow-up of requirements for documentation and notification in accordance with the Regulations related to Electrical Distribution Systems (FEF)	49
8.1	Documentation and notification of installations in accordance with FEF 2006 chapter 3	49
8.2	Risk assessment in accordance with Section 2-2 of FEF 2006	51
9	Definitions	52
10	Overview of template documents	54
11	Version log	54
12	Appendices	55
	Appendix 1 – Administrative procedures regarding the allocation of access via access cards from the Monitoring Centre	55
	Appendix 2 – Request for an access card for internal employees who already have a safety card and an access card	58

1 Purpose and validity

This document shows Statnett's procedural works relating to the FSE, FEF and FEK regulations, and is supplementary to provided instructions. The procedural works must be followed for the tasks that the document discusses, and they specify a uniform practice. Deviations may be made in specific areas under section 5, which relates to the performance of specific types of work, if a risk assessment indicates that it is likely that the same or better level of safety will thereby be achieved. The main purpose of this document is to safeguard personal safety and to ensure that the installations are built, operated, maintained and documented in accordance with the requirements of the regulations.

2 Intended audience

All who work with and in Statnett's electrical installations.

3 Access to Statnett's electrical installations

3.1 Locking up electrical installations

- 3.1.1 Gates/doors that are operated by access card or key and that lead into high-voltage constructions, as well as low-voltage constructions that are not protected against contact, must be kept locked.
- 3.1.2 In cases where gates/doors must be kept open, these must be monitored to prevent unwanted access to the facilities.
- 3.1.3 The gate must not be left until it has been visually determined that it is closed.
- 3.1.4 If it is not possible to lock the gate with the help of the motor drive, the gate must be locked by chain/padlock and suitable key.

3.2 Issuing access cards and keys to electrical installations

- 3.2.1 The Installation Manager authorises personnel to request keys to electrical installations (AN). This is done in the safety card database.
- 3.2.2 Access cards/keys to electrical installations must only be issued to personnel with a valid access permit (AT). The request should preferably be made in writing. For administrative procedures for access cards issued by the Monitoring Centre, see Appendix 1.
- 3.2.3 For access cards/keys that also give access to computer rooms/server rooms in the H and R installations, the manager of the Hybrid data centre (TBH) or someone they authorise must also approve the access. For independent access to computer rooms/server rooms in the H and R installations and associated technical rooms, valid access clearance and authorisation are required in accordance with the Security Act. See also the instructions [Access to Statnett's administration buildings and central offices with technical rooms](#) (limited access).
- 3.2.4 When access cards/keys to electrical installations are issued, the list of issued access cards/keys must be updated in the safety card database. The Monitoring Centre updates the

list of activated access cards in the safety card database, and the personnel who issue keys email a notification to sikkerhetskort@statnett.no for the safety card database to be updated.

- 3.2.5 When access cards/keys to electrical installations are handed in, notification is sent to the Monitoring Centre or the person who issued the keys. The Monitoring Centre removes the access card from the safety card database, and the personnel who receive handed-in keys email a notification to sikkerhetskort@statnett.no for the safety card database to be updated. At the latest when the safety card expires, the access card/key to electrical installations must be made invalid/recovered. This will take place under the direction of the Monitoring Centre and the responsible line manager, upon notification from sikkerhetskort@statnett.no.
- 3.2.6 If an access card/key is lost, the loss must be reported to the Installation Manager, the immediate line manager and sikkerhetskort@statnett.no (by the person who has lost the access card/key). If an access card is lost, this must also be notified to the Monitoring Centre. See also Instructions for Access Keys and Locking Systems in Statnett Substations (SDOK-510-16).

3.3 Use of SMS notification by personnel in high-voltage installations

- 3.3.1 SMS for Entry Registration (only mobile phones registered in Norway with a Norwegian main SIM card may be used):
- 3.3.2 When personnel will be in the vicinity of high-voltage components remotely controlled by the Regional Control Centre, at least one person in the group must register when entering. This person will be responsible for ensuring that everyone has exited the installation before an exit text message is sent. In addition, all appointed as Work Controller at our substations must register their entering when work is in progress. For our high-voltage transmission lines, only designated Work Controller for work in the vicinity of live installations need to register by SMS when work is in progress.
- 3.3.3 Register entry for a substation installation by sending an SMS:
- INN <space><name of installation><space><voltage level> to 26444 (voltage level is filled out to notify the whereabouts of the staff and may be omitted)
 - Example 1: INN NEDRE RØSSÅGA 300 to 26444 (use space between the words when the station name consists of two words)
 - <name of installation> can also be written as a three-letter abbreviation as used by IFS
 - Example 2: INN NRØ 300 to 26444

The following receipt message will be received in both examples:

*Du er registrert inn i høyspenningsanlegg. STASJON: NEDRE RØSSÅGA
Spenningsnivå: 300 kV Tid: 10:45 16.06.2023*

(You have hereby registered entry to a high-voltage installation. SUBSTATION:
NEDRE RØSSÅGA Voltage level: 300 kV Time: 10:45 16.06.2023)

3.3.4 Register entry for high-voltage transmission lines by sending an SMS:

- INN <space><voltage level><name of high-voltage transmission line> to 26444
- Example 3: *INN 300 BLÅFALLI-HUSNES 1* (there should be a space between the transmission line name and the number, as here). The voltage level of the high-voltage transmission line must always be included
- <name of high-voltage transmission line> can also be written as the first four digits of the high-voltage transmission line number as used by IFS
- Example 4: *INN 300L0383*
- The voltage level of the high-voltage transmission line must always be included

The following receipt message will be received in both examples:

*Du er registrert inn i høyspenningsanlegg. LEDNING: BLÅFALLI-HUSNES 1
Spenningsnivå: 300 kV Tid: 10:47 16.06.2023*

(You have hereby registered entry to a high-voltage installation. TRANSMISSION LINE: BLÅFALLI-HUSNES 1 Voltage level: 300 kV Time: 10:47 16.06.2023)

3.3.5 Personnel must never enter a high-voltage installation nor initiate work in the vicinity of a high-voltage installation/transmission line before receiving a receipt message. Check that the correct information appears in the receipt message you have received. If you do not receive a receipt message, please try to register one more time. If you still do not receive a receipt message, please call the relevant Regional Control Centre to register entry.

3.3.6 SMS for Exit Registration (only mobile phones registered in Norway with a Norwegian main SIM card may be used):

3.3.7 The following text message is to be sent by entry-registered personnel who want to exit an installation:

- *UT* to 26444
- Example: *UT*

The following receipt message will be received:

*Du er registrert ut av høyspenningsanlegget.
Stasjonsanlegg: Husk å låse anlegget når du forlater det.
Motoriserte skyveporter: Vent til disse er lukket før du forlater porten.*

(You have hereby registered exit from a high-voltage installation.

Substation: Remember to lock the installation when you leave.

Motorised sliding gates: Wait until these are closed before you leave.)

3.3.8 If you do not receive a receipt message, please try to register one more time. If you do not receive a receipt message, please call the relevant Regional Control Centre to register exit manually.

3.3.9 When performing work at high-voltage installations, consider further measures in addition to the SMS notification to the Regional Control Centre – in particular, consider automatic switching operations in collaboration with the relevant Regional Control Centre.

3.4 Following up SMS notifications for Regional Control Centre

3.4.1 For each connection made by Operation Controller, the list “*Innmelding i anlegg i Sveve*” (“Registration of entry to installations at Sveve”) must be checked to ensure that there are no

registered personnel in the vicinity of our installations. This also applies to work in the vicinity of our transmission line installations.

- 3.4.2 Operation Controller is only responsible for checking that the list does not contain the names of people in the relevant installation, for the stated voltage level, before connecting.
- 3.4.3 If Operation Controller cannot get hold of a person who is registered in the installation, after trying the specified mobile phone and substation phone, a connection can be made.
- 3.4.4 If the system is out of order, Operation Controller must call the relevant substation phone before connecting. If Operation Controller cannot get hold of personnel, a connection can be made.
- 3.4.5 The Regional Control Centre must update the list manually when a person calls and requests registration into an installation. This can be done by logging in as an administrator. Select this option on the login page for Sveve.
- 3.4.6 The Regional Control Centre must, at the request of other cooperating power companies, inform whether there are personnel on the list registered in the installation in question.
- 3.4.7 In an emergency, where there is a danger to life and health, switches can be **DISCONNECTED** without the above points being carried out.
- 3.4.8 Log in to: <https://sys.sveve.no/w1/kunde/statnett/> with your assigned password to see a list of registered personnel inside all of Statnett's installations.
- 3.4.9 In the event of an error, the error must be reported to Sveve via the assigned email address. The email must contain as much information as possible, and as a minimum:
- A general description of the error
 - The subsystem involved: registering into installations, Work Controller in the vicinity, Work Controller disconnected, Installation Manager, boat Førre or cable tunnel?
 - The time the error arose
 - The mobile numbers the error relates to
 - Any error messages received
- Sveve will confirm receipt of the email ASAP.
- 3.4.10 In the event of critical errors, or where Sveve does not confirm receipt of the error report within a reasonable time, the assigned telephone number can be used.
- 3.4.11 The phone line is staffed from 08:00 until 22:00 on weekdays, and from 09:00 until 18:00 at weekends and on public holidays.
- 3.4.12 It is important to note that the telephone should only be used in the event of critical errors, or if contact cannot be made by email.

4 Work Controller and Operation Controller

4.1 Communication between the Work Controller and the Operation Controller

4.1.1 Operation Controller to local personnel (internal and external)/other party's Operation Controller:

4.1.1.1 *I request that the following disconnectors <breaker's identification tag> be labelled, secured and inspected in position OUT (or bay(s) be secured against energising):
(Voltage level must always be given).*

4.1.1.2 *I request that the following earthing switches <breaker's identification tag> be labelled, secured and inspected in position IN (or bay(s) be terminal earthed):
(Voltage level must always be given).*

4.1.2 Local personnel (internal and external)/other party's Operation Controller to Operation Controller:

4.1.2.1 *I confirm that the following disconnectors <breaker's identification tag> are labelled, secured and inspected in position OUT (or bay(s) is/are secured against energising):
(Voltage level must always be given).*

4.1.2.2 *I confirm that the following earthing switches <breaker's identification tag> are labelled, secured and inspected in position IN (or bay(s) is/are terminal earthed):
(Voltage level must always be given).*

4.1.3 Operation Controller in dialogue with the person to be appointed as Work Controller:

4.1.3.1 *I confirm that <name of component(s)> is/are secured against energising at the following locations:
(Voltage level must always be given) (For work on high-voltage transmission lines it must as a minimum be confirmed that the line is secured).*

4.1.3.2 *I confirm that <name of component(s)> has/have secured terminal earthing at the following locations (or indicate missing terminal earthing):
(Voltage level must always be given) (For work on high-voltage transmission lines it must as a minimum be confirmed that the line is terminal earthed).*

4.1.4 Operation Controller in dialogue with the person to be appointed as Work Controller:

4.1.4.1 *I <name of Operation Controller> appoint you as Work Controller, and record <substation/transmission line> Work Controller <name of Work Controller> for work on <component(s)/transmission line>. The time of the appointment is <time>, and the Work Controller number for the appointment is <Work Controller number>.*

4.1.5 The person to be appointed as Work Controller in dialogue with the Operation Controller:

4.1.5.1 *I <name of Work Controller> am planning to use the following number of portable earthing devices <number>.*

4.1.5.2 *I have now been appointed as Work Controller by <name of Operation Controller> on <substation/transmission line> for work on <component(s)/transmission line>. The time of the appointment is <time> and the Work Controller number for the appointment is <Work Controller number>.*

- 4.1.6 Work Controller in dialogue with the Operation Controller when work has been completed:
- 4.1.6.1 *I <name of Work Controller> have removed the following number of portable earthing devices <number>.*
- 4.1.6.2 *I <name of Work Controller> request to terminate work on <component(s)/transmission line>. The time of the appointment was <time> and the Work Controller number for the appointment was <Work Controller number>.*
- 4.1.7 Operation Controller in dialogue with the Work Controller when work has been completed:
- 4.1.7.1 *I have understood that you wish to terminate the work, and I record <substation/transmission line> Work Controller <name of Work Controller> terminates the work on <component/transmission line>. You were appointed for this work at <time/date> with Work Controller number <Work Controller number>. The time of your work termination is <time>. The Operation Controller is <name of Operation Controller>.*
- 4.1.8 Operation Controller to substation personnel (internal and external)/other party's Operation Controller after all concerned parties have reported the work as terminated:
- 4.1.8.1 *I request that securing of the following terminal earthing switches be removed: <breaker's identification tag> (Voltage level must always be given).*
- 4.1.8.2 *I request that securing of the following installations (or disconnectors <breaker's identification tag>) be removed: (Voltage level must always be given).*
- 4.1.9 Substation personnel (internal and external)/other party's Operation Controller to Operation Controller after reversal of established safety measures:
- 4.1.9.1 *I confirm that securing of the following terminal earthing devices has been removed: <breaker's identification tag> (Voltage level must always be given).*
- 4.1.9.2 *I confirm that securing of the following installations (or disconnectors <breaker's identification tag>) has been removed: (Voltage level must always be given).*

4.2 Using Safety Observers within Statnett

- 4.2.1 The Work Controller should ideally be present at the worksite for as long as the work that requires the Work Controller is ongoing. If the Work Controller has to leave the worksite, a Safety Observer must be appointed. The Work Controller must then instruct the Safety Observer with regard to the specific conditions to be monitored, which must also be documented in a prepared appendix to the Instructions for the Work Controller. The Safety Observer should normally have the same qualifications as the Work Controller.
- 4.2.2 If the work to be monitored is work related to electrical installations or electrical equipment, and thus falls under the scope of the Regulations for Electrical Enterprises and Qualification Requirements for Work Related to Electrical Installations and Electrical Equipment (FEK), the Safety Observer must meet the relevant qualification requirements or have relevant DSB approval (see Instructions for planning of work in electrical installations, SDOK-515-36, for more information).
- 4.2.3 Deviations from the qualification requirements for Safety Observers may be made in cases where the work to be supervised is not work related to electrical installations or electrical equipment. The Work Controller must instruct the Safety Observer about the specific safety

measures to be monitored, and these must also be documented in a prepared appendix to the Instructions for the Work Controller. One example would be digging in the vicinity of a disconnected and terminal earthed high-voltage line with a suspended less-than-fully-dimensioned earth where the work is in progress, where the Safety Observer must monitor that the earth is in place.

4.3 Keeping records in substation installations and power-line installations

4.3.1 In all **substations** the following items must be available:

- Duty journal
- Safety protocol
- A red stamp for documentation of appointment as Work Controller by Operation Controller for specific work
- A green stamp for documentation of “work complete” notification from Work Controller to Operation Controller for specific work

4.3.2 The following must be entered in the duty journal:

- All local/manual connections of high-voltage breakers with breaker’s identification tag
- Establishing and discontinuation of labelling, securing and inspection (MSI)
- All observations and incidents during and outside normal working hours that are significant for operations, and that have been verbally communicated to Operation Controller
- The date and time that observations and events were communicated
- The name of the person entering the record and any contact person, Operation Controller, at the Regional Control Centre

4.3.3 The safety protocol must include:

- Date and time
- All appointments of Work Controller by Operation Controller for specific work (stamped with a red stamp)
- All earthings that Work Controller has established in the installation
- All earthings that Work Controller has decommissioned in the installation
- All “work complete” notifications from Work Controller to Operation Controller for specific work (stamped with a green stamp)

4.3.4 All appointments of Work Controller by Operation Controller for specific work must be marked in the safety protocol with a red stamp with the following text:

Utpekt LfS: (Appointed as Work Controller:)

For arbeid på: (For work on:)

Utpekt av LfK: (Appointed by Operation Controller:)

LfS-nr: (Work Controller no.):

- 4.3.5 “Work complete” notification from Work Controller to Operation Controller for specific work must be marked in the security protocol with a green stamp with the following text:

LfS-nr: (Work Controller no.:

Utpekt LfS: (Appointed as Work Controller:)

Klarmelder arbeid på: (Notified work complete on:)

Dato / kl: (Date/time:)

Klarmeldt til LfK: (Notified work complete to Operation Controller:)

- 4.3.6 Everyone appointed as Work Controller for work on earthed and short-circuited **transmission line systems** must be provided with a small notepad for recording:

- all appointments of Work Controller by Operation Controller for specific work on earthed and short-circuited transmission line systems
- all “work complete” notifications from Work Controller to Operation Controller for specific work on earthed and short-circuited transmission line systems
- all earthings established on the transmission line
- all earthings that have been decommissioned

4.4 Voltage testing

4.4.1 Responsibility of Operation Controller

Planning and executing switching operations is conducted according to Instructions for the Operation Controller.

The installation part(s) is/are disconnected, terminal earth established if necessary, and labelled, secured and inspected (MSI) in both/all ends according to Instructions for the Operation Controller.

4.4.2 Methods for voltage testing

Method 1:

When Work Controller is appointed by Operation Controller, voltage can be tested with an approved voltage indicator in accordance with NEK EN 61243-1, -2, -3 or -5 that has a valid sticker; also check that the equipment is in satisfactory condition in accordance with the user manual.

During voltage testing there must be at least two people present, and at least one of them must be approved as Work Controller for work on, or in the vicinity of, earthed and short-circuited installations. For the other person, an access permit to the installation is required and they must be fully qualified or approved for the task by the Directorate for Civil Protection (DSB) (see Instructions for planning of work in electrical installations, SDOK-515-36, for more information).

Method 2:

This method is an alternative for voltage testing and can only be used on transmission line with a nominal voltage above 145kV where standard equipment is not available or can be used. It requires that terminal earth is established in both/all ends of the transmission line where voltage can be applied, and that MSI has been carried out.

When terminal earth has been confirmed in both/all ends of the transmission line and MSI has been confirmed carried out from Operation Controller, voltage testing is carried out with a remote electric field detector. It must be checked by two persons that the name of the transmission line is according to the information provided by the Operation Controller. In addition to Work Controller, the name of the transmission line must also be checked by another person. For the other person, an access permit to the installation is required and fully qualified or approved for the task by the Directorate for Civil Protection (DSB) is mandatory (ref. [instruks for planlegging av arbeid i elektriske anlegg](#) (Instructions for planning of work in electrical installations – only in Norwegian) for more information). The tower number must be written down in the JSA.

The remote electric field detector must be checked annually and tested on an active installation as close to the work as possible. The time for control and testing against an active installation must be stated in the JSA.

These instructions are valid until a permanent method has been found to carry this out in accordance with the governing regulations.

Method 3:

If performing voltage testing by Petersen coil, where a remote-controlled terminal earthing has not been established, the following actions must be carried out in the following order:

- Before the Petersen coil is disconnected, its voltage measurement must be read by the Operation Controller in the operations centre's system. This is done at the request of the person who will be the Work Controller for the work.
- The voltage across the coil must be measured. If the voltage initially shows 0 kV, the coil must be regulated, so that the connected network comes closer to resonance. This will ensure a voltage value across the coil different from 0 kV.
- When the coil is disconnected from all connection points, Operation Controller must check that the voltage measurement shows 0 kV.
- After disconnection, the switches must be secured in the usual manner by Operation Controller (MSI).
- When appointing Work Controller, Operation Controller must state the voltage before and after the coil is disconnected. MSI is then confirmed in the usual manner, before Work Controller is appointed.
- Work Controller must ensure, together with another person who as a minimum has independent access and is fully qualified or approved for the task by DSB (see Instructions for planning of work in electrical installations, SDOK-515-36, for more information), that the coil to be worked on is disconnected in the correct places.
- Work Controller must use insulating gloves and a visor, in addition to required personal protective equipment, when establishing temporary earthing.

4.5 Substation installations where BKK is the owner and has appointed its own Installation Manager on the busbar to be worked towards

- 4.5.1 BKK and Statnett have highlighted the following possibility in joint connection agreements: Statnett's Work Controller has been given the authority to use BKK's busbar terminal earthing

as temporary earthing if necessary. The reason is that BKK only uses its busbar terminal earthings as temporary earthing.

4.5.2 Establishing busbar terminal earthing as temporary earthing

The Work Controller is responsible for establishing visible temporary earthing at the worksite. When planning the work, Work Controller must plan to use busbar terminal earthing as temporary earthing where it is necessary to earth BKK's busbar.

After Statnett's Operation Controller has appointed a Work Controller in connection with the work, Work Controller can establish BKK's busbar terminal earthing and use it as their temporary earthing. In the event of parallel activities, where either BKK's personnel or those of Statnett's other work teams are dependent on that terminal earthing, the situation should be handled by means of on-site dialogue. The person establishing the busbar terminal earthing must also indicate the use of the terminal earthing by their own labelling, clearly showing the name and telephone number of Work Controller.

If a busbar terminal earthing is already established by the time Statnett's Operation Controller has appointed a Work Controller, Work Controller must contact the person who established the busbar terminal earthing and explain what they need. Each Statnett Work Controller must also indicate the use of the terminal earthing by their own labelling, clearly showing the name and telephone number of Work Controller.

4.5.3 Decommissioning busbar terminal earthing as temporary earthing

Once Work Controller has finished the work, but before "work complete" notification has been sent to Statnett's Operation Controller, Work Controller must remove their labelling and ensure that there is no one else in the installation who is dependent on the busbar terminal earthing. If there are no other personnel using the busbar terminal earthing as their temporary earthing, Work Controller must decommission the busbar terminal earthing. If there are other personnel using the busbar terminal earthing, Work Controller must explain to them that Work Controller has completed their work and that their own labelling has been removed.

4.6 **Appointing Work Controller for work on disconnected or in the vicinity of high-voltage installations, and appointing Work Controller for work on or in the vicinity of low-voltage installations**

4.6.1 Notification of entry and exit from a high-voltage installation must follow normal procedures as stipulated in use of SMS notification by personnel in high-voltage installations and is in addition to this section.

4.6.2 There is no connection between the database for appointing a Work Controller (Sveve) and the safety card database. Therefore, it is necessary to manually check that the person who will be appointed is approved to be appointed. The Appointer's safety card must indicate that they are authorised to appoint a Work Controller in the vicinity of a high-voltage installation (UL is ticked) or authorised to appoint a Work Controller for a low-voltage installation (UA is ticked) for the relevant installation.

4.6.3 Procedure for appointing a Work Controller (HVWC) for work in the vicinity of an energised high-voltage installation¹ (only mobile phones registered in Norway with a Norwegian main SIM card may be used).

4.6.3.1 The Appointer sends an SMS to 26444: «HVWC <mobile telephone number of Appointee> <description of the installation>» (max. 50 chars including spaces)

For example: «HVWC 91234567 ALT field KVÆ 1 and KVÆ 2 132 kV»

4.6.3.2 The Appointer receives the following SMS from 26444: «HVWC in the vicinity appointed. Name: <Name of Appointee>. Installation: <description of installation> No. <number>». <number> is a sequential number generated by Sveve for all appointments.

For example: «HVWC in the vicinity appointed. Name: John Smith. Installation: Alta field KVÆ 1 and KVÆ 2 132 kV No. 10021»

4.6.3.3 The Appointee receives an SMS from 26444:

For example: «You are appointed as Work Controller in the vicinity of installation: Alta field KVÆ 1 and KVÆ 2 132 kV No. 10021. Confirm by sending "HVWC OK 10021" to 26444»

4.6.3.4 The Appointee confirms the appointment by sending an SMS to 26444 (adding the <number> is optional if you only have one appointment).

For example: «HVWC OK 10021»

4.6.3.5 The Appointee receives the following SMS from 26444: «Confirmation registered. Remember to sign out by sending "HVWC OUT <number>" to 26444».²

For example: «Confirmation registered. Remember to sign out by sending "HVWC OUT 10021" to 26444»

4.6.3.6 The Appointer receives an SMS from 26444:

For example: «HVWC in the vicinity confirmed. No. 10021 Installation: Alta field KVÆ 1 and KVÆ 2 132 kV Name: John Smith (91234567)»

4.6.3.7 When the work has been completed, the appointed Work Controller sends an SMS to 26444.

For example: «HVWC OUT 10021»

¹ Personnel with mobile phone numbers registered to the company: The name of the person must be entered right after the name of the substation/transmission line. If there is no mobile signal available, the appointing must be documented in another way, such as in a local duty journal or in a dedicated notepad (transmission line).

² After 30 days, the Appointee will be notified that the appointment will be terminated, with the option of extending the appointment themselves if done within seven days. If this is not done within seven days, the appointment will be terminated automatically. The Appointer and Appointee will receive an SMS when the system terminates the appointment.

4.6.3.8 *The appointed Work Controller in the vicinity receives an SMS confirming that the appointment has ended.*

For example: «HVWC appointment ended. No. 10021 Installation: Alta field KVÆ 1 and KVÆ 2 132 kV Name: John Smith (91234567)»

4.6.3.9 *The Appointer receives confirmation that the appointment has ended.*

For example: «HVWC appointment ended. No. 10021 Installation: Alta field KVÆ 1 and KVÆ 2 132 kV Name: John Smith (91234567)»

4.6.3.10 *To check the status of your HVWC appointments, send «My HVWC» to 26444. An SMS with the status of your HVWC appointments will be received from 26444.*

4.6.4 Procedure for appointing a Work Controller (LVWC) for work on or in the vicinity of a low-voltage installation³ (only mobile phones registered in Norway with a Norwegian main SIM card may be used).

4.6.4.1 *The Appointer sends an SMS to 26444: «LVWC <mobile telephone number of Appointee> <description of the installation>» (max. 50 chars including spaces)*

For example: «LVWC 91234567 ALT Main switchboard 43.00»

4.6.4.2 *The Appointer receives the following SMS from 26444: «LVWC appointed. Name: <Name of Appointee>. Installation: <description of installation> No. <number>». <number> is a sequential number generated by Sveve for all appointments.*

For example: «LVWC appointed. Name: John Smith. Installation: Alta Main switchboard 43. No. 10099»

4.6.4.3 *The Appointee receives an SMS from 26444.*

For example: «You are appointed as Work Controller Installation: Alta Main switchboard 43. No. 10099. Confirm by sending: "LVWC OK 10099" to 26444»

4.6.4.4 *The Appointee confirms the appointment by sending an SMS to 26444 (adding the <number> is optional if you only have one appointment).*

For example: «LVWC OK 10099»

³ Personnel with mobile phone numbers registered to the company: The name of the person must be entered right after the name of the substation/transmission line. If there is no mobile signal available, the appointing must be documented in another way, such as in a local duty journal or in a dedicated notepad (transmission line).

- 4.6.4.5 *The Appointee receives the following SMS from 26444: «Confirmation registered. Remember to sign out by sending "LVWC OUT <number>" to 26444»⁴*
- For example: «Confirmation registered. Remember to sign out by sending "LVWC OUT 10099" to 26444»*
- 4.6.4.6 *The Appointer receives an SMS from 26444.*
- For example: «LVWC confirmed. No. 10099. Installation: Alta Main switchboard 43. Name: John Smith (91234567)»*
- 4.6.4.7 *When the work has been completed, the appointed Work Controller sends an SMS to 26444 (adding the <number> is optional if you only have one appointment).*
- For example: «LVWC OUT 10099»*
- 4.6.4.8 *The appointed Work Controller receives an SMS confirming that the appointment has ended.*
- For example: «LVWC appointment ended 10099 Installation: Alta Main switchboard 43. Name: John Smith (91234567)»*
- 4.6.4.9 *The Appointer receives confirmation that the appointment has ended.*
- For example: «LVWC appointment ended. No. 10099 Installation: Alta Main switchboard 43. Name: John Smith (91234567)»*
- 4.6.4.10 *To check the status of your LVWC appointments, send «My LVWC» to 26444. An SMS with the status of your LVWC appointments will be received from 26444.*
- 4.6.5 Procedure for appointing internal personnel as Work Controller (LfSf) for work on disconnected high-voltage installations during construction or dismantling⁵ (only mobile phones registered in Norway with a Norwegian main SIM card may be used).
- 4.6.5.1 *The Appointer sends an SMS to 26444: «LfSf <mobile telephone number of Appointee> <description of installation>» (max. 50 chars including spaces)*
- For example: «LfSf 91234567 From tower 10-15 on 420 kV transmission line Aurland1-Sogndal»*

⁴ After 30 days, the Appointee will be notified that the appointment will be terminated, with the option of extending the appointment themselves if done within seven days. If this is not done within seven days, the appointment will be terminated automatically. The Appointer and Appointee will receive an SMS when the system terminates the appointment.

⁵ The Appointer's safety card must indicate that they are authorised to appoint a Work Controller in the vicinity of a high-voltage installation (UL is ticked) for the relevant installation. If there is no mobile signal available, the appointing must be documented in another way, such as in a local duty journal or in a dedicated notepad (transmission line).

4.6.5.2 The Appointer receives the following SMS from 26444: «LfS på frakoblet utpekt (on disconnected appointed). Navn (Name): <Name of Appointee>. Anlegg (Installation): <description of installation> Nr (No.) <number>». <number> is a sequential number generated by Sveve for all appointments.

For example: «LfS på frakoblet utpekt (on disconnected appointed). Navn (Name): John Smith. Anlegg (Installation): From tower 10-15 on 420 kV transmission line Aurland1-Sogndal Nr (No.) 10004»

4.6.5.3 The Appointee receives an SMS from 26444.

For example: «Du er utpekt som LfS på frakoblet Anlegg: (You are appointed as Work Controller on a disconnected installation): From tower 10-15 on 420 kV transmission line Aurland1-Sogndal Nr (No.) 10004 Bekreft ved å sende (Confirm by sending): "LfS OK 10004" til (to) 26444».

4.6.5.4 The Appointee confirms the appointment by sending an SMS to 26444 (adding the <number> is optional if you only have one appointment).

For example: «LfS OK 10004»

4.6.5.5 The Appointee receives the following SMS from 26444: «Bekreftelse registrert (Confirmation registered). Husk å melde ut ved å sende (Remember to sign out by sending) "LfS UT (OUT) <number>" til (to) 26444»⁶

For example: « Bekreftelse registrert (Confirmation registered). Husk å melde ut ved å sende (Remember to sign out by sending) "LfS UT (OUT) 10004" til (to) 26444»

4.6.5.6 The Appointer receives an SMS from 26444.

For example: «LfS på frakoblet bekreftet (Work Controller on disconnected confirmed). Nr (No.) 10004 Anlegg (Installation): From tower 10-15 on 420 kV transmission line Aurland1-Sogndal. Navn (Name): John Smith (91234567)»

4.6.5.7 When the work has been completed, the appointed Work Controller on disconnected installation sends an SMS to 26444 (adding the <number> is optional if you only have one appointment).

For example: «LfS UT (OUT) 10004»

4.6.5.8 The appointed Work Controller on disconnected installation receives an SMS confirming that the appointment has ended.

For example: «Utmeldt (Signed out) LfS 10004»

⁶ After 30 days, the Appointee will be notified that the appointment will be terminated, with the option of extending the appointment themselves if done within seven days. If this is not done within seven days, the appointment will be terminated automatically. The Appointer and Appointee will receive an SMS when the system terminates the appointment.

4.6.5.9 *The Appointer receives confirmation that the appointment has ended.*

For example: «Lfsf utmeldt (signed out). Nr (No.) 10004 Anlegg (Installation): From tower 10-15 on 420 kV transmission line Aurland1-Sogndal. Navn (Name): John Smith (91234567)»

4.6.5.10 *To check the status of your Work Controller on disconnected installation appointments, send «Mine Lfsf (My Lfsf)» to 26444. An SMS with the status of your Work Controller on disconnected installation appointments will be received from 26444.*

4.7 Approval of external personnel for the role as low-voltage Work Controller at substation installations

4.7.1 The contractor, through recommendation from the Installation Manager, nominates candidates for approval for the role as Work Controller at Statnett substation installations. The candidate must fulfil the required qualifications⁷ for personnel who construct and maintain electrical installations in accordance with the Regulations for Electrical Enterprises and Qualification Requirements for Work Related to Electrical Installations and Electrical Equipment (FEK). In addition, the candidate must be able to communicate in Norwegian, and must have completed internal training in the role of Work Controller within their own organisation. The candidate must also be able to demonstrate practice in the role as Work Controller at distribution systems.

4.7.2 The Project Manager⁸ must examine the candidate's background in respect of the requirements stated in section 4.7.1 and confirm to the contractor and the affected operating area whether the candidate is qualified to attend the courses arranged by Statnett. By attending the course, the candidate will learn to practise the role as Work Controller in compliance with Statnett instructions and procedures.

4.7.3 The Project Manager must ensure that the candidate has completed the required Statnett e-learning courses before local training of the candidate begins. Courses in FSE and first aid must have been completed in advance through their own organisation.

4.7.4 The candidate must complete local training in the area of the installation where they will have the role of Work Controller. The Project Manager is responsible for coordinating local training between the contractor, the project and the affected operating area.

4.7.5 The affected operating area is responsible for holding the local training. It must be ensured that the necessary conversations are held with the candidate to check that they are suitable, both professionally and personally. It must be shown that they take safety seriously. The local training must, as a minimum, ensure that the candidate knows the following about the installation:

- Where the necessary equipment is located. Usage instructions and documented training if applicable.
- What is energised and what is disconnected.
- Labelling and cordoning.

⁷ A relevant certificate or relevant approval from DSB (the Norwegian Directorate for Civil Protection) is sufficient qualification (see Instructions for planning of work in electrical installations, SDOK-515-36, for more information).

⁸ Or someone to whom the Project Manager has given this authority.

- Introduction to the structure of the installation by reviewing a single-line diagram.
- Other activities in the installation.
- Emergency response plan.

4.7.6 The operating area must have a meeting with the candidate to discuss relevant points for Work Controller in Statnett's instructions and key points in electrical safety procedure, as a minimum the sections:

- 3.1 Locking up electrical installations
- 3.3 Use of SMS notification by personnel in high-voltage installations
- 4.6 Appointing Work Controller for work on disconnected or in the vicinity of high-voltage installations, and appointing Work Controller for work on or in the vicinity of low-voltage installations
- 5.4 Work in the secondary circuit on current transformers with the primary side disconnected

It is particularly important to review how the work in control installations/low-voltage installations are planned and risk assessed in Statnett, and how the interaction between Work Controller and the operating area should take place. Based on this conversation, an assessment must be made as to whether the person is aware of their responsibilities and can be recommended.

4.7.7 The Installation Manager⁹ finally approves the candidate in the role as Work Controller, at the request of the Local Area Manager for the relevant area or someone to whom they have given this authority.

4.8 Approval of external personnel for the role as high-voltage Work Controller at substation installations

4.8.1 The contractor, through recommendation from the Installation Manager, nominates candidates for approval for the role as Work Controller at Statnett substation installations. The candidate must fulfil the required qualifications¹⁰ for personnel who construct and maintain electrical installations in accordance with the Regulations for Electrical Enterprises and Qualification Requirements for Work Related to Electrical Installations and Electrical Equipment (FEK). In addition, the candidate must be able to communicate in Norwegian, and must have completed internal training in the role of Work Controller within their own organisation. The candidate must also be able to demonstrate practice in the role of Work Controller in relevant distribution systems, for example in regional grid installations of 47 kV, 66 kV or 132 kV.

4.8.2 The Project Manager¹¹ must examine the candidate's background in respect of the requirements stated in section 4.8.1 and confirm to the contractor and the affected operating area whether the candidate is qualified to attend the courses arranged by Statnett. By attending the course, the candidate will learn to practise the role as Work Controller in compliance with Statnett instructions and procedures.

⁹ Or someone to whom the Installation Manager has given this authority.

¹⁰ A relevant certificate or relevant approval from DSB (the Norwegian Directorate for Civil Protection) is sufficient qualification (see Instructions for planning of work in electrical installations, SDOK-515-36, for more information).

¹¹ Or someone to whom the Project Manager has given this authority.

- 4.8.3 The Project Manager must ensure that the candidate has completed the required Statnett e-learning course(s) before a central course and local training of the candidate begins. Courses in FSE and first aid must have been completed in advance through their own organisation.
- 4.8.4 The candidate must complete and pass a central course and be given local training in the area of the installation where they will have the role of Work Controller. The Project Manager is responsible for coordinating the central course and local training between the contractor, project, administrator for the central course and the affected operating area.
- 4.8.5 The central course for Work Controllers will deal with Statnett's instructions and electrical safety procedure that is relevant for Work Controllers. It is particularly important to review how the work in substation installations is planned and risk assessed at Statnett, and how the interaction between Work Controller and the operating area should take place.
- 4.8.6 The central course will provide a practical approach in the form of education and training in:
- Establishment and use of earthing in the installation and other safety measures:
 - On earthed and short-circuited installations:
 - Principle of MSI
 - Establishing earthing
 - Establishing labelling and cordoning
 - Practical implementation of a conversation with the relevant Regional Control Centre in relation to communication between Operation Controller and Work Controller
 - For work in the vicinity of high-voltage installations:
 - Assessment of risk and outer limit of vicinity zone
 - Establishing labelling and cordoning
 - Practical test of appointment in Sveve
 - Having sufficient conversations with the candidate throughout the training, to ensure an assessment of whether the candidate is suitable, both professionally and personally.
 - Test with relevant questions.
- 4.8.7 The affected operating area is responsible for holding the local training. It must be ensured that the necessary conversations are held with the candidate to check that they are suitable, both professionally and personally. It must be shown that they take safety seriously. The local training must, as a minimum, ensure that the candidate knows the following about the installation:
- Where the necessary equipment is located. Usage instructions and documented training if applicable.
 - What is energised and what is disconnected.
 - Labelling and cordoning.
 - Introduction to the structure of the installation by reviewing a single-line diagram.
 - Review of connection agreements.
 - Other activities in the installation.
 - Emergency response plan.

4.8.8 The Installation Manager¹² finally approves the candidate in the role as Work Controller, at the request of the Local Area Manager for the relevant area or someone to whom they have given this authority.

4.9 Approval of external personnel for the role as Work Controller at transmission line installations

4.9.1 The contractor, through recommendation from the Installation Manager, nominates candidates for approval for the role as Work Controller at Statnett transmission line installations. The candidate must fulfil the required qualifications¹³ for personnel who construct and maintain electrical installations in accordance with the Regulations for Electrical Enterprises and Qualification Requirements for Work Related to Electrical Installations and Electrical Equipment (FEK). Furthermore, the candidate must have completed internal training in the role of Work Controller within their own organisation and be able to demonstrate practice in how electrical safety is ensured and safety measures are carried out in line with EN-50110.

4.9.2 The contractor must ensure that the candidate is able to communicate in the Norwegian language or have sufficient English skills enabling them to successfully complete e-learning courses, carry out theoretical and practical training, and communicate directly with Statnett's Local Area Manager¹⁴ in the relevant area and Statnett's Operation Controller (minimum language skills compatible with European Language Standard level B2).

4.9.3 The Project Manager¹⁵ must examine the candidate's background in respect of the requirements stated in section 4.9.1 and confirm to the contractor whether the candidate is qualified to attend the courses arranged by Statnett for candidates to the role as Work Controller. By attending the course, the candidate will learn to practise the role as Work Controller in compliance with Statnett instructions and procedures.

4.9.4 The Project Manager must ensure that the candidate has been approved for independent access (access permit) to the worksite where the candidate will take on the role of Work Controller.

4.9.5 Prior to participation in the theoretical classroom course, the candidate must have had an independent review of the following e-learning courses provided by Trainor:

- Work Controller – Additional competence for power grids
- Statnett's instructions for the Work Controller
- Statnett's instructions for the Operation Controller

4.9.6 The candidate must complete classroom courses provided by Trainor and pass the final tests. The Project Manager is responsible for coordinating the classroom course between Trainor, the contractor, the project and the affected operating area.

4.9.7 At least one representative from the affected operating area must be present at the classroom course to ensure necessary clarifications during the course.

¹² Or someone to whom the Installation Manager has given this authority.

¹³ A relevant certificate or relevant approval from DSB (the Norwegian Directorate for Civil Protection) is sufficient qualification (see Instructions for planning of work in electrical installations, SDOK-515-36, for more information).

¹⁴ Or someone to whom the Local Area Manager has given this authority.

¹⁵ Or someone to whom the Project Manager has given this authority.

- 4.9.8 The classroom course consists of the following module:
- Statnett general part
- 4.9.9 In addition, the classroom course must cover one or more of the following modules:
- Statnett in the vicinity of live transmission line installations
 - Statnett on or in the vicinity of earthed and short-circuited transmission line installations
 - Statnett construction/demolition/removal of transmission line installations
- 4.9.10 Candidates who are to be approved for the role as Work Controller for work on or in the vicinity of earthed and short-circuited transmission line installations must also complete and pass practical training. This practical training consists of two exercises:
- Communication with the Operation Controller
 - Voltage testing and earthing of transmission line installations
- 4.9.11 The Project Manager is responsible for coordinating these training exercises.
- 4.9.12 The training on communication with Operation Controller must be agreed with the relevant Regional Control Centre. The training exercise must comprise exchange of information related to the safety measures implemented by Operation Controller. Furthermore, the exercise will involve the candidate for the role of Work Controller being appointed by, and notifying work completed to, Operation Controller.
- 4.9.13 Training on voltage testing and earthing of transmission line installations must be agreed with the affected operating area. The Project Manager and Local Area Manager will find a suitable place (disconnected transmission line) to train on voltage testing and earthing. The conditions for the training must be relevant to the work performed by the contractor.
- 4.9.14 The Local Area Manager will interview the candidate to ensure that the candidate is qualified and suited to undertake the role as Work Controller. If they are qualified and suited, the Local Area Manager will recommend the Installation Manager to approve the candidate for the role of Work Controller, with the restrictions considered by the Local Area Manager to be appropriate.
- 4.9.15 The Installation Manager¹⁶ will give the final approval of the candidate for the role of Work Controller.
- 4.10 Disconnected power lines must always be earthed at both ends**
- 4.10.1 Power lines that are disconnected by the Regional Control Centre, for example due to high voltages, must always be earthed at both ends. This must be done to avoid damage to components in the substations in the event of lightning surges. Exceptions can be made where surge protectors have been installed on the power line outlet.

¹⁶ Or someone to whom the Installation Manager has given this authority.

5 Special operations

5.1 Construction, demolition and removal of disconnected high-voltage transmission lines and substations

The requirements of section 5.1 do not apply to external personnel where it has been contractually agreed, through Annex D.3 Statnett's general requirements regarding electrical safety, that the contractor is responsible for electrical safety.

Statnett's internal personnel must use section 4.6 in this procedural works to document the appointment: Appointing Work Controller for work on disconnected or in the vicinity of high-voltage installations, and appointing Work Controller for work on or in the vicinity of low-voltage installations.

- 5.1.1 During construction: The procedure for safeguarding electrical safety comes into force as soon as the installation of transmission lines between towers and components, the establishment of earthing systems for towers and the installation of busbar tubing begins.
- 5.1.2 During demolition: The procedure for safeguarding electrical safety continues to apply until all work on the removal of transmission lines between towers and components, the disconnection of earthing systems for towers and the removal of busbar tubing has been completed.
- 5.1.3 The following table specifies required actions when using contractors and defines who at Statnett has responsibilities. Steps 1 and 2 must be carried out well in advance of the start of work on the installation. The Project Manager can authorise someone else to fulfil that role in accordance with this procedure. The Local Area Manager can authorise someone else to fulfil that role in accordance with this procedure.

Step	What/action	Who/responsibility
1	The Project Manager presents to the Installation Manager evidence that the contractor has the necessary qualifications to be able to construct/demolish the line/substation installation. The name of the Installation Manager must be specified. Furthermore, it must be confirmed that the contractor uses the necessary number of qualified workers within the relevant trades to perform the work, or to immediately follow up ¹⁷ the work of unqualified workers, in accordance with the provisions of FEK . In addition, the contractor must be registered in the DSB Electrical Enterprise Register.	Project Manager
2	The Project Manager must arrange a meeting with the relevant Local Area Manager about the project. The purpose of the meeting is to review transmission line routes and/or installation areas to map work operations that require a Work Controller. A Work Controller must be appointed to ensure electrical safety due to the risk of: <ul style="list-style-type: none"> - atmospheric influences/lightning strikes 	Project Manager

¹⁷ "Immediately follow up" means that a qualified worker must physically check the work performed by unqualified workers. Qualified personnel must therefore be present at all locations where work is in progress.

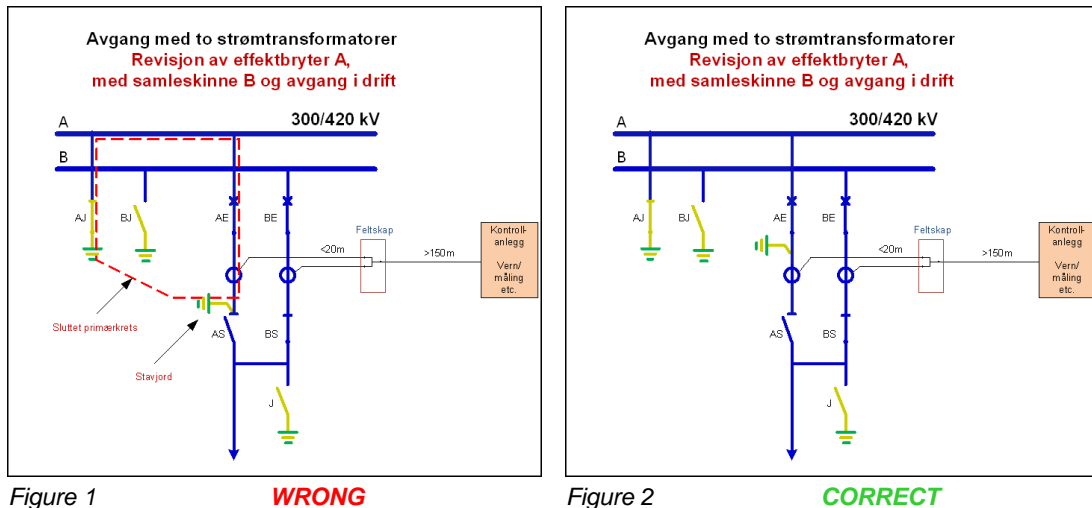
	<ul style="list-style-type: none"> - contact with/arc flash from existing installations - induction from existing installations <p>The Project Manager must identify whether any other installation owner will be affected by the project, and make sure to bring the other installation owner and the Local Area Manager together for a meeting to agree how to handle the matter. The Local Area Manager and other installation owner follow up to ensure that electrical safety is safeguarded for their installations when work is to take place.</p>	
3	The Project Manager must propose candidates suitable for the role of Work Controller (limited to work in line with this procedure) to the Local Area Manager. The Project Manager must provide documentation of the candidates' professional qualifications and the courses they have completed.	Project Manager
4	The request for a safety card for the person is made by the Local Area Manager in line with their job instructions. The following restriction must be stated on the safety card: "Work Controller is limited to work in line with the procedure for safeguarding electrical safety during construction, demolition and dismantling of transmission line and substation installations with a valid JSA."	Local Area Manager
5	A Work Controller must be appointed at each identified worksite to ensure electrical safety. Work Controller must be present at all times. The Local Area Manager is responsible for this appointment.	Local Area Manager
6	Whenever a Work Controller is appointed, a Job Safety Analysis (JSA) must exist that the Local Area Manager and Work Controller have signed. The signed JSA documents the appointment of Work Controller. All hazards associated with electrical safety must be described in the JSA and measures listed. The JSA must clearly state the area within which it applies, e.g. "from tower 10-15 on the Sima-Samnanger line". Work Controller must ensure that all listed measures are implemented. Work Controller must stop any work that involves danger in relation to electrical safety and when a situation arises that is outside the scope of the completed JSA. The Local Area Manager must be contacted.	Local Area Manager

5.2 Work on earthed and short-circuited cables

- 5.2.1 Well before the work on cables starts, a risk analysis in relation to electrical safety must be carried out. This must include, as a minimum, a review of hazards and measures related to:
- induction from other nearby cables
 - thunderstorms
 - the work operation on the cable
 - potential differences at the terminals of new non-energised or terminal earthed cable
 - a careful review of the working methods and equipment to be used when cutting cable, to ensure that the correct cable is being cut
 - communication conditions at the worksite between Work Controller and Operation Controller (these two must be able to communicate directly at all times; consider phone connection conditions, especially on boats)
 - definition of high-voltage area, cordons, labelling and locking (e.g. "splice box")
 - access and training in electrical safety for personnel involved; all personnel who must have independent access to the high-voltage area and are appointed as Work Controller must complete electrical safety training and a first aid course in accordance with the instructions for training/access/safety cards in Statnett's electrical installations
- 5.2.2 For any work on earthed and short-circuited cables, a Work Controller must be appointed at the worksite in accordance with instructions for the Work Controller. If Work Controller has to leave the worksite, a Safety Observer can be appointed in accordance with instructions for the Work Controller.
- 5.2.3 When working on earthed and short-circuited cables, for example splicing, a short-circuit-proof temporary earthing cannot be established at the worksite. A check must therefore be carried out to ensure that the desired cable is de-energised. This can be done by using a spiking gun, tone generator, cable fault locator or other recognised equipment.
- 5.2.4 When working on cable systems, the earthing at the cable's terminals often functions as temporary earthing. Even if terminal earth is used as temporary earthing, the Operation Controller is responsible for the establishment/decommissioning of terminal earth.
- 5.2.5 Just before the work starts, a Job Safety Analysis (JSA) must be carried out. This must be documented in line with Nett's practice of the Job Safety Analysis (JSA) procedure. The risk analysis mentioned in section 5.2.1 and measures taken will be an important input to the JSA.

5.3 Work on circuit breakers in fields with double circuit breakers and double current transformers

- 5.3.1 When working on circuit breakers in fields with double circuit breakers and double current transformers, it must be ensured that the current transformer in the disconnected branch is **not** earthed or short-circuited on both sides. The background for this is discussed in the prepared Note: 2009 Placement of double current transformers in standard two-switch solution (doc. no. 1367654 in IFS). This note includes Figure 1, which shows what must be avoided. Figure 2 shows how it should be done.

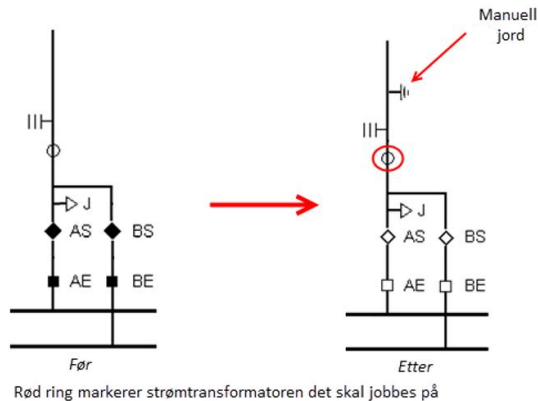


- 5.3.2 In installations where the disconnected branch is earthed or short-circuited on both sides, this procedure **cannot** be used. The work must be carried out in a different way.
- 5.3.3 The Operation Controller is responsible for the safe disconnection (MSI) of the affected busbar and disconnector between the output, circuit breaker and disconnected busbar. Furthermore, Operation Controller is responsible for ensuring that the disconnected busbar is earthed (MSI) using a fixed busbar terminal earthing.
- 5.3.4 The Work Controller is responsible for establishing a temporary earthing between the circuit breaker and the associated current transformer, and any less-than-fully-dimensioned earthing between the circuit breaker and the busbar. If an earthing rod is placed between the current transformer and disconnector, as shown in Figure 1, this cannot be used. In that case, another temporary earthing must be used, placed between the circuit breaker and the associated current transformer. If an earthing rod is placed between the circuit breaker and the current transformer, as shown in Figure 2, this can be used as a temporary earthing.
- 5.3.5 Work Controller is responsible for ensuring that current transformers in disconnected branches cannot be earthed on both sides primarily, or short-circuited secondarily, as primary short-circuiting of current transformers in a branch can result in incorrect measurements of up to 10 per cent and short-circuiting of the secondary side of disconnected current transformers will result in control equipment and protection losing the current measurement.

5.4 Work in the secondary circuit on current transformers with the primary side disconnected

- 5.4.1 The current transformer is disconnected on the primary side, and MSI is carried out under the direction of Operation Controller. As a general rule, the current transformer must not be earthed. A Work Controller is appointed for the current transformer.
- 5.4.2 If the current transformer is placed on the “line side” (“outside”) of a fixed terminal earthing (see example 1), a terminal earth must be manually established using a removable earthing device on the outside of the current transformer (to protect against any lightning surges that may enter the apparatus). The fixed terminal earthing must remain in the open position. This is to avoid the primary side of the current transformer becoming part of a “closed circuit”. MSI

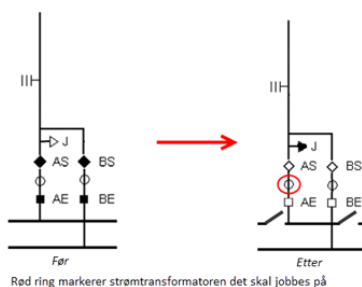
must be carried out on the fixed terminal earthing (open position). If the current transformer is installed on a cable, just a terminal earth should be established on the opposite end.



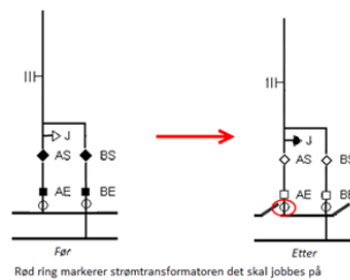
Example 1

5.4.3 When establishing terminal earthing using portable earthing devices, cf. section 5.4.2, a Work Controller must always be appointed. A local voltage test must be carried out using approved voltage tests in connection with such an establishment, and there must be two people present. At least one of these must be approved as Work Controller (checked by Operation Controller). For person number two, an access permit is required (ref. Instructions for training/access/safety cards in Statnett’s electrical installations) for the installation, along with relevant certificate or relevant DSB approval. If Operation Controller implements manual terminal earthing, this must be made visible and checked in the electronic duty journal. Locally, the earthing device must be labelled “Manual terminal earth – only to be removed by order from Operation Controller”. In order to ensure that the manual terminal earthing is visible in the central operating system, a Work Controller must be appointed for as long as the terminal earth is established.

5.4.4 If the current transformer is placed between the disconnecter and busbar (see examples 2 and 3), the directly affected busbar must also be disconnected. A terminal earth is established to handle any lightning overvoltages that may enter the apparatus. In addition, the output must also be disconnected from both branches, as there are double current transformers. Work Controller is responsible for requesting that Operation Controller implement the necessary disconnection/terminal earth/MSI. If work is to be carried out in one or more of the interconnected secondary circuits in field cabinets and/or further towards the control system, this work must be carried out in line with section 5.7.1 of the Instructions for the Work Controller (AfA).



Example 2



Example 3

5.5 Use of camera on insulation rod

5.5.1 The job must be planned and risk assessed before the inspection. This must be documented in the task(s) for the job (or in a separate document linked to the task(s)). Among other things, the following points must be taken into account:

- Selection of insulation rod based on the voltage level to be worked on, and that the rod is in satisfactory condition and cleaned.
- Assess whether there is a risk that the insulation rod could short-circuit live components in the vicinity in the event of accidental movement.
- As far as possible, the insulation rod must be operated vertically under the component to be inspected.
- Consider the weather forecast: the work must not be carried out in strong winds and/or heavy rainfall.
- Defining the area where the inspection is to be carried out.
- There must always be two people present when the inspection is carried out.



Installation of camera on insulation rod.



Use of camera with insulation rod.

5.5.2 A Work Controller must be appointed for work in the vicinity of high-voltage installations at the worksite in accordance with instructions for the Work Controller. If the appointed Work Controller has to leave the worksite, the work must be stopped. Both Work Controller and the person carrying out the work must be approved as Work Controller, both for work in the vicinity of live installations and for work on or in the vicinity of earthed and short-circuited installations.

5.5.3 Just before the work starts, a Job Safety Analysis must be carried out if there are any remaining risk factors that have not been closed in the risk assessment. This must be archived

along with other work documentation and stored in Statnett's document management system. The planning and risk assessment (see section 5.5.1) is an important input to the JSA.

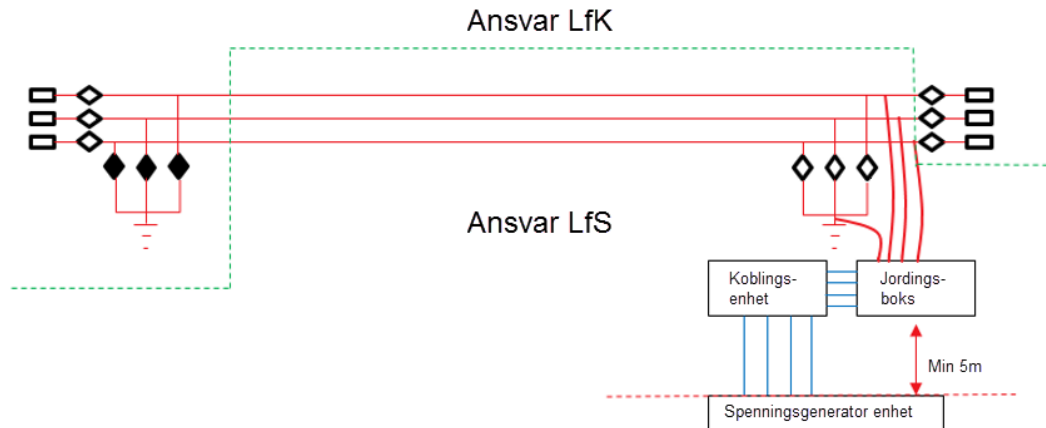
5.6 Impedance measurements/earthing plate measurements¹⁸

- 5.6.1 There must NOT be any other work in progress on the line or the associated outlet in the substation.
- 5.6.2 Well before the work starts, a risk assessment in relation to electrical safety must be carried out. This must include, as a minimum, a review of hazards and measures related to:
- induction and thunderstorms on or near measuring equipment
 - communications at the worksite between the Work Controller and participants in the measurement programme
 - defining the work area, cordoning and labelling
- 5.6.3 Just before the work starts, a Job Safety Analysis must be carried out if there are any remaining risk factors that have not been closed in the risk assessment. The Job Safety Analysis must be documented.
- 5.6.4 Operation Controller appoints a Work Controller for work at the worksite (between line separator and terminal earthing), without connecting the terminal earthing on the line side of the worksite. Operation Controller gives Work Controller permission to connect terminal earthing on the line side of the worksite, in line with Instructions for Operation Controller, section 5.2.4 (which applies even though section 5.2.4 describes functional testing). Operation Controller will not perform MSI on the terminal earthing for as long as Work Controller is appointed.
- 5.6.5 Work Controller:
- Informs all participants in the measurement programme of restrictions relating to where they can be.
 - Receives appointment from Operation Controller, cf. section 5.6.4.
 - Voltage-tests the installation.
 - Connects the terminal earthing on the line side of the worksite (cf. permission from Operation Controller) and verifies that the terminal earthing is "engaged" in all phases.
 - Ensures protection of terminal earthing if indoors.
 - Provides measuring personnel with access to connect measuring equipment and checks that this is done properly.
 - Once the measuring equipment has been connected, delimits the area with cordon tape or similar. There must be a minimum of 5 m between the voltage generator unit (on the outside of the cordon tape) and the coupling unit/earth junction box (on the inside).
 - Ensures that terminal earthing is desecured, decommissioned and secured if outdoors.
 - Gives the go-ahead signal to measurement personnel to carry out measurements.
 - Once measurements have been carried out, desecures, establishes and secures terminal earthing.
 - Ensures that all connecting cables and other equipment are removed from the area.
 - Ensures that the terminal earthing is desecured and decommissioned.

¹⁸ The procedure for these measurements is the same, but the measuring equipment differs.

- Informs Operation Controller that work is finished, all safety measures have been removed, that appointment of Work Controller can be lifted, and that voltage can be applied to the installation.

Principle for impedance/earthing plate measurements



5.7 Removal of ice on disconnected and earthed transmission line

- 5.7.1 Based on a risk evaluation including geography, accessibility and ice and weather conditions, select a method for clearing ice. Clearing of ice is generally to be done on a disconnected and earthed installation, with Work Controller appointed according to Instructions for the high-voltage Work Controller, section 5.8. If clearing of ice will be done with live working, the following procedures can be used: 001 live working procedure Statnett – Clearing of ice from transmission line with insulated rope and snowmobile 132–420 kV (doc. no. 2752821) or 004 live working procedure Statnett – Clearing of ice from transmission line with helicopter and pole 132–420 kV (doc. no. 3810589). Any other procedures must be accepted in advance for use at Statnett by the Installation Manager. Qualification of live working procedures and execution of live working is described in the process description “Prepare and perform work on live electrical equipment”.
- 5.7.2 During all operations for the clearing of ice, necessary measures or a risk assessment must be made clear to all involved in the work. A JSA must be conducted if there are remaining risk factors, and all involved in the work must participate. This also applies to helicopter personnel if a helicopter is used during the work.
- 5.7.3 The bullet points below list methods that can be used to remove ice on lines at Statnett. Personnel/bystanders must not be present under or near the line when clearing of ice is being done. Measures to be taken when crossing ski trails, roads, railways and lines must be documented.
- 5.7.4 Methods known and used by Statnett are described here:
- 5.7.4.1 *Pole hanging below helicopter*
- Pole/object hanging below helicopter with long line. Total length of the straps down to the “pole” must be evaluated based on the current conditions and following an assessment of how high the line being worked on may bounce upwards if all the ice falls off at once.*

If all the lines in a span are to be cleared of ice, start with the top lines. When starting with the phase lines, always do the outer phases before starting the middle phase. Work on clearing ice starts close to the tower, by carefully and gently knocking the pole against the line. After about 50 m of the line has been cleared of ice, move to the other tower in the span and repeat the operation until the entire line is cleared of ice.

Identified measures must include assessments of line clamp types and whether a spacer or other objects are installed on the lines in the span.

5.7.4.2 Insulated rope method with snowmobile

The rope is carried over the line to be cleared of ice and attached to a snowmobile. During clearing of ice, drive about 10 m to the side of the phase. It is important that the rope is of sufficient length to prevent the snowmobile being lifted if the ice falls from the entire span during the operation. A rule of thumb is for the rope to be at least twice as long as the span height without ice. Start work by clearing the top lines, before clearing the side phases and finally the middle phase.

The installation of the lines itself can consist of various types of belts (variator belt). A wire or chain can also be used.

5.7.4.3 Airlift method: IFIS

This is a shackle that is placed around the line to be cleared of ice. The shackle can be used in two ways: either by pulling it along the line with a helicopter, or by leaving it stationary with a vibrator activated.

This method is used on more porous ice, as it is not suitable for hard ice.

5.7.4.4 Applying higher load to lines until the ice melts

This is an option but should be avoided as much as possible. The affected Regional Control Centre can be asked to apply higher load to the line. The effect is reduced if there is a strong wind combined with a temperature many degrees below zero. Risk of injury to personnel and animals must be assessed.

5.7.4.5 Snow/ice scraper (the Beinset method)

The scraper is a plastic assembly with two cutter heads. It is operated by two people and is brought up onto the line by means of an insulated rope. To prevent the line from oscillating when the load drops, another person holds the other rope. Effective on lines up to 132 kV.

5.7.4.6 Log attached to a rope, manual method

A log of a hardwood such as oak is attached to a rope that is carried over the line to be cleared of ice. The operation consists of pulling the rope so that the log hits the ice/line, and the ice falls off.

If we have ice only on the top line, and climbing the tower is possible, we climb the tower and use a wooden log to hit the top line directly. This causes oscillations that usually make the ice drop.

5.8 Firefighting in and in the vicinity of Statnett's electrical installations

- 5.8.1 In the event of fire in or in the vicinity of Statnett's substation or transmission line installations, the Statnett Regional Control Centre must be notified.
- 5.8.2 **When the Statnett Regional Control Centre is notified of fire** in or in the vicinity of Statnett's installations by the fire service or others, the centre must ask for a description of the location of the fire (GPS coordinates and/or the reading of signage on the nearest tower or gate on the substation and/or street address). Letters have been sent to all fire services in Norway describing how firefighters are to notify and deal with Statnett's installations. The Regional Control Centre cannot give permission for firefighting within 30 m of a Statnett installation until Statnett's personnel on site have given the all-clear for firefighting (Management of fire in or in the vicinity of Statnett's high-voltage installations, doc. no. 3873474).
- 5.8.3 Statnett personnel must always monitor the firefighting and are responsible for electrical safety at or in the vicinity of Statnett's electrical installations. Communication with the emergency services through emergency lines is clarified on site.
- 5.8.4 **The Regional Control Centre mobilises personnel that have been approved as Work Controller to the site of the fire.** The possibility that installations need to be disconnected, terminal earthed and secured against energising must be considered. Therefore, in the event of fire in the vicinity of a high-voltage line, personnel should be mobilised to perform labelling, securing and inspection (MSI) at all line ends as soon as the line has been identified.
- 5.8.5 **Electrical safety training must be provided** for personnel who are to work under the supervision of the Work Controller and who do not have an access permit. Training of emergency service personnel, police and firefighters is performed as an on-site review under the direction of the approved Work Controller. The following is reviewed verbally: main points in this procedure and the responsibility of Work Controller in safeguarding electrical safety. Work Controller is appointed in line with applicable guidelines.
- 5.8.6 **Before the electrical installation is earthed and secured according to the instructions for the Work Controller/instructions for the Operation Controller, water should not be applied directly to the installation.** It is important to maintain close dialogue with the Regional Control Centre at all times. When support and clarification is needed, contact the Installation Manager. Statnett's emergency response plan is to be used for notification and handling internally at Statnett and externally and with the media.
- 5.8.7 **For high-voltage lines in particular:** Dropping fresh water by helicopter above a live line may be allowed provided that the helicopter maintains a good distance (> 50 m) above the line. Furthermore, it is required that people on the ground are kept outside the area where the fresh water is dropped. This should be made clear to the firefighters by the appointed Work Controller. If there are other installations on the tower, e.g. fibre optics boxes, the Operation Controller should notify the Monitoring Centre. If there are other line owners in the area, they must be contacted by Operation Controller to maintain safety at their installations.
- 5.8.8 **In the vicinity:** The appointed Work Controller for work in the vicinity makes an assessment on site as to whether fresh water can be used for firefighting on the live line, or the line will have to be disconnected. There is considered to be little risk in having a live line when there is little growth along the course and/or greater height up to the phase lines. A condition for firefighting is that the person hosing is only hosing horizontally or down towards the ground in the course. If the appointed Work Controller in the vicinity has decided that the line should be

disconnected, the condition continues to apply until the line has been disconnected, earthed and secured (MSI).

5.8.9 **Earthed and secured:** When the line is disconnected, earthed and secured (MSI), Work Controller has been appointed for work on earthed and short-circuited installations, and Work Controller has established their safety measures, you can freely hose on the line and towers (firefighters need not then be accompanied).

5.8.10 **For substations in particular:** Work Controller makes an assessment on-site as to if and when the electrical installation is to be disconnected. It is important to maintain close dialogue with the Regional Control Centre. When support and clarification is needed, contact the Installation Manager. Fresh water can only be hosed on installations when they are earthed and secured according to the instructions for Work Controller. Fresh water can be hosed on buildings and other areas that are more than 30 m from an electrical high-voltage installation that is not earthed and secured.

For fires in earthed and secured transformers, reactors etc. where concrete walls restrict the area of the fire, you can firefight on the condition that water/extinguishant does not come into contact with other live installation parts. For electrical high-voltage installations where visible, less-than-fully-dimensioned earthing cannot be established because of fire, firefighting can still be allowed when Work Controller has checked that terminal earthing has been established.

5.9 The execution of measurements with external voltage source in SF₆ installations

5.9.1 Prerequisites

Two measurement methods are used and performed in accordance with Procedure for Maintenance of Circuit Breaker GIS no. 16.12. motion/time measurement, functional test (doc. no. 1681519 in IFS). Micro-ohm measurement is NOT to be performed. The method used depends on whether the SF₆ installation has insulated terminal earthings that can be used for connecting measuring equipment, and where in the installation they are installed.

Substation personnel will give information about which measuring method is to be used, where the measuring equipment is to be connected, and which disconnecter delimits the measuring circuit. These disconnecters will be used as safety measures for appointment by Work Controller. The following two measurement methods are used:

1. Delooping output for connecting measuring equipment on SF₆ feedthrough or cable feedthrough. The following prerequisites apply for using this method:
 - Manual terminal earthing must be established on **delooped** line in the measuring station.
 - No other work can be done on the relevant output in the measuring station.
 - No other work can be done on the affected busbar in the measuring station.
2. Connecting measuring equipment on insulated busbar terminal earthing in the measuring station, where the busbar terminal earthing is equipped with earthing jumpers that connect the terminal earthing to the earthing for the SF₆ installation. The jumpers are removed, and measuring equipment is connected to the insulated part of the terminal earthing. The following prerequisites apply for using this method:
 - No other work can be done on the affected busbar in the measuring station.

- When working on circuit breakers in fields with double circuit breakers and double current transformers, it must be ensured that the current transformer in the disconnected branch is not earthed or short-circuited at the same time on both sides when the other branch is operative. Insulated terminal earthing in connected position that has had the earthing jumpers removed is not considered sufficient earthing in this regard. See section 5.3 in this procedural works: Work on circuit breakers in fields with double circuit breakers and double current transformers.

If another franchisee is to make similar measurements in their own installation (shared ownership), and connects measuring equipment to Statnett's installation, there must be a Work Controller on both Statnett's installation and the other franchisee's installation at the same time. Typically, Statnett will have the Work Controller on the terminal earthing, where the measuring equipment is connected, and the other franchisee will be Work Controller on their own circuit breakers that are to be measured.

5.9.2 Just before the work starts, a JSA must be carried out. This must be documented in IFS.

5.9.3 Delooping output for connecting measuring equipment on SF₆ feedthrough or cable feedthrough

Work Controller must inform Operation Controller about:

- Where the external voltage source (measuring equipment) is to be connected.
- Which disconnectors delimit the measuring circuit. These will be used as safety measures for appointment by Work Controller.
- Which terminal earthings/disconnectors are to be secured and which terminal earthings/disconnectors are to be running during work.
- Where replacement earthing is to be established.
- Operation Controller orders and gets labelling, securing and inspection (MSI) acknowledged on necessary safety measures and replacement earthing.
- Operation Controller checks whether there are other appointments of Work Controller on disconnected, earthed and secured installations in the measuring circuit where Work Controller is to be appointed. If there are other appointments in the same measuring circuit, these must be notified clear before appointment can be made.
- If planned safety measures or other components in the measuring circuit where Work Controller will use external voltage source belong to another installation owner, it must be made clear between the relevant Operation Controllers that no other Work Controller can be appointed in the same measuring circuit.
- Appointment of Work Controller where rod earthing/lance earthing is modelled on output in eterra.
- Installation: Substation XXXX; Appointed Work Controller on installation part: Line XXXX and terminal earth XXXX.
- Appointment of Work Controller where rod earthing/lance earthing is not modelled on output in eterra.
- Installation: Substation XXXX; Appointed Work Controller on installation part: Terminal earth XXXX.
- The number of manual terminal earths (1) is noted in the appointment together with the text: Replacement earthing established. This appointment will be notified clear in the end.
- Installation: Substation XXXX; Appointed Work Controller on installation part: Line XXXX.
- The appointment(s) apply to the entire measurement period. This is where the line is delooped and looped again after work is finished. No notification of delooping or looping is to be submitted, as there is a Work Controller on the output for the entire period.

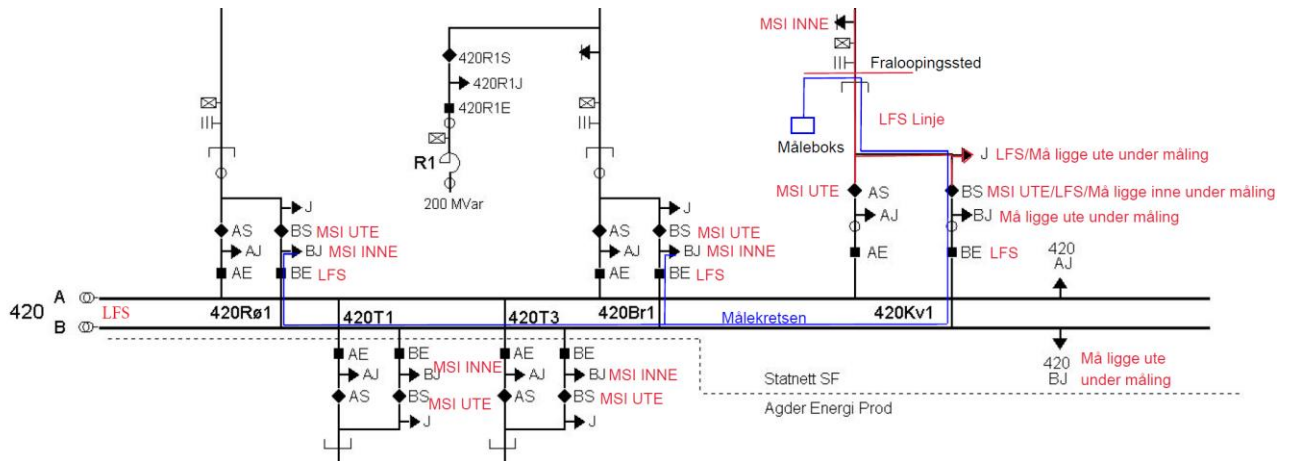
- Operation Controller appoints Work Controller for work on all BE circuit breakers that are to be measured, BS disconnector in delooped field and SS420B.
- Clear notification, desecuring and busbar rerouting. New MSI against 420A switches; Operation Controller appoints Work Controller for work on all AE circuit breakers that are to be measured, AS disconnector in delooped field and SS420A.

5.9.4 Connecting measuring equipment on insulated busbar terminal earthing

Work Controller must inform Operation Controller about:

- Where the external voltage source (measuring equipment) is to be connected.
- Which disconnectors delimit the measuring circuit. These will be used as safety measures for appointment by Work Controller.
- Which terminal earthings/disconnectors are to be secured and which terminal earthings/disconnectors are to be running during work.
- Operation Controller orders and gets labelling, securing and inspection (MSI) acknowledged on necessary safety measures.
- Operation Controller checks whether there are other appointments of Work Controller on disconnected, earthed and secured installations in the measuring circuit where Work Controller is to be appointed. If there are other appointments in the same measuring circuit, these must be notified clear before appointment can be made.
- If planned safety measures or other components in the power circuit where Work Controller will use external voltage source belong to another installation owner, it must be made clear between the relevant Operation Controllers that no other Work Controller can be appointed in the same measuring circuit.
- Installations with one disconnector per branch: Operation Controller appoints Work Controller for work on all BE circuit breakers that are to be measured, 420BJ and SS420B.
- Installations with two disconnectors per branch: Operation Controller appoints Work Controller for work on all BE circuit breakers that are to be measured along with associated disconnectors, BS1, 420BJ and SS420B.
- Clear notification, desecuring and busbar rerouting. New MSI against 420A switches.
- Installations with one disconnector per branch: Operation Controller appoints Work Controller for work on all AE circuit breakers that are to be measured, 420AJ and SS420A.
- Installations with two disconnectors per branch: Operation Controller appoints Work Controller for work on all AE circuit breakers that are to be measured along with associated disconnectors, AS1, 420AJ and SS420A

Schematic diagram for connecting measuring equipment on feedthrough, ref. section 5.9.3
Example: Substation Holen, measuring equipment connected to field Kvilldal. Measuring of 420B circuit breakers



Appointment of Work Controller for delooping and looping where rod earthing/lance earthing is modelled on output in erterra				
1	The line is disconnected and earthed at both ends			
2	MSI ordered opposite substation	Disconnectors and terminal earthing		
3	MSI ordered measuring station	OUTSIDE 420Kv1 AS and BS	INSIDE 420Kv1 rod earthing	
4 or 5	Received confirmation MSI opposite substation	Disconnectors and terminal earthing		
4 or 5	Received confirmation MSI measuring station	OUTSIDE 420Kv1 AS and BS	420Kv1 rod earthing established	Data input feed INSIDE 420Kv1 rod earthing in erterra
6	Appointer Work Controller: NN	Installation: Substation Holen	Installation part: 420Kv1J and line Kvilldal	This Work Controller is to be notified clear in the end

Appointment of Work Controller for delooping and looping where rod earthing/lance earthing is not modelled on output in erterra				
1	The line is disconnected and earthed			
2	MSI ordered opposite substation	Disconnectors and terminal earthing		
3	MSI ordered measuring station	OUTSIDE 420Kv1 AS and BS	Establishment of manual terminal earth ordered	Operation Controller writes in the comment field in erterra (OIS) for this MSI order that manual terminal earth is to be established
4 or 5	Received confirmation MSI opposite substation	Disconnectors and terminal earthing		
4 or 5	Received confirmation MSI measuring station	OUTSIDE 420Kv1 AS and BS	Manual terminal earth established	
6	Appointer Work Controller: NN	Installation: Substation Holen	Installation part: 420Kv1J	Number of manual terminal earths is noted in the appointment (1) together with the text: Replacement earthing established.
7	Appointer Work Controller: NN	Installation: Substation Holen	Installation part: Line Kvilldal	This Work Controller is to be notified clear in the end

Appointment of Work Controller for measuring 420B circuit breakers with one disconnector in each branch			
1	All 420BE and 420BS are disconnected,	All 420BJ in field are connected, except 420Kv1BJ	Statnett Operation Controller and any other Operation Controller

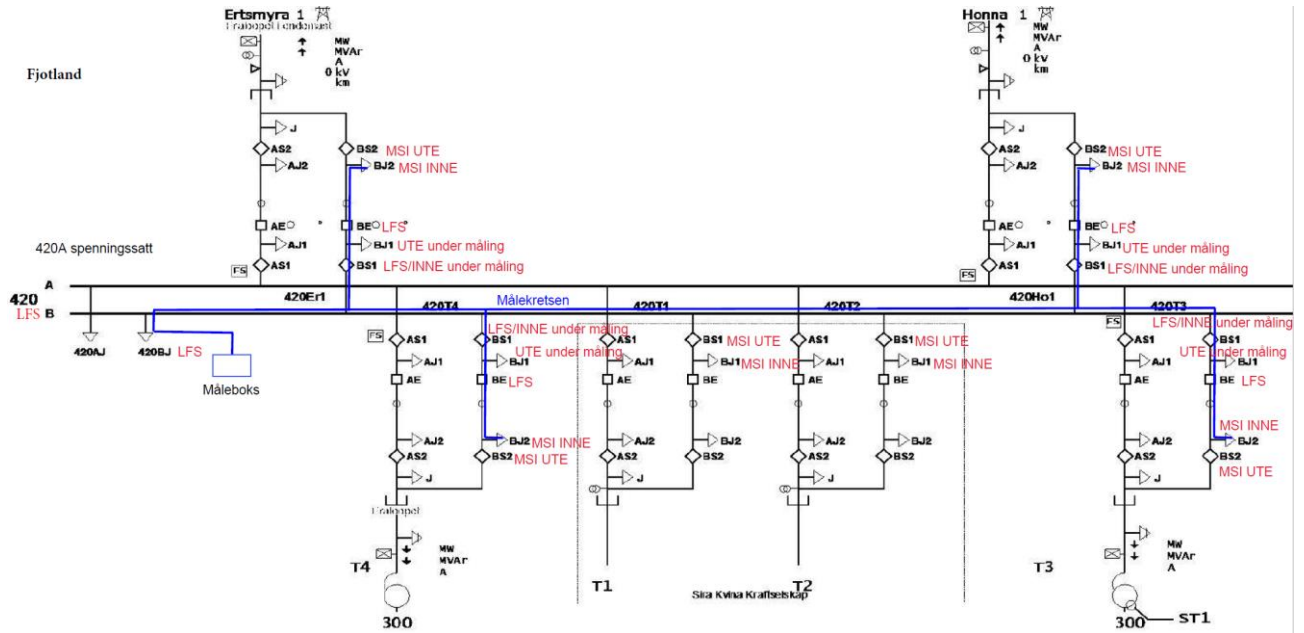
	then 420BJ is connected			
2	MSI ordered	OUTSIDE All 420BS except 420Kv1BS	INSIDE All 420BJ in field except 420Kv1BJ	420Kv1BS has MSI OUTSIDE already
3	MSI ordered potential other Operation Controller	OUTSIDE All 420BS	INSIDE All 420BJ in field	
4 or 5	Opposite confirmation MSI	Disconnectors and terminal earthings		
4 or 5	Opposite confirmation MSI potential other Operation Controller	Disconnectors and terminal earthings		
6	Appointer Work Controller: NN	Installation: Substation Holen	Installation part: All 420B circuit breakers that are to be measured along with 420Kv1BS and 420B	420Kv1BS is automatically desecured in eterra (OIS) after this appointment

Work Controller notifies work complete for measuring 420B circuit breakers with one disconnector in each branch				
1	Work Controller informs that they want to notify work complete			
2	Operation Controller receives confirmation on 420Kv1BS MSI OUTSIDE	Operation Controller records this in the eterra system (OIS)		
3	Work Controller notifies work complete			
4	Operation Controller notes MSI OUTSIDE 420Kv1BS in the eterra system (OIS)	Now becomes an active MSI in the eterra system (OIS)		
5	Operation Controller confirms that no other parties need our MSI	Disconnectors and terminal earthings		
5	Operation Controller orders desecuring	All BS disconnectors and BJ terminal earthings in field except 420Kv1BS, -BJ	Statnett Operation Controller and potentially other Operation Controller	
6	Operation Controller decommissions all 420BJ in field and then 420BJ	Statnett Operation Controller and potentially other Operation Controller		

Corresponding approach when measuring 420A circuit breakers

Schematic diagram for connecting measuring equipment on insulated busbar terminal earthing ref. section 5.9.4

Example: Substation Fjotland, measuring equipment connected to 420BJ. Measuring of 420B circuit breakers



Appointment of Work Controller for measuring 420B circuit breakers with disconnectors on both sides of the circuit breaker			
1	All 420BE, BS1 and BS2 are disconnected in field and then 420BJ is connected	All 420BJ2 in field that is to be measured are connected, 420BJ1 is connected in other fields.	Statnett Operation Controller and potential other Operation Controller NB: 420BJ1, 420BJ2 and 420BE in the same field must not be connected at the same time if the field is operating towards A. See section 5.1.2.
2	MSI ordered	OUTSIDE All 420BS2 in field that is to be measured	INSIDE All 420BJ2 in field that is to be measured
3	MSI ordered potential other Operation Controller	OUTSIDE All 420BS1 in field	INSIDE All 420BJ1 in field
4 or 5	Received confirmation MSI	Disconnectors and terminal earthings	
4 or 5	Received confirmation MSI potential other Operation Controller	Disconnectors and terminal earthings	
6	Appointer Work Controller: NN	Installation: Substation Fjotland	Installation part: All 420B circuit breakers that are to be measured and 420BS1 disconnector in branch that is to be measured along with 420BJ
7	420BJ1 in field that is to be measured remain OUTSIDE for the entire measurement period		

Notify work completed in normal manner, thereafter busbar rerouting and similar approach for appointment on 420A circuit breakers

5.10 Statnett’s Klæbu training facility

5.10.1 Section Head NBB is the owner of the installation. The owner of the test installation has outsourced day-to-day operations and maintenance of the installation to operating area Midt. The owner of the test installation provides the funds and needed staff to run day-to-day operations and maintenance of the installation. The owner manages all use of and activity in the test installation.

5.10.2 The Local Area Manager for Midt has been assigned the task of handling day-to-day operations and maintenance of the test installation by the owner, in the same way as for other

installations within its area of responsibility, including maintaining compliance with regulations and existing and established policies regarding electrical safety at Statnett.

5.10.3 All existing and established policies regarding electrical safety at Statnett apply to work at or in the vicinity of the test installation.

5.10.4 Appointment of Work Controller is made in line with Appointing Work Controller for work on disconnected or in the vicinity of high-voltage installations, and appointing Work Controller for work on or in the vicinity of low-voltage installations, by means of the procedure for appointing internal personnel as Work Controller (LfSf) for work on disconnected high-voltage installations during construction or dismantling. When testing the high-voltage installation, the appointer can write the following SMS to Work Controller who is to be appointed for the particular activity: *LfSf <mobile phone number of the person being appointed> at Klæbu training facility.*

5.10.5 When working on the test installation earthing/short circuiting must be established according to Statnett policies. For practical reasons permanent earthing/short circuiting can be established at the installation at each end. The approved method for an overhead transmission line is an appropriate conductor with cable lugs at each end fastened by a through bolt on the flag in the de-energising clamp and in a hole in the cross arm. All three phases are earthed at both ends. If this method is used, Work Controller must inspect whether the earthing is intact before giving permission for implementation of activities at the installation.

5.10.6 When renting out the test installation to external tenants, this must be documented by using the Template for agreement between Statnett and external tenants of Klæbu training facility to maintain electrical safety when activities are performed at the installation.

5.11 Operation of busbar protection during rebuilding/new construction

5.11.1 When rebuilding AIS installations, the following generally applies:

- Protection on all input fields must be set so that the total fault clearance time from these fields does not exceed 500 ms.
- Existing breaker failure protection (BFP) must be kept operational throughout the rebuilding period. When switching/testing the individual fields, it is nevertheless acceptable for BFP to be unavailable for a short period of time (up to one day).
- During periods without operational breaker failure protection, personnel should avoid spending time in the shafts of live transformers. In its planning process, the rebuilding project must make arrangements to avoid this.
- Existing BB Diff can normally be turned off during the rebuilding period. Substations with high power flow where the long-term absence of two-zone busbar protection will cause bottlenecks are an exception. A decision on BB Diff may be refused or not taken in connection with the preparation of a protection specification for the installation.

5.11.2 When rebuilding GIS installations, the following generally applies:

- Protection on all input fields must be set so that the total fault clearance time from these fields does not exceed 500 ms.
- Existing busbar protection (BFP and BB Diff) must be kept operational throughout the rebuilding period. Exceptions may be permitted in circumstances as described below. When switching/testing the individual fields, it is acceptable for busbar protection to be

unavailable for a short period of time (up to one day). At the final conversion of power circuits to new busbar protection, a short transition period (up to four days) without operational busbar protection is acceptable.

- During periods without breaker failure protection, personnel should avoid spending time in the shafts of live transformers. Likewise, personnel should avoid working near pressure relief devices/rupture discs in the GIS hall during periods without operational BB Diff. In its planning process, the rebuilding project must make arrangements to avoid this.

Exemptions from the requirement for operational busbar protection during the rebuilding period:

An exemption to the requirement for operational BB Diff during the rebuilding period can be granted if the system will withstand an internal arc fault with a duration of 500 ms without the enclosure burning through. A prerequisite for such an exemption is that Statnett's technical leads for GIS installations confirm that burning through the enclosure is not possible. The assessment is based on the calculated maximum short-circuit current and duration for busbar faults during the rebuilding period as well as technical data for the installation in question.

The exemption only applies to BB Diff, not BFP.

5.11.3 For the commissioning of busbar protection in new substations, the following generally applies:

- BFP must be operational for all commissioned fields. Temporary blocking of BFP for short periods (up to one day) can be accepted in connection with testing other fields.
- BB Diff must be operational for all commissioned fields. Temporary blocking of BB Diff for short periods (up to one day) can be accepted in connection with testing new fields.
- During periods without operational busbar protection, personnel should avoid spending time in the shafts of live transformers. Likewise, during such periods personnel should avoid working near pressure relief devices/rupture discs in the GIS hall. In its planning process, the development project must make arrangements to avoid this.

6 Fault management at Statnett's installations

6.1 Faults at Statnett's installations

6.1.1 General information about fault management

- Making a test connection should normally not be done before the likely fault location has been found and isolated, or it is most likely that the fault was temporary. Only energise presumed healthy installation parts. In the event of major incidents, decision-making support should also be obtained from the Local Area Manager, technical leads and the Installation Manager.
- Standing faults should be located and disconnected as soon as possible.
- Standing single-phase faults in coil-earthed or insulated grid must be disconnected as soon as possible, and at the latest within two hours. (In Nordnettet there is a separate procedure permitting a standing earthing fault for a maximum of 45 minutes.)
- Any connection of terminal earth and establishment of MSI is to be implemented without undue delay.

6.1.2 Calling in personnel

When operations personnel are called in, Operation Controller and called-in personnel must always assess together whether it is necessary to send one or two people to the installation.

In the event of an alarm on or failure of an HVDC installation:

- Call HVDC personnel to log in via remote access.
- Call on-call operating personnel to attend the installation as a matter of urgency for troubleshooting and local assistance. Operation Controller informs HVDC personnel about who has been called in.

Called-in personnel must call Operation Controller on arrival at the installation and carry out a verbal risk assessment. On the basis of this assessment, optionally take measures for reducing risk before inspecting the fault location. Risk-reducing measures are to be noted in the duty journal by Operation Controller.

6.1.3 Faults in transformers

Considerations before possible test connection:

- In the event of a transformer failure due to a signal received regarding gas, on-load tap changer pressure, automated shut-off valve or differential current (diff. or zero-point diff.), where it is not due to faulty connections in the control system in connection with Commissioning:
 - The transformer must be inspected.
 - An oil sample must be taken as soon as possible.
 - Internal transformer personnel must be contacted for assessment and follow-up of the transformer.
 - Supply Quality and Operations Support (LRL) must be contacted to assess the fault and check protection.
 - Installation Manager and Local Area Manager must be informed. Installation Manager must approve connection on recommendation by Local Area Manager.

- If the transformer has gone down due to distance protection or overcurrent (without there being an overload) without gas or diff., the fault may be on the secondary or tertiary side of the transformer.
 - Check whether parallel transformers have stepped away from each other so that the distance protection has tripped due to a high circulating current.
 - Notification of a fault found in the transmission grid makes it most likely there is an auxiliary trigger for the fault in underlying grid, or unselectivity.
 - After any successful connection, the affected operating area is notified of the incident, to assess follow-up with oil sampling etc.
- For a test connection where the underlying grid is dark:
 - Disconnect all outputs and energise the transformer towards the empty busbar.
 - If the line owner confirms that the fault is disconnected, all healthy lines can be added again one by one.
 - If a standing earthing fault reappears during the restore, the faulty line is to be immediately decommissioned again.

6.1.4 Faults in SF₆ installations

- Standing faults entail a hazard to personnel (toxic gas) and large-scale damage to the installation.
- Any test connection may entail large-scale additional damage/costs to the installation, which in turn leads to extended downtime.
- Considerations before possible test connection:
 - Eliminate the possibility that the fault is in an encapsulated installation – gas sampling (smells of rotten eggs in the event of flashover).
 - If the fault is ascertained to be outside an encapsulated installation, there are grounds for considering test connection. In these cases, attempt energising from conventional installations if possible.
 - If the fault is presumed to be in an enclosed installation, the installation should not be test connected. The installation must usually be opened for checks. If a fault in the SF₆ installation cannot be ruled out, a possible test connection must be cleared with the Installation Manager.

6.1.5 Faults in switching stations/switchgear

- Considerations before any test connection:
 - Eliminate the possibility that the fault is standing – the installation should be inspected.
 - If the fault is likely to be temporary, there are grounds for considering a test connection.

6.1.6 Faults on cable/overhead transmission line

- Cable: When overload on cables is needed beyond registered limits, this must be cleared with Emergency Response and Internal Work Cable (NBK).
- Overhead transmission line: As a rule of thumb for potential manual disconnect, it can be presumed that sagging down to dangerously low clearance happens in 15 minutes with 20 per cent overload (Ampere).
- If there is a suspected phase failure in a coil-earthed grid, risk of overvoltages is to be assessed when choosing a sectioning plan – check phase currents, U₀ voltages.

- In case of disconnection of line with inserted cable: Disconnect cable and line first, thereafter regulate/disconnect on coil. Reverse the process when connecting line with inserted cable.
- Try to set the compensation so that safe extinguishing conditions are best ensured.
- Considerations before any test connection:
 - Assess whether a fault entails a hazard to people and animals (contact voltage) and property (fire), i.e. whether there is considerable human or animal traffic across the area.
 - Eliminate the possibility that the fault may be in any inserted cable/ submarine cable – check the line image and calculated distance to the fault.
 - If the earth current protection has been tripped, there is a high-impedance fault, usually a tree falling down or a phase fault. The transmission line should usually be inspected. An indication of a phase break is that the earth current protection has tripped at one end of the cable.
 - If the distance protection is tripped, there is a low-impedance fault, and there has been a short circuit.
 - When lightning is registered close to the line course, and there are no concurrent signals from the substations, the fault can be presumed temporary. The same applies in the event of strong wind or wet snow/ contaminated precipitation.
 - If the fault is likely to be temporary, there are grounds for considering a test connection.
 - On a sunny day with no wind, the threshold should be very high before any manual test connection. Normally the technical lead for lines is to be consulted, and the substation installation is inspected. Assess and wait at least 30 minutes, and optionally contact the local fire service/police and ask if there have been any incidents that may explain the fault. Obtain authorisation from the technical lead for lines. After any successful connection, the load threshold is to be reduced to 70 per cent of normal, until the line has been inspected with regards to possible flashover to vegetation.

6.1.7 Fault on compensating equipment

- Considerations before any test connection:
 - Eliminate the possibility that the fault may be in the compensating equipment itself.
 - Eliminate the possibility that the fault may be in an adjacent transformer (SVC/phase compensator).
- If oil-filled shunt reactors have failed due to gas, on-load tap changer pressure, automated shut-off valve or diff., there is reason to suspect a serious fault. Necessary measures if faults are due to one or more of these functions:
 - Reactor must be inspected. Deblocking and test connection can only be done if a temporary outside fault has been ascertained.
 - Furthermore, an oil sample is to be taken from the reactor and analysed in a lab as soon as possible.
 - Transformer personnel from Emergency Response and Internal Work Substation (NBS) are to be contacted for assessment and follow-up of the transformer.
 - Supply Quality and Operations Support (LRL) must be contacted for assessment and check of protection and fault analysis.

- Installation Manager and Local Area Manager must be informed. Installation Manager must approve connection on recommendation by Local Area Manager.
- Test connection of compensating equipment is usually not regarded as time critical, and should not be done before the installation has been inspected.

6.1.8 Alarm and failure of cable installations

Measures here are based on the memorandum: Action list in case of alarm and downtime on cable installation, doc. no. 2160771 in IFS). Head of section Emergency Response and Internal Work Cable (NBK) is responsible for ensuring that the correct version of this list is approved by the person concerned and released.

- If the installation only has one alarm for high pressure and one for low pressure, the stipulated procedure for critically high pressure or critically low pressure is to be followed.
- Manual disconnection does not trigger system protection, so there may be a need for the National Control Centre to take measures before the cable is disconnected.
- Test connection is not to be done in the event of standing pressure alarms or loss of signal transmission.
- Critically high pressure:
 - Check Sveve and contact signed-in personnel at the affected cable installation for evacuation.
 - Disconnect the cable installation.
 - Call in personnel and notify the Local Area Manager for the cable installation immediately.
- High pressure:
 - Call in personnel and notify the Local Area Manager for the cable installation immediately.
 - Track the trend of measurements from the cable installation and inform the called-in personnel in the event of any change.
- Critically low pressure:
 - Check Sveve and contact signed-in personnel at the affected cable installation for evacuation.
 - Disconnect the cable installation.
 - Call in personnel and notify the Local Area Manager for the cable installation immediately.
- Low pressure:
 - Call in personnel and notify the Local Area Manager for the cable installation immediately.
 - Track the trend of measurements from the cable installation and inform the called-in personnel in the event of any change.

Automatic reconnection of lines with inserted cables is treated differently depending on whether coil earthing is present or not. See SDOK-295-10: Principle for setting GIK for transmission line installations with inserted cables, for further clarification.

6.1.9 Failure of monitoring for exposed installations

- In the event of failure of monitoring for cable installations, the following measures and assessments must be carried out immediately:
 - Call in personnel so that operating parameters for cables and glands are read at least twice a day.
 - The first manual reading must be made within 24 hours.
 - Manual reading of the monitoring equipment is to continue until the signal fault is corrected.
 - Installation Manager together with specialists will assess the situation and take action if the signals from the cable installation in the time before signal loss show a discrepancy compared to normal operation.
- In the event of failure of monitoring for SF₆-filled installations and components, the following measures and assessments must be carried out immediately:
 - Call in personnel so that the gas pressure at the installation is read at least once a day.
 - The first manual reading must be made within 24 hours.
 - Manual reading of the monitoring equipment is to continue until the signal fault is corrected.
 - Installation Manager together with specialists will assess the situation and take action if the signals from the cable installation in the time before signal loss show a discrepancy compared to normal operation.

7 Maintenance and follow-up of Statnett's electrical installations

7.1 Statnett's electrical distribution systems

- 7.1.1 The Local Area Manager must ensure that necessary inspection and maintenance is done, so that installations at all times meet the requirements in the Regulations related to Electrical Distribution Systems (FEF).
- 7.1.2 Before new installations are to be used, and after each modification, the person responsible for the execution or modification of the installation must ensure it has been checked and tested.
- 7.1.3 The declaration of conformity and documentation for both the execution and project planning and design are to be delivered to the Local Area Manager in accordance with section 8.1 in this procedural works: Documentation and notification of installations in accordance with FEF 2006 chapter 3.
- 7.1.4 The Local Area Manager must at all times store the declaration of conformity and updated documentation in IFS.
- 7.1.5 The work is to be done by someone with the professional qualifications to work on their own in low-voltage installations and high-voltage installations. This means that the person has a relevant qualification for the work in question. The person will then be responsible for the professional execution of the work (ref. Section 6 of FEK).
- 7.1.6 Low-voltage installations.

The Local Area Manager is responsible for follow-up of the following items:

- After new installation:
 - That the person with the professional responsibility for the work as undertaken issues a declaration of conformity.
 - On installation of new LV switchboards/fuse boxes: That the installation is thermographed during the first year.
- On discovery:
 - Damage to the electrical installation must be rectified as soon as possible.
 - Fluorescent lighting that is blinking must be changed immediately (overheating and fire hazard).
 - Ensure all extension cords and connected equipment are in order.
- Every year:
 - Visual inspection of electrical installation in all rooms. Check for visible damage, brown spots (overheating) etc.
 - Test triggering all residual current breakers (buttons on fuses).
 - Visual inspection of all LV switchboards/fuse boxes.
- At least every four years:
 - Do a thermovision of all LV switchboards/fuse boxes in the building.
- At least every ten years, a more detailed inspection of the installation is to be performed, that at minimum comprises:
 - Visual inspection of LV installation in all rooms.
 - Measuring transition resistance to earth and possible check of all circuits. (Transition resistance to earth is measured for the installation at an

appropriate location. If a low value for transition resistance is shown, you must commence checking each circuit.)

- Check and rectification of any faults and defects in the installation.
- The Local Area Manager is responsible for follow-up and execution of the points above being established/documented in IFS.

7.1.7 High-voltage installations.

The Local Area Manager is responsible for follow-up of the following items:

- After new installation:
 - That the person with the professional responsibility for the work as undertaken issues a declaration of conformity.
 - On installation of new components/lines: That the installation is thermographed during the first year.
- On discovery:
 - Damage to the electrical installation must be rectified as soon as possible.
 - Fault reports in IFS are to be used and planned according to acceptable rectification time.
- Maintenance programme:
 - A maintenance programme is to be defined for each electrical component and established as a measure in IFS.
 - The following document describes this in more detail: RCM analysis of substation, line and cable installations (doc. no. 1287597).
 - For substation installations, substation inspection rounds should be defined in IFS within one year, where visual inspection is done to check that the installation is in order.
 - For distribution line installations, inspections must be defined in IFS where it is visually checked that the line is in order as prescribed in the regulations. Line inspection is to be performed when lines have been exposed to abnormal strains and at least once a year. Line inspection is to be documented with line inspection reports in IFS. In addition to inspection of the line itself, it must be checked that there is nothing new (e.g. buildings, containers, machinery and equipment) along the course. If this is the case, measures are to be initiated, and it must be reported in the Statnett nonconformity system immediately.

7.1.8 Check of earthing system:

- Important and exposed parts of the earthing system are to be checked regularly, and at least every ten years. This is to be done by visual check, measuring and any necessary recalculations. This applies to tower earthing and substation earthing measured against remote earthing. Refer to: Technical specification Earthing substation – General section (SDOK-47-51).
- Disneuter and other zero-point protection is to be checked annually.
- For earthing systems, assessments, choices, calculations, measurements, layout and checks are to be documented in IFS.

- 7.1.9 Installations that are not in use are either to be maintained or removed. The Local Area Manager is responsible for follow-up and execution of the points above being established and documented in IFS.
- 7.1.10 All planned maintenance/rounds/inspections are to be done. If they are not done, a risk assessment must be performed on the work order. This will describe the reason for the delay, an assessment that it is safe to not do it, along with an assessment as to when it will be set up for execution again.
- 7.1.11 The installation is under the jurisdiction of the Norwegian Directorate for Civil Protection (DSB), who perform inspections.

7.2 Statnett's low-voltage electrical installations that are not part of distribution systems

This point does not apply to transformer substations, switching stations, HVDC installations and cable gland installations, as these are defined as distribution systems.

Certain administrative buildings are also subject to the Regulations related to Electrical Supply Installations, where the responsibilities and possible interfaces are described in separate agreement documents.

Examples where this point applies: office buildings, warehouse buildings, garages, cabins, radio line stations and other low-voltage facilities that normally have their grid connection from an external power utility and not from Statnett's substation.

- 7.2.1 The building owner must ensure that necessary inspections and maintenance are performed, so that installations at all times meet the safety requirements in the Regulation relating to Electrical Low Voltage Installations (FEL), Chapter V. On use and connection of electrical equipment to installations, be careful so that there is no risk to life or property.
- 7.2.2 Before new installations are to be used, and after each modification, the person responsible for the execution or modification of the installation must ensure it has been checked and tested to make sure it meets the requirements in the regulation. The declaration of conformity and documentation are to be provided to the building owner. The building owner must at all times keep the declaration of conformity and updated documentation. The work is to be done by someone with the professional qualifications to work on their own in low-voltage installations. This means that the person has the relevant certificate of completed vocational training, and thus is responsible for the professional execution of the work (ref. Section 6 of the Regulations for Electrical Enterprises and Qualification Requirements for Work Related to Electrical Installations and Electrical Equipment (FEK)). Usually an electrical installation contractor is used to make modifications to the installation.
- 7.2.3 The building owner is responsible for follow-up of the following items:
- After new installation:
 - That the electrical installation contractor issues a declaration of conformity.
 - On installation of new LV switchboards/fuse boxes: That the installation is thermographed during the first year.
 - On discovery:
 - Damage to the electrical installation is to be rectified as soon as possible
 - Fluorescent lighting that is blinking must be changed immediately (overheating and fire hazard).

- Ensure all extension cords and connected equipment are in order.
- Every year:
 - Visual inspection of electrical installation in all rooms. Check for visible damage, brown spots (overheating) etc.
 - Test triggering all residual current breakers (buttons on fuses).
 - Visual inspection of all LV switchboards/fuse boxes.
- Every four years:
 - Do a thermovision of all LV switchboards/fuse boxes in the building.
- Every ten years, an electrician from an electrical installation contractor must perform an inspection of the installation, at least comprising:
 - Visual inspection of LV installation in all rooms.
 - Measuring transition resistance to earth and check of all circuits.
 - Check and rectification of any faults and defects in the installation.

7.2.4 The building owner is responsible for the use of the Statnett management system for maintenance and for ensuring that nonconformities and improvements are registered. Likewise, that documentation of the execution of the points above is kept and stored as installation documentation.

7.2.5 The installation is under the jurisdiction of the Local Electricity Inspectorate (DLE), which performs inspections.

7.3 Follow-up of short-circuit currents in Statnett's high-voltage installations

7.3.1 Installations must be planned, constructed and installed in such a manner that they can withstand the mechanical and thermal effects that can result from a short circuit. Within the framework of Electrical power installations (NEK 440:2022), all types of short circuits must be taken into account:

- three-phase
- phase-to-phase
- phase-to-earth
- double earth faults

7.3.2 Installations must have protection that automatically disconnects in the event of three-phase short-circuits and phase-to-phase short-circuits. Installations must be protected with equipment that automatically disconnects earth faults or provide a warning of an earth fault. The short-circuit currents are calculated based on a data model that represents today's grid, and a data model that represents the grid structure five to ten years from now. No margins are added for future changes that are not included in the calculation model.

7.3.3 Team Kontrollanlegg Vern, NTKV, is responsible for making calculations of short-circuit currents in Statnett's installations.

- The following must be calculated:
 - subtransient short-circuit currents, I_k'' , for thermal dimensioning
 - peak currents, i_s , for calculating mechanical forces
- Calculations are carried out in accordance with the methodology described in the Procedure for calculating short-circuit currents in Statnett's installations (SDOK-295-17).

- For grids with a directly earthed 0-point, the 1-phase earth fault current must also be calculated.
- An overview of the latest calculations must be available to anyone who needs it through the document: Calculation of short-circuit currents in Statnett's installations.
- The document must be stored in IFS and linked to Governing documents; folder ID: 02-Kortslutningspåkjenninger i nettet ("02-Short-circuit stresses in the grid"). The document must be approved in DokAdm by the Head of NTKV.
- The document must be updated in the event of changes, and reviewed annually, and must contain at least:
 - today's maximum values in all substations and voltage levels
 - future maximum values: determined on the basis of the assumptions in the Procedure for calculating short-circuit currents in Statnett's installations (SDOK-295-17)
 - description of assumptions and explanations for the calculations

7.3.4 When commissioning a new installation, the declaration of conformity must document that the installation is dimensioned according to the transient and stationary short-circuit currents that may occur.

8 Follow-up of requirements for documentation and notification in accordance with the Regulations related to Electrical Distribution Systems (FEF)

8.1 Documentation and notification of installations in accordance with FEF 2006 chapter 3

- 8.1.1 Installation information must be quality assured, approved and linked in the installation structure in IFS in accordance with the requirements and deadlines specified in the list of requirements and process for transferring installation information.
- 8.1.2 Sections 3.1 and 3.2 of FEF 2006 provide further guidance on the preparation of a declaration of conformity and how it and documentation must be stored. Before new or rebuilt installations are put into operation, the installation must be inspected and, to the extent necessary, tested to verify that it meets the requirements in FEF. The installations must also be functionally tested to the extent that is practically possible. The inspection, tests and function tests must be documented. At Statnett, declarations of conformity must be established for all new electrical installations that are put into operation. In addition, declarations of conformity must be written for all replacements and conversions of installations that require design and/or tests and function tests before commissioning.
- The declaration of conformity must also state the doc. no. for the document that contains the risk assessment in accordance with Section 2-2 of FEF 2006. Declaration(s) of conformity for the design of the electrical installation is/are prepared by the company that has carried out the detailed design of the installation being built, based on the risk assessment in Section 2-2. Declaration(s) of conformity for the execution of the electrical installation is/are prepared by the company that has been responsible for the assembly of the electrical installation. This must have attached documentation of inspections, tests (FAT, SAT) and function tests in addition to technical documentation of the installation.
 - A declaration of conformity for design must always be available before assembly begins.
 - The declaration of conformity must always be approved by the Installation Manager in the company that prepared it.
 - Internally at Statnett, the declaration of conformity is written in a separate template document (doc. no. 1178332 in IFS).
 - For work performed in low-voltage installations, there is a separate tab for final control that is used in addition to any tests that must be referred to in the declaration of conformity.
 - The file is archived according to the following rules:
 - Declaration of conformity project planning_<Title><space><Installation name><space><Project number>
 - Declaration of conformity executing_<Title><space><Installation name><space><Project number>
 - Installation name is IFS three-letter substation code or IFS line number.
 - Title indicates which installation or what the declaration of conformity has been written for.
 - Project number is entered if it exists.
 - For example:
 - Declaration of conformity project planning_Replacement of transformer T51 at Frogner substation FRO 10895
 - Declaration of conformity project planning_Replacement of tower on line 420 kV Ringerike-Syilling L0729 12387
 - Declaration of conformity executing_Replacement of transformer T51 at Frogner substation FRO 10895
 - Declaration of conformity executing_Replacement of tower on line 420 kV Ringerike-Syilling L0729 12387

- The declaration of conformity is linked to the project and installation (at individual and/or function level). It must also be linked to the following folder in IFS:
 - 10 Declarations of conformity, with description: 10 Declarations of conformity
 - The Project Manager must ensure that the declaration of conformity is prepared and that it is sent for approval to the Installation Manager for the relevant electrical work in Statnett. The Installation Managers are described with their area of responsibility in the Instructions for Installation Managers for Statnett's electrical distribution systems (doc. no. 3230725).
- 8.1.3 For projects/activities with more than one declaration of conformity, a summary document must be prepared in a separate template document (SDOK-409-17).
- The summary document must include any declarations of conformity from external companies along with internal declarations of conformity.
 - The document must be entered in IFS in the same way as for the individual declarations of conformity described above.
- 8.1.4 Section 3.3 of FEF 2006 states that before execution and making changes to electrical installations, a notification must be sent to DSB.
- The Project Manager sends an email to DSB containing the information specified in Section 3.3 of FEF 2006. A copy of the email is sent to the Installation Manager.
- The email is archived in IFS as follows:
 - Notification to DSB_<Title><space><Installation name><space><Project number>
 - Title indicates which installation or the purpose of the notification.
 - Installation name is IFS three-letter substation code or IFS line number.
 - Project number is entered if it exists.
 - For example:
 - Notification to DSB_Replacement of transformer T51 at Frogner substation FRO 10895
 - Notification to DSB_Replacement of tower on line 420 kV Ringerike-Syilling L0729 12387
 - The notification is linked to the project and installation. It must also be linked to the following folder in IFS:
 - 13 Notification to DSB, with description: 13 Notification to DSB
 - The notification is sent as an email to the DSB Regional Office for Electricity Supervision to which the installation is subject.
- 8.1.5 Personal injuries or damage to installations or property caused by electricity or that occurs when working on or in the vicinity of electrical installations, or when operating electrical installations, must in each individual case be notified as soon as possible to the Installation Manager.
- Where Statnett's employees have been exposed to electrocution, this must also be notified to Statnett's occupational health service (BHT). See the Occupational health service page on Nettopp.
 - All accidents caused by electrocution and electric arcing must also be notified to DSB. Section 3-4 of FEF 2006 states that notification must be made to DSB as soon as possible in the event of personal injury or major material damage. Serious accidents must also be reported by telephone to DSB on 33 41 25 00 (switchboard) or to the DSB duty officer on 48 21 20 00. Accidents caused by electrocution and electric arcing are notified to DSB by filling in a form on DSB's website for electrical accidents, injuries and damage. A copy of DSB's electrical accident notification form must be sent to the Installation Manager.

8.2 Risk assessment in accordance with Section 2-2 of FEF 2006

8.2.1 Section 2-2 of FEF 2006 reads: "A risk assessment must be performed to map risks within and in connection with the electrical installation. During execution, the risk assessment must be used as a basis for choosing solutions. This must be documented."

- At Statnett, a risk assessment of the chosen solution must be made in the design phase. The solution that is chosen must not involve any danger to people or material. The declaration of conformity must document that equipment has been selected and the installation designed in accordance with regulations, national standards and Statnett's standards.
- At an early phase in the project, a risk assessment must also be made in relation to existing installations and the surrounding environment (weather, wind, ground conditions, risk of landslides, neighbouring properties etc.). If special measures must be implemented in relation to the regulations (coordination of insulation, exemptions etc.), the associated risk assessment must also be documented.
- A risk assessment as described in Section 2-2 is carried out continuously in all phases of the project. When the electrical installation has been completed, the result should be a single document, archived at the installation. During phases BP0–BP4 of the project, the risk assessment that exists from one phase to another will form the basis for the further detailed design and construction of the electrical installation. The risk assessment can at some point also form a basis that will be handed over to an external company that will carry out detailed design of an installation. A detailed design may lead to the discovery that changes must be made to the risk assessment, which then must be updated.
- The risk assessment is written in a specific template document (doc. no. 1643013). This document may also refer to other documents. The file is archived in IFS as follows:
 - Risk assessment pursuant to Section 2.2 of FEF_<Title><space><Installation name><space><Project number>
- Title indicates which installations or what the risk assessment covers.
- Installation name is IFS three-letter substation code or IFS line number.
- Project number is entered if it exists.
- For example:
 - Risk assessment pursuant to Section 2.2 of FEF_Replacement of transformer T51 at Frogner substation FRO 10895
 - Risk assessment pursuant to Section 2.2 of FEF_Replacement of tower on line 420 kV Ringerike-Sylling L0729 12387
- The risk assessment is linked to the project and installation (at individual and/or function level). It must also be linked to the following folder in IFS:
 - 14 Risk assessment pursuant to Section 2.2 of FEF, with description: 14 Risk assessment pursuant to Section 2.2 of FEF
- The declaration of conformity must state the doc. no. of the document containing the risk assessment.

9 Definitions

Access: Physical opportunity to unlock doors using a card reader. An access card is assigned.

Access card: Physical access card that is used to open and close doors/gates, depending on the access that has been given.

Access level: Grading of access in access cards based on where in the installation access is granted. See also section 2 in Appendix 1.

Access permit: One of the authorisations that can be granted in the safety card database. See also instructions for training/access/safety cards in Statnett's electrical installations.

AIS: Air Insulated Substation.

Authorisation in safety card: Indicates which rights and any restrictions with regard to access permits apply to the holder of the safety card.

Breaker failure protection (BFP): Protection function that takes effect if a circuit breaker does not break an ongoing short-circuit current. It therefore rapidly ensures fault clearance by taking out all other circuit breakers that feed short-circuit current to the fault location. The trip command normally goes via logic in busbar protection so that bar-selective disconnection is achieved.

Building owner: The person at Statnett who takes care of the owner follow-up of the building in which the low-voltage installation is located.

Busbar differential protection (BB Diff): Immediate short-circuit protection for faults in the busbar area based on the differential protection principle. In most cases, the protection will have several zones (be bus-selective) so that only faulty busbar systems are disconnected.

Busbar protection (BB protection): Protection function that normally includes both differential protection for the busbar(s) as well as breaker failure protection for the individual circuit breakers connected to the busbar(s).

Declaration of conformity: Document issued for an electrical installation indicating that the installation is designed and built in line with applicable laws, regulations and standards.

GIS: Gas Insulated Substation.

Guide permit: The authorisation required to accompany a person who does not have an entry permit. In order for the person to enter the installation, they must also be granted access.

Installation Manager: Person appointed by the owner/operator to be responsible for and oversee the daily operation and maintenance of the electrical installations.

JSA: Job Safety Analysis.

Key: A key suitable for locking and unlocking gates/doors leading into high-voltage installations and low-voltage installations that are not protected against contact.

Local Area Manager: The person at Statnett who looks after the follow-up of maintenance of the electrical installations, as well as the owner follow-up of the building/land where the low-voltage installation/high-voltage installation is located.

Low-voltage electrical installation: An installation with a maximum nominal voltage of up to 1,000 V alternating voltage or 1,500 V direct voltage.

MSI: *Markering, sikring og inspeksjon* – Labelling, securing and inspection.

On-call personnel: Internal and external personnel who, through their own safety card, are approved as on-call duty officers.

Operation Controller: Nominated person in control of switching operations who is responsible for ensuring that switching of high-voltage installations is conducted in a safe manner.

Safety card: An entry in the safety card database that shows which personal approvals you have linked to Statnett's electrical installations. Safety cards are issued by Statnett's Installation Manager and apply to Statnett's electrical installations, where Statnett has responsibility as Installation Manager. The individual can take a printout/screenshot of the safety card.

Safety card database: Database indicating authorisations with regard to electrical installations for each individual. See also section 1 in Appendix 1.

Safety Observer: Person instructed and designated by the Work Controller to supervise the work in cases where the Work Controller has to leave the worksite. The Safety Observer can/must stop the work if necessary, but does not have the authority to restart the work or establish/remove safety measures.

System Supervisor at Regional Control Centre North and Regional Control Centre South:

The System Supervisor must be appointed according to the current procedure at the relevant Regional Control Centre.

The System Supervisor has connection authority and is appointed as Operation Controller.

The System Supervisor can delegate connection tasks to other previously approved Operation Controllers.

Temporary earthing: Fully-dimensioned earthing and short circuiting of installation parts where work is being conducted.

Work Controller: Appointed person who has been given responsibility for electrical safety at the worksite.

Worksite: Positions where personnel and equipment are inside the live working zone, or where there is a risk of entering the live working zone. The outer limit of the live working zone is determined by the system voltage, cf. FSE Section 5, table 1.

10 Overview of template documents

- Template document for risk assessment in accordance with Section 2-2 of FEF 2006 (doc. no. 1643013)
- Template document for declaration of conformity (see user guide as a note to cell A1) (doc. no. 1178332)
- Template document for overview of declarations of conformity (SDOK-409-17)
- Template for simple risk assessment of activities in Statnett's electrical installations (doc. no. 3278092)
- Template for agreement regarding work within 30 m (warning distance) from overhead lines/ high-voltage installations (doc. no. 2086741)
- Template for agreement for work in the vicinity between Statnett and the franchisee (doc. no. 3087627)
- Template for agreement between Statnett and contractor in relation to safeguarding electrical safety during the construction, demolition and dismantling of electrical installations (doc. no. 2608215)
- Template for agreement between Statnett and external tenants of the Klæbu Training Facility for safeguarding electrical safety during activities in the facility (doc. no. 3265503)
- Template for agreement between COMPANY and Statnett on the hiring of Statnett personnel (doc. no. 3273836)
- Template for access to Statnett's electrical facilities through connection agreements (doc. no. 2448557)

11 Version log

Valid from	Revision category (New/Updated/Wording/None)	Description of important changes
15.08.2024	Updated	4.4.2: Added temporary method 2 for voltage testing on transmission line above 145kV, where the voltage testing itself is confirmation that terminal earthing has been established in both/all ends and the use of a remote electric field detector.

12 Appendices

Appendix 1 – Administrative procedures regarding the allocation of access via access cards from the Monitoring Centre

Frameworks:

1. The safety card database indicates at all times who has an access permit (AT) to Statnett's high-voltage installations and low-voltage installations that are not protected against contact, hereafter called installations, cf. [instructions for training/access/safety cards in Statnett's electrical installations](#).
2. Access to the substation area can further be restricted within the following access levels:
 1. Gate
 2. Substation building
 3. Control room
 4. Key cabinet

This is not regulated in the safety card database, except for requests in line with section 11. The need for a particular access level must be assessed by the person requesting access via access card.

Issuing access via access card:

3. Procedure:
 - a. Anyone with the authorisation "Request keys to electrical installations (AN)" in the safety card database can authorise access via access card.
 - b. For internal employees who already have access cards and safety cards, the request is made here: [Request for access to electrical installations](#). See also Appendix 2.
 - c. Otherwise, the request is made using the link <https://support.statnett.no/>. Select category **Monitoring Centre** under **Case** and **New case**.
 - d. The operator at the Monitoring Centre checks the request against the safety card database.
 - e. The expiry date on the access is set to the expiry date on the safety card.
 - f. The operator at the Monitoring Centre updates the field "Issued high-voltage keys" in the safety card database.
4. Clarification: You do not need to have gained access via an access card to be able to have an access permit to an electrical installation, but to gain access via an access card you must have an access permit to the installation, cf. section 1.

Withdrawal of access via access card:

5. When an access via safety card has expired, sikkerhetskort@statnett.no sends a monthly list to the Monitoring Centre of access cards to be deactivated.
6. The Monitoring Centre confirms back to sikkerhetskort@statnett.no when access cards have been deactivated.

Guidelines:

7. All employees within an **operating area** are fundamentally granted access via access card to **all installations in Statnett's operating areas (with the exception of computer/server rooms in the H and R installations, see section 5.5 of the procedure)**, however within the limitations specified in the safety card database, cf. section 1.
Each employee's access is approved by the Local Area Manager (or someone authorised by them).
8. **Operational personnel in Regional IT Infrastructure (TBI)** are fundamentally granted access via access card to **all installations in Statnett's operating areas (with the exception of computer/server rooms in the H and R installations, see section 5.5 of the procedure)**, however within the limitations specified in the safety card database, cf. section 1.
Each employee's access is approved by the Installation Manager (Assistant Installation Manager), as long as there is no question of access within one operating area. In that case, the Local Area Manager (or someone authorised by them) provides approval.
9. **Other personnel** at Statnett are granted access via access card **as required**, within the limitations specified in the safety card database, cf. sections 1 and 3.
Each employee's access is approved by the Installation Manager (Assistant Installation Manager), as long as there is no question of access within one operating area. In that case, the Local Area Manager (or someone authorised by them) provides approval.
10. **External personnel** are allocated access via access card as needed within the limitations specified in the safety card database, cf. section 1.
Each employee's access is approved by the Installation Manager (Assistant Installation Manager), as long as there is no question of access within one operating area. In that case, the Local Area Manager (or someone authorised by them) provides approval.

Special notes for installations with shared ownership in the same substation:

11. In installations where other companies own electrical installations, where Statnett owns a gate/fence/ground, and where access is regulated in an agreement (usually through a separate section in a *connection agreement*) between a Statnett Installation Manager and another company's Installation Manager, the following procedure is followed:
 - a. The other company's Installation Manager submits a list of names to the Local Area Manager on an **annual** basis or when **changes** are needed, based on the template Access to Statnett's electrical installations through connection agreements.¹⁹
 - b. The Local Area Manager sends the list to sikkerhetskort@statnett.no.
 - c. sikkerhetskort@statnett.no enters personnel into the safety card database ("dummy cards" with course dates of 1 January, along with a note in the comment field that the card is based on a request from another Installation Manager). Furthermore, the restriction field for AT in the safety card database specifies which card readers the access card should be limited to.
For example, "Access card limited to card reader Gate". This is to ensure that the personnel at the Monitoring Centre can check and issue access cards in line with section 3.
 - d. sikkerhetskort@statnett.no requests access via access card, cf. section 3. This is done by attaching the list (see point b) to the request sent to the Monitoring Centre.
 - e. The Monitoring Centre issues access cards in line with the list submitted, once the necessary authorisations have been checked against the safety card database, cf. section c.

¹⁹ When first established, and in the event of changes, the affected operating area must ask the Installation Manager in the other company for a list based on the template Access to Statnett's electrical installations through connection agreements (doc. no. 2448557).

- f. The expiry date of the access in the access card is set to the expiry date of the safety card.
12. In installations where other companies own high-voltage installations and access is not regulated in an agreement between the Installation Managers: Requests are made in line with section 3.

Appendix 2 – Request for an access card for internal employees who already have a safety card and an access card

For internal employees, a page has been created on Nettopp to grant access on existing access cards.

You can find it here: [Request for access to electrical installations](#).

A prerequisite for using this procedure is that you already have an access card and a safety card.

The first page shows a predefined list where you can select Operating Group/Operating Area and Substation. The name is prefilled. Choose where you want access, and enter your access card number and safety card number.

Your request for access will then be sent to your nearest superior who has AN in their safety card, and you will receive an email as documentation.

After AN has received an email about this, the person in charge can either approve or reject with a comment.

After AN has approved the application, it is automatically sent to ovs@statnett.no for processing in superoffice with an ID no. and a link to the case. Clicking it brings up this:

The Monitoring Centre can then grant the desired access and sends a response back to the applicant by email.

Procedure

Electrical safety procedural works

Revision log SDOK-515-73:

Revision	Approved	Approved by	Description
7.0	Show changes 16.08.2024	Endre Johan Hoel	See the version log
6.0	Show changes 25.06.2024	Endre Johan Hoel	See the version log
5.0	Show changes 02.01.2024	Arnfinn Granheim	See the version log
4.0	Show changes 29.09.2023	Arnfinn Granheim	See the version log
3.0	Show changes 31.03.2023	Arnfinn Granheim	See the version log
2.0	Show changes 30.12.2022	Arnfinn Granheim	Electrical safety prosedures are incorporated in an electrical safety procedural works.

...