Operating Instructions for Electricity Distribution and Connection Work

1 Overview

These instructions provide guidance on performing work and switching related to electricity supply both in normal running conditions and in the event of an electricity supply failure.

All work related to electricity supply must have a switching plan, a risk assessment for own work and an electrical work permit. In case of an emergency, no work permit is required.

An electrical work permit for the switchgear in the STP area can only be issued by the persons responsible for electricity supply (Jari Holmberg, Joel Salmio, Jarkko Heikkilä). Switchgear switching is performed by the persons mentioned above, or a person authorised by them.
After the electrical work permit is issued, an actual work permit must still be obtained to perform the work in accordance with company policy.

Section 2 of these instructions covers normal running conditions, including switching required for shutdowns. Section 3 includes procedures to be carried out during an electricity supply failure and immediately after the failure.

In these instructions, technician refers to BOHA's and Quant Service's
electricians and electrical and instrumentation technicians who participate in maintenance work.

For Quant Service's technicians, this is a recommendation until otherwise ordered by the person responsible for NNH's electricity and automation operations.

1.1 Abbreviations of companies

Boliden Harjavalta Oy; BOHA
Quant Service Oy; Quant
Oy AGA Ab; AGA
Norilsk Nickel Harjavalta Oy; NNH
Suomen Teollisuuden Energiapalvelut – STEP Oy; STEP

1.2 Communications

As a rule, failures are communicated by the following:

BOHA, NNH, AGA, STEP:

- Jari Holmberg (deputy: Joel Salmio), BOHA
- Jaakko Ravantti (deputy: Jari Malmi), NNH
- Ilkka Malmi (deputy: Jari Holmberg), AGA Joona Rajala (deputy: Jari Holmberg), STEP

The person primarily responsible for fault investigation and switching during a failure is Jari Holmberg or Joel Salmio, or a person separately designated by them. If a person responsible is temporarily unable to perform his/her task or is not reached when needed, the persons responsible for communications mentioned above act as deputy responsible persons.

These instructions are supplemented and updated as necessary. The person responsible for this is Jari Holmberg.

Note! The operation of GSM phones can be disrupted during a power outage!

2 Work and switching in normal running conditions

In this case, the 110 kV switching substation and the intermediate-voltage network are considered to be a general electricity distribution network (cf. standard SFS 6002).

With regard to the distribution network, the following equipment is excluded from these instructions: high voltage motors, NiSu transformer, Ni electrolysis rectifier transformer, and the variable-frequency drive output of the main gas blower of the R7 and R8 plants. These are so-called
process equipment controlled remotely by using a process control system. If these circuit breaker outputs must be controlled or isolated, such actions are operational actions and the necessary control is carried out by the maintenance personnel.

In controlling the process outputs, the same two-person practice as for distribution network switching is to be followed. In this case, at least one of the two persons must have completed the orientation for the intermediate-voltage switchgear in question. Before any switching, these persons must always contact the appropriate control room to verify that the work permit is valid and the work can be done, and they must also verify that the bay to be controlled in the switchgear room is correct.

2.1 Switching

Distribution network switching may only be carried out by Jari Holmberg, Joel Salmio or Jarkko Heikkilä. If necessary, the on-duty electricians will act as deputies in cooperation with any of the persons mentioned above.
In case of an emergency, an on-duty electrician can perform an emergency switching under the guidance of Jari Holmberg, Joel Salmio or Jarkko Heikkilä (must be enabled with, for example, a constant telephone communication).

All switching operations must be pre-planned and mutually agreed upon. With the exception of emergency switching, two of the persons listed above must always be present when switching.

Immediately before switching, the persons participating in the work must go through the switching operation and make sure that everyone understands how the switching is to be performed, how it affects to the network status and what are their own tasks during the switching. **Before switching, at least two different persons must verify that the circuit breaker to be controlled is correct and that the control can be done safely.**

Switchyard switching operations must also be pre-planned and documented in writing. In addition, the switching plans must be reviewed by another person (Jari, Joel or Jarkko).

2.2 Preventive maintenance work on electricity supply

Preventive maintenance work on electricity supply is subject to the same approval requirement by two competent persons as switching. Such work include, for example, protection relay testing.

All preventive maintenance work must be pre-planned and mutually agreed upon. Immediately before starting the work, the persons participating in the work must go through the work and make sure that everyone understands how the work should be carried out, how it affects to the network status and what are the safe and correct bypasses that must be done in advance on the protection systems etc. **Before starting, at least two different persons must verify that the object of the work is correct, that the control can be done safely and that the bypasses are sufficient for, for example, a protection relay test.**

After the preventive maintenance work is completed, all bypasses must be returned to their normal state. This must be done and verified before the work is signed off.

3 Actions in the event of a supply failure

An electricity supply failure can be either external or internal, i.e. in BOHA's distribution network. There are two procedures: for a supply failure taking place during the normal working hours and for a similar event taking place outside working hours.

When investigating an internal failure, the first priority is to ensure personnel safety and then minimise further damage. Only after this we can start re-energising the network according to the situation.

The persons mentioned in these instructions are aware of their tasks in the event of a failure. They are also provisionally trained in their tasks, and refresher training must be organised regularly.

3.1 Procedure in the event of an interruption during the normal working hours

- **The staff in control rooms** ensures that Jari Holmberg, Joel Salmio, Jarkko Heikkilä and/or the on-duty electrician are aware of the situation.
- The on-duty electrician goes immediately to the electrical operating area of the main switching substation K1.
- The person designated for the shift maintenance duty goes immediately to Pumppuranta (river bank pump station).
- The control room operators ensure that the diesel systems and turbine pumps start up.
- Jari Holmberg, Joel Salmio and Jarkko Heikkilä go to the SCADA control room. Mika Vuori goes to the sulphuric acid plant control room, Tuomo Kuivala goes to the smelter control room, Hannu-Pekka Leino goes to the Ni-ely control room, Jari Malmi goes to the reduction plant control room, Mikko Laine goes to the chemical plant control room, Ilkka Malmi goes to AGA's control room and Joona Rajala goes to the power plant control room.

3.2 Procedure in the event of an interruption outside working hours

- **The control room staff ensures that the on-duty electrician is aware of the situation and goes to K1.** The on-duty electrician reports the interruption to Jari

Holmberg (tel. 040 1677 505), Joel Salmio (tel. 040 1867947) or Jarkko Heikkilä (tel. 040 7127447.

- The on-duty electrician goes immediately to the electrical operating area of the main switching substation K1.
- The person designated for the shift maintenance duty goes immediately to Pumppuranta (river bank pump station).
- At K1, the on-duty electrician immediately starts to investigate what has happened and what the electrical distribution network status is.
- After Jari Holmberg or Joel determines the network status, they decide on the necessary further actions and whether additional power is needed.

4 Operation of the emergency power logic

If an interruption takes place in the 110 kV network, the emergency power logic immediately connects the LSV's backup power supply to the smelter's K2 busbar 2 whose loads are the transformers of the converter and compressed air plants. After this, the emergency power logic waits for the delayed automatic reclosing of the supply lines. If the supply does not remain on, i.e. there is a permanent fault, the emergency power logic has two options.

After the delay of the delayed automatic reclosing, the emergency power logic checks if the Kauttua 110 kV line is energised. If it is, the factory area is connected to the Kauttua line by first opening circuit breakers AE14Q0 and AE16Q0 and then closing AE18Q0. Now the factory area is connected to a supply that can withstand almost a full load.

If the Kemira line is also dead, the logic connects the supply via the LSV supply. This supply cannot withstand a high load, so the switchgear is switched on in steps to minimise spikes.

5 Assessing the situation

- Check the voltage and switching status of the intermediate-voltage network from MicroSCADA and on the emergency power logic operating screen.
- If the SCADA connections or the logic operating screen does not work, check the circuit breaker K1.J01 status and voltage display from the main switchgear K1 bay.

- Check whether LSV supply K1.J15 is active, is K1.J01 open and K1.J04 and K1.J13 closed.

6 Further actions

- Explain the statuses of the circuit breakers described above to the person responsible for electricity supply.
- Check the status of the rest of the network with MicroSCADA or by conducting the necessary checks in the field.
- In case of an external failure, re-energise the network to the normal state in accordance with the instructions by the person responsible for electricity supply as soon as possible.
- The emergency power logic may also have energised the Kauttua line, in which case the person responsible for electricity supply can authorise loading and deactivate the “emergency power” condition from MicroSCADA.
- If the failure was an internal failure, check, for example, alarms and changed position information of switchgear and pick-ups of protection relays.
- Try to determine the causes that led to the failure and prevent further damage.
- The network is then re-energised step by step in accordance with the instructions by the person responsible for electricity supply.
- After the emergency power condition is deactivated, the person responsible for electricity supply authorises switching off the diesels of the extraction-reduction plant, Pumppuranta (river bank pump station) and furnace water pump station (diesels have their own instructions on this procedure).

7 Duties at the power plant

All operations related to electricity supply and electrical switching are led by one of the electrical team's professionals mentioned in section 2.

In the event of an electricity supply failure, the power plant is responsible for communicating the notifications to the relevant control rooms in the factory area and for ensuring the situation of at the Pumppuranta (river bank pump station).

8 Emergency power

Indication of active emergency power supply has been added to all control systems. This information is displayed in the top section or as a separate pop-up window on the system screens. In such a case, only necessary, low-power (< 50 kW) motors and other similar equipment may be started. In addition to these, boiler circulation water pumps, air compressor(s) etc. must be started. There are separate instructions for these at the power plant.

The electrical team must be asked for a separate permission to start higher power equipment.