TD-OP-0038

GRIDCo

OPERATING PROCEDURE FOR SAWLA SUBSTATION

GHANA GRID COMPANY LTD

Title:	**OPERATING PROCEDURE FOR SAWLA SUBSTATION (SA38)**		
Issued To:	Director, System Operations Director, NNS Manager, SCC Manager, Dispatch Operations Area Manager, Tamale Operating Staff, Tamale Area Maintenance Staff, Tamale Area Dispatch Staff, SCC	**Number:**	TD-OP-0038
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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 SA38 Substation to service for planned and auto outages.

2. Scope

The directive will be used by Operators at Tamale Operating Area and System Control Center (SCC) for operation of equipment at SA38 Substation.

3. Procedure

3.1. To take BU1SA line out of service

SCC shall carry out (or advise the SA38 Operator to carry out) the following:

- Verify opened 38L1-D transfer disconnect switch
- Open 38L1A breaker

SCC shall carry out (or advise the BU54 Operator to carry out) the following:

- Open 54DL1 and 54T3L1 breakers
- Check for no potential on BU1SA line

3.2. To take out, isolate and de-energize BU1SA line for work

- SA38 Operator request for Station Guarantee from BU54

SCC shall carry out (or advise the SA38 Operator to carry out) the following:

- Check opened 38L1-D transfer disconnect switch and turn off its 125Vdc supply
- Open 38L1A breaker

SCC shall carry out (or advise BU54 Operator to carry out) the following:

- Open 54DL1 and 54T3L1 breakers
- Check for no potential on BU1SA line

SCC shall advise BU54 Operator to carry out the following:

- Open 54DL1-L1 and 54T3L1-L1 disconnect switches and turn off its 125Vdc supply

- Close 54BU1SA-G ground disconnect switch

SCC shall advise SA38 Operator to carry out the following:

- Check opened 38L1-D transfer disconnect switch and turn off its 125Vdc supply
- Open 38L1A-L1 disconnect switch and turn off its 125Vdc supply
- Close 38BU1SA-G ground disconnect switch

3.3. To restore BU1SA line to service after work

3.3.1. Prepare BU1SA line for restoration:

SA38 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 BU1SA line

SCC shall advise BU54 Operator to carry out the following:

- Check opened 54DL1 and 54T3L1 breakers
- Open 54BU1SA-G ground disconnect switch
- Turn on 125Vdc supply and close 54DL1-L1 and 54T3L1-L1 disconnect switches

SCC shall advise SA38 Operator to carry out the following:

- Check opened 38L1A breaker
- Check opened 38L1-D transfer disconnect switch and turn on its 125Vdc supply
- Open 38BU1SA-G ground disconnect switch
- Turn on 125Vdc supply and close 38L1A-L1 disconnect switch

3.3.2. Restoration of BU1SA line to service:

SCC shall:

- Advise the BU54 and SA38 Operators of readiness to restore BU1SA line to service
- Close (or advise the BU54 Operator to close) 54DL1 and 54T3L1

breakers

- Close (or advise the SA38 Operator to close) 38L1A breaker

3.4. To restore BU1SA line to service after automatic outage

If BU1SA line trips auto due to fault:

SA38 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 BU54 Operator to energize) the line **ONCE** by closing 54DL1 and 54T3L1 breakers
- Close (or advise the SA38 Operator to close) 38L1A breaker

SA38 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 SA2WA line out of service

SCC shall carry out (or advise the SA38 Operator to carry out) the following:

- Verify opened 38L2-D transfer disconnect switch
- Open 38L2A breaker

SCC shall carry out (or advise the WA68 Operator to carry out) the following:

- Open 68L2D and 68L1L2 breakers
- Check for no potential on SA2WA line

3.6. To take out, isolate and de-energize SA2WA line for work

- SA38 Operator shall request for Station Guarantee from WA68

SCC shall carry out (or advise the SA38 Operator to carry out) the following:

- Check opened 38L2-D transfer disconnect switch and turn off its 125Vdc supply
- Open 38L2A breaker

SCC shall carry out (or advise the WA68 Operator to carry out) the following:

- Open 68L2D and 68L1L2 breakers
- Check for no potential on SA2WA line

SCC shall advise WA68 Operator to carry out the following:

- Open 68L2D-L2 and 68L1L2-L2 disconnect switches and turn off its 125Vdc supply
- Close 68SA2WA-G ground disconnect switch

SCC shall advise SA38 operator to carry out the following:

- Open 38L2A-L2 disconnect switch and turn off its 125Vdc supply
- Close 38SA2WA-G ground disconnect switch

3.7. To restore SA2WA line to service after work

3.7.1. Prepare SA2WA line for restoration:

SA38 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 SA2WA line

SCC shall advise WA68 Operator to carry out the following:

- Check opened 68L2D and 68L1L2 breakers
- Open 68SA2WA-G ground disconnect switch
- Turn on 125Vdc supply and close 68L2D–L2 and 68L1L2-L2 disconnect switches

SCC shall advise SA38 Operator to carry out the following:

- Check opened 38L2A breaker
- Check opened 38L2-D transfer disconnect switch and turn on 125Vdc

supply

- Open 38SA2WA-G ground disconnect switch
- Turn on 125Vdc supply and close 38L2A-L2 disconnect switch

3.7.2. Restoration of SA2WA line to service:

SCC shall:

- Advise the WA68 and SA38 Operators of readiness to restore SA2WA line to service
- Close (or advise the WA68 Operator to close) 68L2D and 68L1L2 breakers
- Close (or advise the SA38 Operator to close) 38L2A breaker

3.8. To restore SA2WA line to service after automatic outage

If SA2WA line trips auto due to fault:

SA38 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 WA68 Operator to energize) the line **ONCE** by closing 68L2D and 68L1L2 breakers
- Close (or advise the SA38 Operator to close) 38L2A breaker

SA38 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 38T1 Transformer for work

SCC shall advise SA38 Operator to carry out the following:

- Inform Customer(s) about readiness to take off 38T1 Bank
- Request Customer(s) on 38T1 Bank to take off their load
- If the station service is on 38T1 transfer supply to 38T2 by switching from AC1 to AC2
- Open AC1 Contactor/MCB to take off supply to 38T1 transformer auxiliaries

SCC shall carry out (or advise SA38 Operator to carry out) the following:

- Open 38T1Y breaker
- Open 38AT1 breaker
- Check for no potential on 38T1 Bank

SCC shall advise SA38 Operator to carry out the following:

- Check opened 38D-T1 bypass disconnect switch and turn off its 125Vdc supply
- Check opened 38T1Y-S bypass disconnect switch and turn off its 125Vdc supply
- Open 38T1Y-T1 disconnect switch
- Open 38AT1-T1 disconnect switch and turn off its 125Vdc supply
- Open AC control MCB to 38T1 auxiliaries
- Open 125V DC MCB to 38T1 primary and secondary protection and tag with PC13

3.10. To restore 38T1 Bank to service after work

3.10.1. Prepare 38T1 bank for restoration:

SA38 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 38T1 Bank and temporary grounds removed
- Check opened 38T1Y-S bypass disconnect switch
- Check opened 38D-T1 disconnect switch and turn on its 125Vdc supply

- Close 38T1Y-T1 disconnect switch
- Turn on 125Vdc supply and close 38AT1-T1 disconnect switch
- Close AC control MCB to 38T1 auxiliaries
- Close 125V DC MCB to 38T1 primary and secondary protection and remove PC13 tag
- Advise SCC of readiness to restore 38T1 Bank to service

3.10.2. Restoration of 38T1 bank to service:

- SCC shall close (or advise SA38 Operator to close) the 38AT1 breaker
- SA38 Operator shall advise Customer(s) of readiness to restore 38Y Bus to service
- SCC shall close (or advise SA38 Operator to close) the 38T1Y breaker

3.11. To restore 38T1 Bank to service after automatic outage

If 38T1 bank trips auto due to fault:

SA38 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 SA38 Operator to energize) the bank **ONCE** by closing 38AT1 breaker

SA38 Operator shall advise Customer(s) of readiness to restore 38Y bus to service

SCC shall close (or advise SA38 Operator to close) 38T1Y breaker

SA38 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 38T2 Transformer for work

SCC shall advise SA38 Operator to carry out the following:

- Inform Customer(s) about readiness to take off 38T2 bank
- Request Customer(s) on 38T2 Bank to take off their load
- If the station service is on 38T2 transfer supply to 38T1 by switching from AC2 to AC1
- Open AC1 Contactor/MCB to take off supply to 38T2 transformer auxiliaries

SCC shall carry out (or advise SA38 Operator to carry out) the following:

- Open 38T2Y breaker
- Open 38AT2 breaker

SCC shall advise SA38 Operator to carry out the following:

- Check opened 38T2Y-S bypass disconnect switch and turn off its 125Vdc supply
- Check opened 38D-T2 transfer disconnect switch and turn off its 125Vdc supply
- Open 38T2Y-T2 disconnect switch
- Open 38AT2-T2 disconnect switch and turn off its 125Vdc supply
- Open AC control MCB to 38T2 auxiliaries
- Open 125V DC MCB to 38T2 primary and secondary protection and tag with PC13
- Check for no potential on 38T2 Bank

3.13. To restore 38T2 Bank to service after work

3.13.1. Prepare 38T2 bank for restoration:

SA38 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 38T2 Bank and temporary grounds removed

- Check opened 38T2Y-S bypass disconnect switch
- Check opened 38D-T2 transfer disconnect switch and turn on its 125Vdc supply
- Close 38T2Y-T2 disconnect switch
- Turn on 125Vdc supply and close 38AT2-T2 disconnect switch
- Close AC control MCB to 38T2 auxiliaries
- Close 125V DC MCB to 38T2 primary and secondary protection and remove PC13 tag
- Advise SCC of readiness to restore 38T2 Bank to service

3.13.2. Restoration of 38T2 bank to service:

- SCC shall close (or advise SA38 Operator to close) the 38AT2 breaker
- SA38 Operator shall advise Customer(s) of readiness to restore 38Y Bus to service
- SCC shall close (or advise SA38 Operator to close) the 38T2Y breaker

3.14. To restore 38T2 Bank to service after automatic outage

If 38T2 bank trips auto due to fault:

SA38 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 SA38 Operator to energize) the bank **ONCE** by closing 38AT2 breaker

SA38 Operator shall advise Customer(s) of readiness to restore 38Y Bus to service

SCC shall close (or advise SA38 Operator to close) 38T2Y breaker

SA38 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 38R1 Reactor for work

SCC shall carry out (or advise SA38 Operator to carry out) the following:

- Open AC1 Contactor/MCB to take off supply to 38R1 Reactor auxiliaries
- Place 38R1 Reactor at tap position 1
- Open 38AR1 breaker
- Check opened 38R1-D transfer disconnect switch and turn off its 125Vdc supply
- Open 38AR1-R1 disconnect switch and turn off its 125Vdc supply
- Open AC control MCB to 38R1 auxiliaries
- Open 125V DC MCB to 38R1 primary and secondary protection and tag with PC13
- Check for no potential on 38R1 Reactor

3.16. To restore 38R1 Bank to service after work

3.16.1. Prepare 38R1 bank for restoration:

SA38 Operator shall:

- Check for no potential on 38R1 Bank and temporary grounds removed
- Check opened 38D-R1 bypass disconnect switch and turn on its 125Vdc supply
- Turn on 125Vdc supply and close 38AR1-R1 disconnect switch
- Close AC control MCB to 38R1 auxiliaries and remove tag
- Close 125V DC MCB to 38R1 primary and secondary protection and remove PC13 tag
- Advise SCC of readiness to restore 38R1 Bank to service

3.16.2. Restoration of 38R1 bank to service:

- SCC shall close (or advise SA38 Operator to close) 38AR1 breaker if voltage is below 174.28kV

3.17. To Isolate 38T1Y Breaker for work

- SA38 Operator shall request for Station Guarantee from Customer(s) on 38Y Bus

SCC shall carry out (or advise SA38 Operator to carry out) the following:

- Open 38SC1Y breaker
- Open 38T1Y breaker
- Open 38AT1 breaker

SCC shall advise SA38 Operator to carry out the following:

- Check opened 38T1Y-S bypass disconnect switch
- Open 38SC1Y-Y disconnect switch
- Open 38T1Y-Y disconnect switch
- Open 38T1Y-T1 disconnect switch
- Check for no potential on 38T1 Bank

3.18. To restore 38T1Y Breaker to service after work

3.18.1. Prepare 38T1Y breaker for restoration:

SA38 Operator shall:

- Advise SCC when work on the 38T1Y breaker has been completed and permit(s) surrendered (including all Station Guarantees)
- Check for no potential on 38T1Y Breaker and temporary grounds removed
- Check opened 38T1Y-S bypass disconnect switch
- Close 38SC1Y-Y disconnect switch
- Close 38T1Y-Y disconnect switch
- Close 38T1Y-T1 disconnect switch

3.18.2. Restoration of 38T1Y breaker to service:

SCC shall close (or advise SA38 Operator to close) the 38AT1 breaker to energize 38T1 transformer

- SA38 Operator shall advise Customer(s) of readiness to restore 38T1Y breaker to service

- SCC shall close (or advise SA38 Operator to close) the 38T1Y breaker

3.19. To Isolate 38T2Y Breaker for work

- SA38 Operator shall request for Station Guarantee from Customer(s) on 38T2Y Bus

SCC shall carry out (or advise SA38 Operator to carry out) the following:

- Open 38SC1Y breaker

- Open 38T2Y breaker

- Open 38AT2 breaker

SCC shall advise SA38 Operator to carry out the following:

- Check open 38T2Y-S bypass disconnect switch

- Open 38YSC1-Y disconnect switch

- Open 38T2Y-Y disconnect switch

- Open 38T2Y-T2 disconnect switch

- Check for no potential on 38T2 Bank

3.20. To restore 38T2Y Breaker to service after work

3.20.1. Prepare 38T1Y breaker for restoration:

SA38 Operator shall:

- Advise SCC when work on the 38T2Y breaker has been completed and permit(s) surrendered (including all Station Guarantees)

- Check for no potential on 38T2Y Breaker and temporary grounds removed

- Check opened 38T2Y-S bypass disconnect switch

- Close 38YSC2-Y disconnect switch

- Close 38T2Y-Y disconnect switch

- Close 38T2Y-T2 disconnect switch

3.20.2. Restoration of 38T2Y breaker to service:

- SA38 Operator shall advise Customer(s) of readiness to restore 38T2Y breaker to service

- SCC shall close (or advise SA38 Operator to close) the 38T2Y breaker

3.21. To isolate 38SC1 Capacitor Bank for work

SCC shall carry out (or advise SA38 Operator to carry out) the following:

- Open 38YSC1 breaker

SCC shall advise SA38 Operator to carry out the following:

- Open 38YSC1-SC1 disconnect switch

- Close 38SC1-G ground disconnect switch

3.22. To restore 38SC1 Capacitor Bank to service after work

3.22.1. Prepare 38SC1 Capacitor Bank for restoration:

SA38 Operator shall:

- Advise SCC when work on the 38SC1 Capacitor Bank has been completed and permit(s) surrendered (including all Station Guarantees)

- Check for no potential on 38SC1 Capacitor Bank and temporary grounds removed

- Open 38SC1-G ground disconnect switch

- Close 38YSC1-SC1 disconnect switch

3.22.2. Restoration of 38SC1 Capacitor Bank to service:

- SCC shall close (or advise SA38 Operator to close) 38YSC1 breaker if 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' bus provides the normal points of supply to all circuits such as BU1SA, SA2WA lines, 38T1, 38T2 transformers, 38R1 Reactor and 38SC1 Capacitor Bank. The 'D' bus provides the necessary by-pass route for only one circuit at a time.

The Reactor with its tap at position 10 allows each line to be shunt compensated and avoid voltage jumps occurring at the receiving end.

5. Approval

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Director, Technical Services