TD-OP-0073

GRIDCo

OPERATING PROCEDURE FOR BAWKU SUBSTATION

GHANA GRID COMPANY LTD

Title:	**OPERATING PROCEDURE FOR BAWKU SUBSTATION (BK73)**		
Issued To:	Director, System Operations Director, NNS Manager, SCC Manager, Dispatch Operations Area Manager, Bolga Operating Staff, Bolga Area Maintenance Staff, Bolga Area Dispatch Staff, SCC	**Number:**	TD-OP-0073
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CONTENTS

1. Purpose

This directive specifies the operations to be carried out to take out of service, isolate or restore equipment at BK73 Substation to service for planned and auto outages.

2. Scope

The directive will be used by Operators at Bolga Operating Area and System Control Center (SCC) for operation of equipment at BK73 Substation.

3. Procedure

3.1. To take ZB1BK line out of service

SCC shall carry out (or advise the BK73 Operator to carry out) the following:

- Open 73L1A and 73L1T2 breakers

SCC shall carry out (or advise the ZB53 Operator to carry out) the following:

- Verify opened 53L1-D transfer disconnect switch
- Open 53AL1 breaker
- Check for no potential on ZB1BK line

3.2. To take out, isolate and de-energize ZB1BK line for work

- BK73 Operator request for Station Guarantee from ZB53

SCC shall carry out (or advise the BK73 Operator to carry out) the following:

- Open 73L1A and 73L1T2 breakers

SCC shall carry out (or advise ZB53 Operator to carry out) the following:

- Verify opened 53L1-D transfer disconnect switch and turn off its 125Vdc supply
- Open 53AL1 breaker
- Check for no potential on ZB1BK line

SCC shall advise ZB53 Operator to carry out the following:

- Open 53AL1-L1 disconnect switch and turn off its 125Vdc supply

- Close 53ZB1BK-G ground disconnect switch

SCC shall advise BK73 Operator to carry out the following:

- Open 73L1A-L1 and 73L1T2-L1 disconnect switches and turn off 125Vdc supply
- Close 73ZB1BK-G ground disconnect switch

3.3. To restore ZB1BK line to service after work

3.3.1. Prepare ZB1BK line for restoration:

BK73 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 ZB1BK line

SCC shall advise ZB53 Operator to carry out the following:

- Check opened 53AL1 breaker
- Check opened 53L1-D transfer disconnect switch and turn on its 125Vdc supply
- Open 53ZB1BK-G ground disconnect switch
- Turn on 125Vdc supply and close 53AL1-L1 disconnect switch

SCC shall advise BK73 Operator to carry out the following:

- Check opened 73L1A and 73L1T2 breakers
- Open 73ZB1BK-G ground disconnect switch
- Turn on 125Vdc supply and close 73L1A-L1 and 73L1T2-L1 disconnect switches

3.3.2. Restoration of ZB1BK line to service:

SCC shall:

- Advise the ZB53 and BK73 Operators of readiness to restore ZB1BK line to service
- Close (or advise the ZB53 Operator to close) 53AL1 breaker
- Close (or advise the BK73 Operator to close) 73L1A and 73L1T2 breakers

3.4. To restore ZB1BK line to service after automatic outage

If ZB1BK line trips auto due to fault:

BK73 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 ZB53 Operator to energize) the line **ONCE** by closing 53AL1 breaker
- Close (or advise the BK73 Operator to close) 73L1A and 73L1T2 breakers

BK73 Operator shall:

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

3.5. To take DP2BK line out of service

SCC shall carry out (or advise the BK73 Operator to carry out) the following:

- Open 73AL2 and 73L2T1 breakers

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

- Open the associated line breakers at their end
- Check for no potential on DP2BK line

3.6. To take out, isolate and de-energize DP2BK line for work

- BK73 Operator shall request for Station Guarantee from Dapaong

SCC shall carry out (or advise the BK73 Operator to carry out) the following:

- Open 73AL2 and 73T1L2 breakers

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

- Open the associated line breakers at their end

- Check for no potential on DP2BK line

SCC shall advise Dapong Operator to carry out the following:

- Isolate their end of the line

SCC shall advise BK73 operator to carry out the following:

- Open 73AL2-L2 and 73L2T1-L2 disconnect switches and turn off 125Vdc supply

- Close 73DP2BK-G ground disconnect switch

3.7. To restore DP2BK line to service after work

3.7.1. Prepare DP2BK line for restoration:

BK73 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 DP2BK line

SCC shall advise Dapong Operator to carry out the following

- Check opened the associated line breakers

SCC shall advise BK73 Operator to carry out the following:

- Check opened 73AL2 and 73L2T1 breakers

- Open 73DP2BK-G ground disconnect switch

- Turn on 125Vdc supply and close 73AL2-L2 and 73L2T1-L2 disconnect switches

3.7.2. Restoration of DP2BK line to service:

SCC shall:

- Advise the Dapong and BK73 Operators of readiness to restore DP2BK line to service

- Close (or advise the BK73 Operator to close) 73AL2 and 73L2T1 breakers

- Advise the Dapong Operator to close the associated line breakers at their

end

3.8. To restore DP2BK line to service after automatic outage

If DP2BK line trips auto due to fault:

BK73 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 BK73 Operator to energize) the line **ONCE** by closing 73AL2 and 73L2T1 breakers
- Advise the Dapaong Operator to close their end breakers

BK73 Operator shall:

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

3.9. To isolate 73T1 Transformer for work

SCC shall advise BK73 Operator to carry out the following:

- Inform Customer about readiness to take off 73T1 bank
- Request Customer on 73T1 Bank to take off their load
- If the station service is on 73T1 transfer supply to 73T2 by switching from AC1 to AC2
- Open AC1 Contactor/MCB to take off supply to 73T1 transformer auxiliaries

SCC shall carry out (or advise BK73 Operator to carry out) the following:

- Open 73T1Y1 breaker
- Open 73DT1 and 73L2T1 breakers

- Check for no potential on 73T1 Bank

SCC shall advise BK73 Operator to carry out the following:

- Open 73T1Y1-Y1 disconnect switch
- Open 73DT1-T1 and 73L2T1-T1 disconnect switches and turn off 125Vdc supply
- Open AC control MCB to 73T1 auxiliaries
- Open 125Vdc MCB to 73T1 primary and secondary protection and tag with PC13

3.10. To restore 73T1 Bank to service after work

3.10.1. Prepare 73T1 bank for restoration:

BK73 Operator shall:

- Advise SCC when work on the transformer has been completed and permit(s) surrendered (including all Station Guarantees)
- Check for no potential on 73T1 Bank and temporary grounds removed
- Close 73T1Y1-Y1 disconnect switch
- Turn on 125Vdc supply and close 73DT1-T1 and 73L2T1-T1 disconnect switches
- Close AC control MCB to 73T1 auxiliaries
- Close 125Vdc MCB to 73T1 primary and secondary protection and remove PC13 tag
- Advise SCC of readiness to restore 73T1 Bank to service

3.10.2. Restoration of 73T1 bank to service:

- SCC shall close (or advise BK73 Operator to close) the 73DT1 and 73L2T1 breakers
- BK73 Operator shall advise Customer of readiness to restore 73T1 Bank to service
- SCC shall close (or advise BK73 Operator to close) the 73T1Y1 breaker

3.11. To restore 73T1 Bank to service after automatic outage

If 73T1 bank trips auto due to fault:

BK73 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 BK73 Operator to energize) the bank **ONCE** by closing 73DT1 and 73L2T1 breakers

BK73 Operator shall advise Customer of readiness to restore 73Y1 Bus to service

SCC shall close (or advise BK73 Operator to close) 73T1Y1 breaker

BK73 Operator shall:

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

3.12. To isolate 73T2 Transformer for work

SCC shall advise BK73 Operator to carry out the following:

- Inform Customer about readiness to take off 73T2 bank
- Request Customer on 73T2 Bank to take off their load
- If the station service is on 73T2 transfer supply to 73T1 by switching from AC2 to AC1
- Open AC2 Contactor/MCB to take off supply to 73T2 transformer auxiliaries

SCC shall carry out (or advise BK73 Operator to carry out) the following:

- Open 73T2Y2 breaker
- Open 73DT2 and 73L1T2 breakers
- Check for no potential on 73T2 Bank

SCC shall advise BK73 Operator to carry out the following:

- Open 73T2Y2-Y2 disconnect switch
- Open 73DT2-T2 and 73L1T2-T2 disconnect switches and turn off 125Vdc supply
- Open AC control MCB to 73T2 auxiliaries
- Open 125Vdc MCB to 73T2 primary and secondary protection and tag with PC13

3.13. To restore 73T2 Bank to service after work

3.13.1. Prepare 73T2 bank for restoration:

BK73 Operator shall:

- Advise SCC when work on the transformer has been completed and permit(s) surrendered (including all Station Guarantees)
- Check for no potential on 73T2 Bank and temporary grounds removed
- Close 73T2Y2 -Y2 disconnect switch
- Turn on 125Vdc supply and 73DT2-T2 and 73L1T2-T2 disconnect switches
- Close AC control MCB to 73T2 auxiliaries
- Close 125Vdc MCB to 73T2 primary and secondary protection and remove PC13 tag
- Advise SCC of readiness to restore 73T2 Bank to service

3.13.2. Restoration of 73T2 bank to service:

- SCC shall close (or advise BK73 Operator to close) the 73DT2 and 73L1T2 breakers
- BK73 Operator shall advise Customer of readiness to restore 73Y2 Bus to service
- SCC shall close (or advise BK73 Operator to close) the 73T2Y2 breaker

3.14. To restore 73T2 Bank to service after automatic outage

If 73T2 bank trips auto due to fault:

BK73 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 BK73 Operator to energize) the bank **ONCE** by closing 73DT2 and 73L1T2 breakers

BK73 Operator shall advise Customer of readiness to restore 73Y2 Bus to service

SCC shall close (or advise BK73 Operator to close) 73T2Y2 breaker

BK73 Operator shall:

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

3.15. To Isolate 73T1Y1 Breaker for work

- BK73 Operator shall request Station Guarantee from Customer on 73Y1 Bus Feeder

SCC shall advise BK73 Operator to carry out the following:

- Inform Customer about readiness to take off 73T1 bank
- Request Customer on 73T1 Bank to take off their load
- Open AC1 Contactor/MCB to take off supply to 73T1 transformer auxiliaries
- If the station service is on 73T1 transfer supply to 73T2 by switching from AC1 to AC2

SCC shall carry out (or advise BK73 Operator to carry out) the following:

- Open 73T1Y1 breaker
- Open 73DT1 and 73L2T1 breakers
- Check for no potential on 73T1 Bank

SCC shall advise BK73 Operator to carry out the following:

- Open 73T1Y1-Y1 disconnect switch

- Open 73DT1-T1 and 73L2T1-T1 disconnect switches and turn off 125Vdc supply

3.16. To restore 73T1Y1 Breaker to service after work

3.16.1. Prepare 73T1Y1 breaker for restoration:

BK73 Operator shall:

- Advise SCC when work on the 73T1Y1 breaker has been completed and permit(s) surrendered (including all Station Guarantees)
- Check for no potential on 73T1Y1 Breaker and temporary grounds removed
- Close 73T1Y1-Y1 disconnect switch
- Turn on 125Vdc supply and close 73DT1-T1 and 73L2T1-T1 disconnect switches
- Close AC control MCB to 73T1 auxiliaries
- Advise SCC of readiness to restore 73T1Y1 breaker to service

3.16.2. Restoration of 73T1Y1 breaker to service:

- SCC shall close (or advise BK73 Operator to close) the 73DT1 and 73L2T1 breakers
- BK73 Operator shall advise Customer of readiness to restore 73Y1 Bus to service
- SCC shall close (or advise BK73 Operator to close) the 73T1Y1 breaker

3.17. To Isolate 73T2Y2 Breaker for work

- BK73 Operator shall request Station Guarantee from Customer on 56F2 feeder

SCC shall carry out (or advise BK73 Operator to carry out) the following:

- Request Customer on 73T2 Bank to take off their load
- Open AC2 Contactor/MCB to take off supply to 73T2 transformer auxiliaries
- If the station service is on 73T2 transfer supply to 73T1 by switching from AC2 to AC1

SCC shall advise BK73 Operator to carry out the following:

- Open 73T2Y2 breaker
- Open 73DT2 and 73L1T2 breakers
- Check for no potential on 73T2 Bank

SCC shall advise BK73 Operator to carry out the following:

- Open 73T2Y2-Y2 disconnect switch
- Open 73DT2-T2 and 73L1T2-T2 disconnect switches and turn off 125Vdc supply

3.18. To restore 73T2Y2 Breaker to service after work

3.18.1. Prepare 73T2Y2 breaker for restoration:

BK73 Operator shall:

- Advise SCC when work on the 73T2Y2 breaker has been completed and permit(s) surrendered (including all Station Guarantees)
- Check for no potential on 73T2Y2 breaker and temporary grounds removed
- Close 73T2Y2-Y2 disconnect switch
- Close AC control MCB to 73T2 auxiliaries
- Turn on 125Vdc supply and close 73DT2-T2 and 73L1T2-T2 disconnect switches

3.18.2. Restoration of 73T2Y2 breaker to service:

- SCC shall close (or advise BK73 Operator to close) the 73DT2 and 73L1T2 breakers
- BK73 Operator shall advise Customer of readiness to restore 73T2 Bank to service
- SCC shall close (or advise BK73 Operator to close) the 73T2Y2 breaker

3.19. To isolate 73Y1SC1 Capacitor Bank for work

SCC shall carry out (or advise BK73 Operator to carry out) the following:

- Open 73Y1SC1 breaker

SCC shall advise BK73 Operator to carry out the following:

- Open 73Y1SC1-Y1 disconnect switch
- Close 73Y1SC1-G ground disconnect switch

3.20. To restore 73Y1SC1 Capacitor Bank to service after work

3.20.1. Prepare 73Y1SC1 Capacitor Bank for restoration:

BK73 Operator shall:

- Advise SCC when work on the 73Y1SC1 Capacitor Bank has been completed and permit(s) surrendered (including all Station Guarantees)
- Check for no potential on 73Y1SC1 Capacitor Bank and temporary grounds removed
- Open 73Y1SC1-G ground disconnect switch
- Close 73Y1SC1-Y1 disconnect switch

3.20.2. Restoration of 73Y1SC1 Capacitor Bank to service:

- SCC shall close (or advise BK73 Operator to close) 73Y1SC1 breaker if the voltage is below 32.8kV

3.21. To isolate 73Y2SC2 Capacitor Bank for work

SCC shall carry out (or advise BK73 Operator to carry out) the following:

- Open 73Y2SC2 breaker

SCC shall advise BK73 Operator to carry out the following:

- Open 73Y2SC2-Y2 disconnect switch
- Close 73Y2SC2-G ground disconnect switch

3.22. To restore 73Y2SC2 Capacitor Bank to service after work

3.22.1. Prepare 73Y2SC2 Capacitor Bank for restoration:

BK73 Operator shall:

- Advise SCC when work on the 73Y2SC2 Capacitor Bank has been completed and permit(s) surrendered (including all Station Guarantees)
- Check for no potential on 73Y2SC2 Capacitor Bank and temporary

grounds removed

- Open 73Y2SC2-G ground disconnect switch

- Close 73Y2SC2-Y2 disconnect switch

3.22.2. Restoration of 73Y2SC2 Capacitor Bank to service:

- SCC shall close (or advise BK73 Operator to close) 73Y2SC2 breaker if the voltage is below 32.8kV

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 station has two 161kV buses. The main 'A' and 'D' buses have a breaker and half configuration which provides the normal points of supply to all circuits/equipment such as ZB1BK and DP2BK lines, 73T1, 73T2 Transformers, 73Y1SC1 and 73Y2SC2 Capacitor Banks.

5. Approval

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Director, TSD