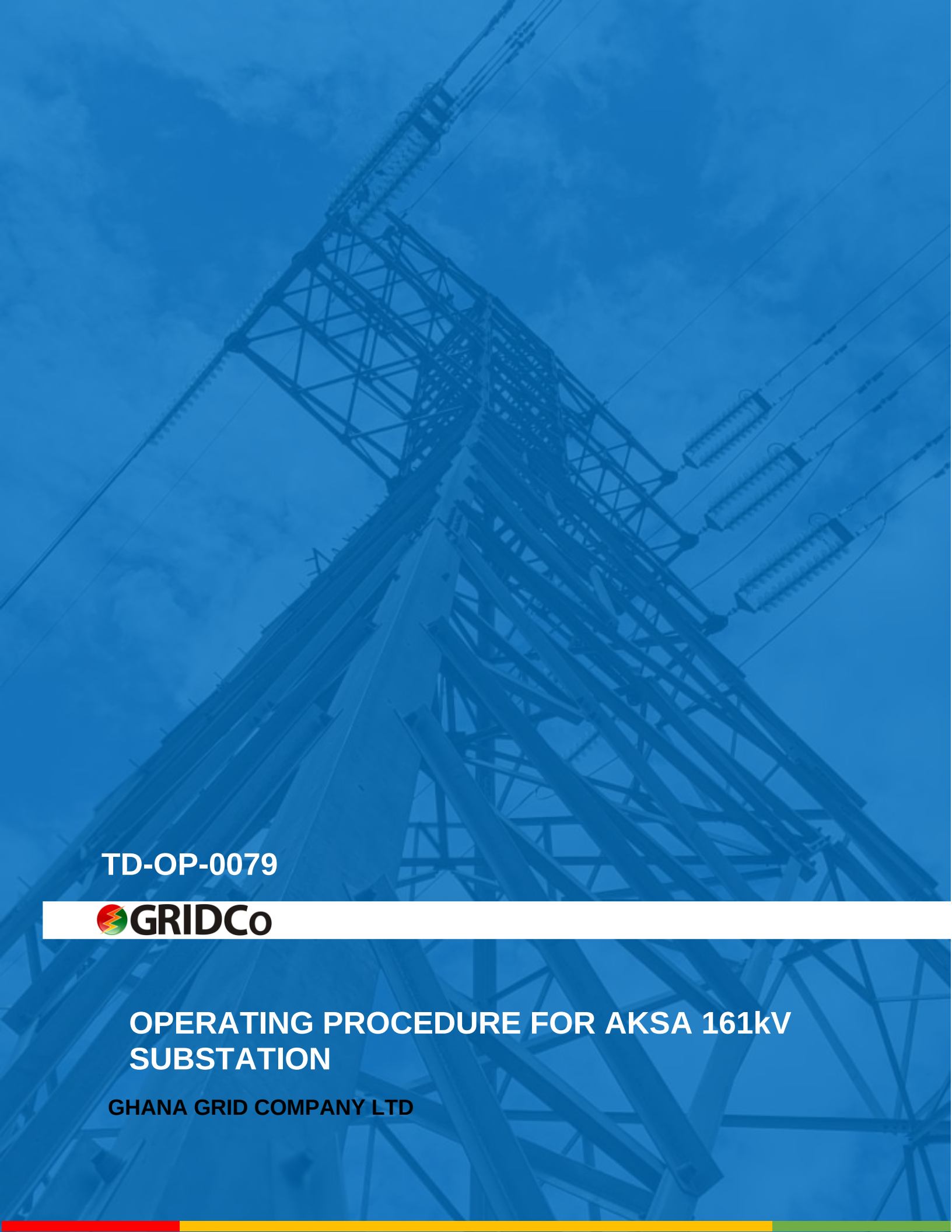

TD-OP-0079

GRIDCo

OPERATING PROCEDURE FOR AKSA 161kV SUBSTATION

GHANA GRID COMPANY LTD

Title: OPERATING PROCEDURE FOR AKSA 161KV SUBSTATION (AK79)	
Director, System Operations Director, SNS Manager, SCC Manager, Dispatch Operations Manager, AKSA Operating Staff, AKSA Maintenance Staff, AKSA Dispatch Staff, SCC	**Number:** TD-OP-0079 **Subject Area:** Operating **Issue Date:** Trial **Origin:** Technical Services
Key Words: Take Out, Isolate, Prepare, Energize, Restore, Automatic Outage	

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TECHNICAL DIRECTIVES

1. Purpose

This directive specifies the operations to be carried out to take out of service, isolate or restore equipment at AK79 Substation to service for planned and auto outages.

2. Scope

The directive will be used by Operators at AKSA and System Control Center (SCC) for operation of equipment at AK79 Substation.

3. Procedure

3.1. To take AK22SM line out of service

SCC shall carry out (or advise the AK79 Operator to carry out) the following:

- Open 79ADL22 breaker

SCC shall carry out (or advise the SM60 Operator to carry out) the following:

- Open 60L22A and 60L22L10 breakers
- Check for no potential on AK22SM line

3.2. To take out, isolate and de-energize AK22SM line for work

- AK79 Operator shall request for Station Guarantee from SM60

SCC shall carry out (or advise the AK79 Operator to carry out) the following:

- Open 79ADL22 breaker

SCC shall carry out (or advise the SM60 Operator to carry out) the following:

- Open 60L22A and 60L22L10 breakers
- Check for no potential on AK22SM line

SCC shall advise the AK79 Operator to carry out the following:

- Open 79ADL22-L22 disconnect switch and turn off 125Vdc supply
- Close 79AK22SM-G ground disconnect switch

SCC shall advise the SM60 Operator to carry out the following:

- Open 60L22A-L22 and 60L22L10-L22 disconnect switches and turn off

125Vdc supply

- Close 60AK22SM-G ground disconnect switch

3.3. To restore AK22SM line to service after work

3.3.1. Prepare AK22SM line for restoration

AK79 Operator shall

- Advise SCC when work on the line has been completed and permit(s) surrendered (including all Station Guarantees)

- Check for no potential on AK22SM line

SCC shall advise SM60 Operator to carry out the following:

- Open 60AK22SM-G ground disconnect switch

- Turn on 125Vdc supply and close 60L22A-L22 and 60L22L10-L22 disconnect switches

SCC shall advise AK79 Operator to carry out the following:

- Check opened 79ADL22 breaker

- Open 79AK22SM-G ground disconnect switch

- Turn on 125Vdc supply and close 79ADL22-L22 disconnect switch

3.3.2. Restoration of AK22SM line to service:

SCC shall:

- Advise the AK79 and SM60 Operators of readiness to restore AK22SM line to service

- Close (or advise SM60 operator to close) 60L22A and 60L22L10 breakers

- Close (or advise AK79 operator to close) 79ADL22 breaker

3.4. To restore AK22SM line to service after automatic outage

If AK22SM line trips auto due to fault:

- Advise SCC about the outage

- Acknowledge all alarms and record relay operation details

- Reset relay targets

- Report relay operation details to SCC

SCC shall

- Energize (or advise the AK79 Operator to energize) the line **ONCE** by closing 79ADL22 breaker

- Close (or advise SM60 operator to close) 60L22A and 60L22L10 breakers

AK79 Operator shall:

- Advise the Supervisor/Area Manager of operation above

- Advise maintenance men to patrol the line if the above operation is not successful

3.5. To take AK23SM line out of service

SCC shall carry out (or advise the AK79 Operator to carry out) the following:

- Open 79ADL23 breaker

SCC shall carry out (or advise the SM60 Operator to carry out) the following:

- Open 60L23A and 60L23L20 breakers

- Check for no potential on AK23SM line

3.6. To take out, isolate and de-energize AK23SM line for work

- AK79 Operator shall request for Station Guarantee from SM60

SCC shall carry out (or advise the AK79 Operator to carry out) the following:

- Open 79ADL23 breaker

SCC shall carry out (or advise the SM60 Operator to carry out) the following:

- Open 60L23A and 60L23L20 breakers

- Check for no potential on AK23SM line

SCC shall advise the AK79 Operator to carry out the following:

- Open 79ADL23-L23 disconnect switch and turn off 125Vdc supply

- Close 79AK23SM-G ground disconnect switch

SCC shall advise the SM60 Operator to carry out the following:

- Open 60L23A-L23 and 60L23L20-L23 disconnect switches and turn off 125Vdc supply

- Close 60AK23SM-G ground disconnect switch

3.7. To restore AK23SM line to service after work

3.7.1. Prepare AK23SM line for restoration

AK79 Operator shall

- Advise SCC when work on the line has been completed and permit(s) surrendered (including all Station Guarantees)

- Check for no potential on AK23SM line

SCC shall advise SM60 Operator to carry out the following:

- Open 60AK23SM-G ground disconnect switch

- Turn on 125Vdc supply and close 60L23A-L23 and 60L23L20-L23 disconnect switches

SCC shall advise AK79 Operator to carry out the following:

- Check opened 79ADL23 breaker

- Open 79AK23SM-G ground disconnect switch

- Turn on 125Vdc supply and close 79ADL23-L23 disconnect switch

3.7.2. Restoration of AK23SM line to service:

SCC shall:

- Advise the AK79 and SM60 Operators of readiness to restore AK23SM line to service

- Close (or advise SM60 operator to close) 60L23A and 60L23L20 breakers

- Close (or advise AK79 operator to close) 79ADL23 breaker

3.8. To restore AK23SM line to service after automatic outage

If AK23SM line trips auto due to fault:

- Advise SCC about the outage
- Acknowledge all alarms and record relay operation details
- Reset relay targets
- Report relay operation details to SCC

SCC shall

- Energize (or advise the AK79 Operator to energize) the line **ONCE** by closing 79ADL23 breaker
- Close (or advise SM60 operator to close) 60L23A and 60L23L20 breakers

AK79 Operator shall:

- Advise the Supervisor/Area Manager of operation above
- Advise maintenance men to patrol the line if the above operation is not successful

3.9. To isolate 79T1 Transformer for work

SCC shall carry out or advise AK79 operator to carry out the following:

- Inform customers about readiness to take off 79T1 Bank
- Shut down 79G7, 79G8, 79G9, 79G10 and 79G11 generators
- Open Contactor/MCB to take off supply to 79T1 transformer auxiliaries

SCC shall carry out (or advise AK79 Operator to carry out) the following:

- Open 79B2T1 and 79B1T1 breakers
- Open 79T1AD breaker

AK79 Operator shall:

- Check for no potential on 79T1 Bank
- Open 79T1AD-A and 79T1AD-D disconnect switches
- Open AC control MCB to 79T1 auxiliaries and tag
- Open 125V DC MCB to 79T1 primary and secondary protection and tag with PC13

3.10. To restore 79T1 Bank to service

3.10.1. Prepare 79T1 Bank restoration:

AK79 Operation shall:

- Advise SCC when work on the bank has been completed and permit(s) surrendered (including all Station Guarantees)
- Check for no potential on 79T1 Bank and temporary grounds removed
- Turn on 125Vdc supply and close 79T1AD-A and 79T1AD-D disconnect switches
- Close AC control MCB to 79T1 auxiliaries and remove tag
- Close 125V DC MCB to 79T1 primary and secondary protection and remove PC13 tag
- Advise SCC and Customers of readiness to energize 79T1 bank

3.10.2. Restoration of 79T1 Bank:

- Start 79G7, 79G8, 79G9, 79G10 and 79G11 generators
- SCC shall close (or advise AK79 Operator to close) 79B2T1 and 79B1T1 breakers
- SCC shall close (or advise AK79 Operator to close) the 79T1AD breaker

3.11. To restore 79T1 Bank to service after automatic outage

If 79T1 Bank trips auto due to fault:

AK79 Operator shall:

- Advise SCC about the outage
- Acknowledge all alarms and record relay operation details
- Reset relay targets
- Report relay operation details to SCC

SCC shall:

- Energize (or advise the AK79 Operator to energize) the bank **ONCE** by closing 79T1AD breaker
- Advise Customer of readiness to restore 79T1 transformer to service

- Close 79B2T1 and 79B1T1 breakers

AK79 Operator shall:

- Advise the Supervisor/Area Manager and SCC of operation above
- Isolate the Transformer for maintenance men to work on the equipment if operation above is not successful. See Explanation.

3.11.1. To isolate 79T2 Transformer for work

SCC shall carry out or advise AK79 operator to carry out the following:

- Inform customers about readiness to take off 79T2 Bank
- Shut down 79G1, 79G2, 79G3, 79G4 and 79G5 generators
- Open Contactor/MCB to take off supply to 79T2 transformer auxiliaries

SCC shall carry out (or advise AK79 Operator to carry out) the following:

- Open 79B3T2 and 79B4T2 breakers
- Open 79T2AD breaker

AK79 Operator shall:

- Check for no potential on 79T2 Bank
- Open 79T2AD-A and 79T2AD-D disconnect switches
- Open AC control MCB to 79T2 auxiliaries and tag
- Open 125V DC MCB to 79T2 primary and secondary protection and tag with PC13

3.12. To restore 79T2 Bank to service

3.12.1. Prepare 79T2 Bank restoration:

AK79 Operation shall:

- Advise SCC when work on the bank has been completed and permit(s) surrendered (including all Station Guarantees)
- Check for no potential on 79T2 Bank and temporary grounds removed

- Turn on 125Vdc supply and close 79T2AD-A and 79T2AD-D disconnect switches

- Close AC control MCB to 79T2 auxiliaries and remove tag

- Close 125V DC MCB to 79T2 primary and secondary protection and remove PC13 tag

- Advise SCC and Customers of readiness to energize 79T2 bank

3.12.2. Restoration of 79T2 Bank:

- Start 79G1, 79G2, 79G3, 79G4 and 79G5 generators

- SCC shall close (or advise AK79 Operator to close) 79B3T2 and 79B4T2 breakers

- SCC shall close (or advise AK79 Operator to close) the 79T2AD breaker

3.13. To restore 79T2 Bank to service after automatic outage

If 79T2 Bank trips auto due to fault:

AK79 Operator shall:

- Advise SCC about the outage

- Acknowledge all alarms and record relay operation details

- Reset relay targets

- Report relay operation details to SCC

SCC shall:

- Energize (or advise the AK79 Operator to energize) the bank **ONCE** by closing 79T2AD breaker

- Advise Customer of readiness to restore 79T2 transformer to service

- Close 79B3T2 and 79B4T2 breakers

AK79 Operator shall:

- Advise the Supervisor/Manager and SCC of operation above

- Isolate the Transformer for maintenance men to work on the equipment if operation above is not successful. See Explanation.

3.14. To isolate 79T3 Transformer for work

SCC shall carry out or advise AK79 operator to carry out the following:

- Inform customers about readiness to take off 79T3 Bank
- Shut down 79G19, 79G20, 79G21 and 79G22 generators
- Open Contactor/MCB to take off supply to 79T3 transformer auxiliaries

SCC shall carry out (or advise AK79 Operator to carry out) the following:

- Open 79B5T3 breaker
- Open 79T3AD breaker

AK79 Operator shall:

- Check for no potential on 79T3 Bank
- Open 79T3AD-A and 79T3AD-D disconnect switches
- Open AC control MCB to 79T3 auxiliaries and tag
- Open 125V DC MCB to 79T3 primary and secondary protection and tag with PC13

3.15. To restore 79T3 Bank to service

3.15.1. Prepare 79T3 Bank restoration:

AK79 Operation shall:

- Advise SCC when work on the bank has been completed and permit(s) surrendered (including all Station Guarantees)
- Check for no potential on 79T3 Bank and temporary grounds removed
- Turn on 125Vdc supply and close 79T3AD-A and 79T3AD-D disconnect switches
- Close AC control MCB to 79T3 auxiliaries and remove tag
- Close 125V DC MCB to 79T3 primary and secondary protection and remove PC13 tag
- Advise SCC and Customers of readiness to energize 79T3 bank

3.15.2. Restoration of 79T3 Bank:

- Start 79G19, 79G20, 79G21 and 79G22 generators
- SCC shall close (or advise AK79 Operator to close) 79B5T3 breaker
- SCC shall close (or advise AK79 Operator to close) the 79T3AD breaker

3.16. To restore 79T3 Bank to service after automatic outage

If 79T3 Bank trips auto due to fault:

AK79 Operator shall:

- Advise SCC about the outage
- Acknowledge all alarms and record relay operation details
- Reset relay targets
- Report relay operation details to SCC

SCC shall:

- Energize (or advise the AK79 Operator to energize) the bank **ONCE** by closing 79T3AD breaker
- Advise Customer of readiness to restore 79T3 transformer to service
- Close 79B5T3 breaker

AK79 Operator shall:

- Advise the Supervisor/Manager and SCC of operation above
- Isolate the Transformer for maintenance men to work on the equipment if operation above is not successful. See Explanation.

3.17. To isolate 79T4 Transformer for work

SCC shall carry out or advise AK79 operator to carry out the following:

- Inform customers about readiness to take off 79T4 Bank
- Shut down 79G12, 79G13, 79G14 and 79G15 generators

- Open Contactor/MCB to take off supply to 79T4 transformer auxiliaries

SCC shall carry out (or advise AK79 Operator to carry out) the following:

- Open 79B6T4 breaker
- Open 79T4AD breaker

AK79 Operator shall:

- Check for no potential on 79T4 Bank
- Open 79T4AD-A and 79T4AD-D disconnect switches
- Open AC control MCB to 79T4 auxiliaries and tag
- Open 125V DC MCB to 79T4 primary and secondary protection and tag with PC13

3.18. To restore 79T4 Bank to service

3.18.1. Prepare 79T4 Bank restoration:

AK79 Operation shall:

- Advise SCC when work on the bank has been completed and permit(s) surrendered (including all Station Guarantees)
- Check for no potential on 79T4 Bank and temporary grounds removed
- Turn on 125Vdc supply and close 79T4AD-A and 79T4AD-D disconnect switches
- Close AC control MCB to 79T4 auxiliaries and remove tag
- Close 125V DC MCB to 79T4 primary and secondary protection and remove PC13 tag
- Advise SCC and Customers of readiness to energize 79T4 bank

3.18.2. Restoration of 79T4 Bank:

- Start 79G12, 79G13, 79G14 and 79G15 generators
- SCC shall close (or advise AK79 Operator to close) 79B6T4 breaker
- SCC shall close (or advise AK79 Operator to close) the 79T4AD breaker

3.19. To restore 79T4 Bank to service after automatic outage

If 79T4 Bank trips auto due to fault:

AK79 Operator shall:

- Advise SCC about the outage
- Acknowledge all alarms and record relay operation details
- Reset relay targets
- Report relay operation details to SCC

SCC shall:

- Energize (or advise the AK79 Operator to energize) the bank **ONCE** by closing 79T4AD breaker
- Advise Customer of readiness to restore 79T4 transformer to service
- Close 79B6T4 breaker

AK79 Operator shall:

- Advise the Supervisor/Manager and SCC of operation above
- Isolate the Transformer for maintenance men to work on the equipment if operation above is not successful. See Explanation.

3.20. To isolate 79T5 Transformer for work

SCC shall carry out or advise AK79 operator to carry out the following:

- Inform customers about readiness to take off 79T5 Bank
- Shut down 79G6, 79G16, 79G17 and 79G18 generators
- Open Contactor/MCB to take off supply to 79T5 transformer auxiliaries

SCC shall carry out (or advise AK79 Operator to carry out) the following:

- Open 79B7T5 breaker
- Open 79T5AD breaker

AK79 Operator shall:

- Check for no potential on 79T5 Bank
- Open 79T5AD-A and 79T5AD-D disconnect switches
- Open AC control MCB to 79T5 auxiliaries and tag
- Open 125V DC MCB to 79T5 primary and secondary protection and tag with PC13

3.21. To restore 79T5 Bank to service

3.21.1. Prepare 79T5 Bank restoration:

AK79 Operation shall:

- Advise SCC when work on the bank has been completed and permit(s) surrendered (including all Station Guarantees)
- Check for no potential on 79T5 Bank and temporary grounds removed
- Turn on 125Vdc supply and close 79T5AD-A and 79T5AD-D disconnect switches
- Close AC control MCB to 79T5 auxiliaries and remove tag
- Close 125V DC MCB to 79T5 primary and secondary protection and remove PC13 tag
- Advise SCC and Customers of readiness to energize 79T5 bank

3.21.2. Restoration of 79T5 Bank:

- Start 79G6, 79G16, 79G17 and 79G18 generators
- SCC shall close (or advise AK79 Operator to close) 79B7T5 breaker
- SCC shall close (or advise AK79 Operator to close) the 79T5AD breaker

3.22. To restore 79T5 Bank to service after automatic outage

If 79T5 Bank trips auto due to fault:

AK79 Operator shall:

- Advise SCC about the outage
- Acknowledge all alarms and record relay operation details
- Reset relay targets
- Report relay operation details to SCC

SCC shall:

- Energize (or advise the AK79 Operator to energize) the bank **ONCE** by closing 79T5AD breaker
- Advise Customer of readiness to restore 79T5 transformer to service
- Close 79B7T5 breaker

AK79 Operator shall:

- Advise the Supervisor/Manager and SCC of operation above
- Isolate the Transformer for maintenance men to work on the equipment if operation above is not successful. See Explanation.

3.23. To isolate 79T6 Transformer for work

SCC shall carry out or advise AK79 operator to carry out the following:

- Inform customers about readiness to take off 79T6 Bank
- Shut down ---------- generators
- Open Contactor/MCB to take off supply to 79T6 transformer auxiliaries

SCC shall carry out (or advise AK79 Operator to carry out) the following:

- Open ---------- breaker
- Open 79T6AD breaker

AK79 Operator shall:

- Check for no potential on 79T6 Bank
- Open 79T6AD-A and 79T6AD-D disconnect switches
- Open AC control MCB to 79T6 auxiliaries and tag

- Open 125V DC MCB to 79T6 primary and secondary protection and tag with PC13

3.24. To restore 79T6 Bank to service

3.24.1. Prepare 79T6 Bank restoration:

AK79 Operation shall:

- Advise SCC when work on the bank has been completed and permit(s) surrendered (including all Station Guarantees)
- Check for no potential on 79T6 Bank and temporary grounds removed
- Turn on 125Vdc supply and close 79T6AD-A and 79T6AD-D disconnect switches
- Close AC control MCB to 79T6 auxiliaries and remove tag
- Close 125V DC MCB to 79T6 primary and secondary protection and remove PC13 tag
- Advise SCC and Customers of readiness to energize 79T6 bank

3.24.2. Restoration of 79T6 Bank:

- Start ---------- generators
- SCC shall close (or advise AK79 Operator to close) ---------- breaker
- SCC shall close (or advise AK79 Operator to close) the 79T6AD breaker

3.25. To restore 79T6 Bank to service after automatic outage

If 79T6 Bank trips auto due to fault:

AK79 Operator shall:

- Advise SCC about the outage
- Acknowledge all alarms and record relay operation details
- Reset relay targets
- Report relay operation details to SCC

SCC shall:

- Energize (or advise the AK79 Operator to energize) the bank **ONCE** by closing 79T6AD breaker

- Advise Customer of readiness to restore 79T6 transformer to service

- Close ---------- breaker

AK79 Operator shall:

- Advise the Supervisor/Manager and SCC of operation above

- Isolate the Transformer for maintenance men to work on the equipment if operation above is not successful. See Explanation.

4. Explanation

Transformer and Bus automatic outages may be caused by the following relay operations:

- Transformer differential lockout relay-86T

- Transformer Bucholtz relay or high temperature lockout relay-86G

- Transformer overcurrent back up relays

a. If 86T operates, the breakers which have opened auto, cannot be reclosed until the lockout relay has been reset or the lockout feature has been by-passed.

- Carry out thorough inspection of the Transformer and the 34kV and 11kV Structures looking for oil leakage, shattered insulators on the structures and dead birds or reptiles

b. 86T can be reset manually immediately after an automatic outage if the station is attended.

c. 86G cannot be reset unless transformer gas and / or temperature conditions are normal or the MCB to the transformer protective relays is off.

NOTE:

I. If it has been necessary to restore the MCB to the transformer relay in order to reset 86G and restore a healthy bank to service, they shall not be restored until the gas and /or temperature conditions on the faulted bank is rectified.

II. Operation of 86T or 86G lockout relays may be due to major transformer faults hence No attempt should be made to re-energize the bank until Electrical Maintenance staff have inspected and meggered the Transformer.

ISOLATION AND DE-ENERGIZING

1. Open the necessary breaker(s) to take the line off potential.

2. Check all three phases off potential using the Multifunction meter or Analog Voltmeter or for Pole discrepancies on the panel.

3. Open the necessary disconnect switches or MODS to isolate the line from all sources of supply.

4. Close the Grounding Switch.

5. Report completion of the isolation and de-energizing at all assisting stations, to the where the Protection Guarantee is to be issued and to System Control Centre.

6. Issue Work or Work and Test Permit to the workman.

ORDER TO OPERATE

1. An O.TO. (Order-To-Operate) to isolate a line is as follows:

    a. Line Voltage - Check all three phases off potential
    b. Line Breaker - Check Open
    c. Line Disconnect Switches - Open, lock and Tag (MCB to MOD Turn-off)

2. Due to communication difficulties arising when grounds are placed on a line it is necessary to issue a Protection Guarantee on the line before grounds are placed. A work and Test Permit allows for closing and opening permanent grounds switches while the Permit is in effect.

3. If work is to be done a permanent ground switches a PC 14 to close the ground switch is not required.

The Generating station has two 161Kv buses. The main 'A' and 'D' buses, configuration provides the normal points of supply to all circuits/equipment such as AK22SM and AK23SM lines.

5. Approval

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Director, Technical Services

TECHNICAL DIRECTIVES