

TD-OP-0058



OPERATING PROCEDURE FOR ANWOMASO SUBSTATION

GHANA GRID COMPANY LTD

TECHNICAL DIRECTIVES

Title: OPERATING PROCEDURE FOR ANWOMASO SUBSTATION (AW58)		
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TECHNICAL DIRECTIVES

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1. Purpose

This directive specifies the operations to be carried out to take out of service, isolate or restore equipment at AW58 Substation to service for planned and auto outages.

2. Scope

The directive will be used by Operators at Kumasi Operating Area and System Control Center (SCC) for operation of equipment at AW58 Substation.

3. Procedure

3.1. To take AW1K line out of service

SCC shall carry out (or advise the AW58 Operator to carry out) the following:

- Open 58DL1 and 58L1L2 breakers

SCC shall carry out (or advise the K13 Operator to carry out) the following:

- Open 13L1A and 13L1T2 breakers
- Check for no potential on AW1K line

3.2. To take out, isolate and de-energize AW1K line for work

- AW58 Operator request for Station Guarantee from K13

SCC shall carry out (or advise the AW58 Operator to carry out) the following:

- Open 58DL1 and 58L1L2 breakers

SCC shall carry out (or advise K13 Operator to carry out) the following:

- Open 13L1A and 13L1T2 breakers
- Check for no potential on AW1K line

SCC shall advise K13 Operator to carry out the following:

- Open 13L1A-L1 and 13L1T2-L1 disconnect switches and turn off its 125Vdc supply
- Close 13AW1K-G ground disconnect switch

SCC shall advise AW58 Operator to carry out the following:

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- Open 58DL1-L1 and 58L1L2-L1 disconnect switches and turn off its 125Vdc supply
- Close 58AW1K-G ground disconnect switch

3.3. To restore AW1K line to service after work

3.3.1. Prepare AW1K line for restoration:

AW58 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 AW1K line

SCC shall advise K13 Operator to carry out the following:

- Check opened 13L1A and 13L1T2 breakers
- Open 13AW1K-G ground disconnect switch
- Turn on 125Vdc supply and close 13L1A-L1 and 13L1T2-L1 disconnect switches

SCC shall advise AW58 Operator to carry out the following:

- Check opened 58DL1 and 58L1L2 breakers
- Open 58AW1K-G ground disconnect switch
- Turn on 125Vdc supply and close 58DL1-L1 and 58L1L2-L1 disconnect switches

3.3.2. Restoration of AW1K line to service:

SCC shall:

- Advise the K13 and AW58 Operators of readiness to restore AW1K line to service
- Close (or advise the K13 Operator to close) 13L1A and 13L1T2 breakers
- Close (or advise the AW58 Operator to close) 58DL1 and 58L1L2 breakers

3.4. To restore AW1K line to service after automatic outage

If AW1K line trips auto due to fault:

AW58 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 AW1K Operator to energize) the line **ONCE** by closing 58DL1 and 58L1L2 breakers
- Close (or advise the K13 Operator to close) 13L1A and 13L1T2 breakers

AW58 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 N2AW line out of service

SCC shall carry out (or advise the AW58 Operator to carry out) the following:

- Open 58L2A and 58L1L2 breakers

SCC shall carry out (or advise the N14 Operator to carry out) the following:

- Open 14DL2 and 14L12L2 breakers
- Check for no potential on N2AW line

3.6. To take out, isolate and de-energize N2AW line for work

- AW58 Operator shall request for Station Guarantee from N14

SCC shall carry out (or advise the AW58 Operator to carry out) the following:

- Open 58L2A and 58L1L2 breakers

SCC shall carry out (or advise the N14 Operator to carry out) the following:

- Open 14DL2 and 14L12L2 breakers

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- Check for no potential on N2AW line

SCC shall advise N14 Operator to carry out the following:

- Open 14L2D-L2 and 14L12L2-L2 disconnect switches and turn off its 125Vdc supply
- Close 14N2AW-G ground disconnect switch

SCC shall advise AW58 operator to carry out the following:

- Open 58L2A-L2 and 58L1L2-L2 disconnect switches and turn off its 125Vdc supply
- Close 58N2AW-G ground disconnect switch

3.7. To restore N2AW line to service after work

3.7.1. Prepare N2AW line for restoration:

AW58 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 N2AW line

SCC shall advise N14 Operator to carry out the following:

- Check opened 14DL2 and 14L12L2 breakers
- Open 14N2AW-G ground disconnect switch
- Turn on 125Vdc supply and close 14DL2-L2 and 14L12L2-L2 disconnect switches

SCC shall advise AW58 Operator to carry out the following:

- Check opened 58L2A and 58L1L2 breakers
- Open 58N2AW-G ground disconnect switch
- Turn on 125Vdc supply and close 58L2A-L2 and 58L1L2-L2 disconnect switches
- Open 58N2AW-G ground disconnect switch

3.7.2. Restoration of N2AW line to service:

SCC shall:

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- Advise the N14 and AW58 Operators of readiness to restore N2AW line to service
- Close (or advise the N14 Operator to close) 14DL2 and 14L12L2 breakers
- Close (or advise the AW58 Operator to close) 58L2A and 58L1L2 breakers

3.8. To restore N2AW line to service after automatic outage

If N2AW line trips auto due to fault:

AW58 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 N14 Operator to energize) the line **ONCE** by closing 14DL2 and 14L12L2 breakers
- Close (or advise the AW58 Operator to close) 58L2A and 58L1L2 breakers

AW58 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 58T1 Transformer for work

SCC shall advise AW58 Operator to carry out the following:

- Inform Customer(s) about readiness to take off 58T1 bank
- Request Customer(s) on 58T1 Bank to take off their load
- Transfer Station Service from AC1 to AC2
- Open AC1 Contactor/MCB to take off supply to 58T1 transformer

auxiliaries

SCC shall carry out (or advise AW58 Operator to carry out) the following:

- Open 58SC1 breaker
- Open 58T1F1 breaker
- Open 58AT1 and 58DT1 breakers
- Check for no potential on 58T1 Bank

AW58 Operator shall:

- Open 58T1F1-F1 disconnect switch
- Open 58AT1-T1 and 58DT1-T1 disconnect switches and turn off its 125Vdc supply
- Open AC control MCB to 58T1 auxiliaries and tag
- Open 125V DC MCB to 58T1 primary and secondary protection and tag with PC13

3.10. To restore 58T1 Bank to service after work

3.10.1. Prepare 58T1 Bank for restoration:

AW58 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 58T1 Bank and temporary grounds removed
- Close 58T1F1-F1 disconnect switch
- Turn on 125Vdc supply and close 58AT1-T1 and 58DT1-T1 disconnect switches
- Close AC control MCB to 58T1 auxiliaries and remove tag
- Close 125V DC MCB to 58T1 primary and secondary protection and remove PC13 tag
- Advise SCC of readiness to restore 58T1 Bank to service

3.10.2. Restoration of 58T1 Bank to service:

- SCC shall close (or advise AW58 Operator to close) the 58AT1 and 58DT1 breakers

- AW58 Operator shall advise Customer(s) of readiness to restore 58T1 Bank to service
- SCC shall close (or advise AW58 Operator to close) the 58T1F1 breaker

3.11. To restore 58T1 Bank to service after automatic outage

If 58T1 bank trips auto due to fault:

AW58 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 AW58 Operator to energize) the bank **ONCE** by closing 58AT1 and 58DT1 breakers

AW58 Operator shall advise Customer(s) of readiness to restore 58F1 feeder to service

SCC shall close (or advise AW58 Operator to close) 58T1F1 breaker

AW58 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 58T2 Transformer for work

SCC shall advise AW58 Operator to carry out the following:

- Inform Customer(s) about readiness to take off 58T2 bank
- Request Customer(s) on 58T2 Bank to take off their load
- Transfer Station Service from AC2 to AC1
- Open AC2 Contactor/MCB to take off supply to 58T2 transformer auxiliaries
- Open 58SC2F2 breaker

- Open 58T2F2 breaker
- Open 58AT2 and 58DT2 breakers
- Check for no potential on 58T2 Bank

AW58 Operator shall:

- Open 58T2F2-F2 disconnect switch
- Open 58AT2-T2 and 58DT2-T2 disconnect switches and turn off its 125Vdc supply
- Open AC control MCB to 58T2 auxiliaries and tag
- Open 125V DC MCB to 58T2 primary and secondary protection and tag with PC13

3.13. To restore 58T2 Bank to service after work

3.13.1. Prepare 58T2 Bank for restoration:

AW58 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 58T2 Bank and temporary grounds removed
- Close 58T2F2-F2 disconnect switch
- Turn on 125Vdc supply and close 58AT2-T2 and 58DT2-T2 disconnect switches
- Close AC control MCB to 58T2 auxiliaries and remove tag
- Close 125V DC MCB to 58T2 primary and secondary protection and remove PC13 tag
- Advise SCC of readiness to restore 58T2 Bank to service

3.13.2. Restoration of 58T2 Bank to service:

- SCC shall close (or advise AW58 Operator to close) the 58AT2 and 58DT2 breakers
- AW58 Operator shall advise Customer(s) of readiness to restore 58F2 feeder to service
- SCC shall close (or advise AW58 Operator to close) the 58T2F2

breaker

3.14. To restore 58T2 Bank to service after automatic outage

If 58T2 bank trips auto due to fault:

AW58 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 AW58 Operator to energize) the bank ONCE by closing 58AT2 and 58DT2 breakers

AW58 Operator shall advise Customer(s) of readiness to restore 58F2 feeder to service

SCC shall close (or advise AW58 Operator to close) 58T2F2 breaker

AW58 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 58T5 Transformer for work

AW58 Operator shall request for Station Guarantee from Customer(s) on 58F5 Feeder

SCC shall advise AW58 Operator to carry out the following:

- Inform Customer(s) about readiness to take off 58T5 bank
- Request Customer(s) on 58T5 bank to take off their load
- Open 58T5F3 breaker
- Open 58AT5 and 58DT5 breakers
- Check for no potential on 58T5 Bank

SCC shall carry out (or advise AW58 Operator to carry out) the following:

- Open 58AT5-T5 and 58DT5-T5 disconnect switches and turn off its 125Vdc supply
- Open AC control MCB to 58T5 auxiliaries and tag
- Open 125V DC MCB to 58T5 primary and secondary protection and tag with PC13

3.16. To restore 58T5 Bank to service after work

3.16.1. Prepare 58T5 Bank for restoration:

AW58 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 58T5 Bank and temporary grounds removed
- Turn on 125Vdc supply and close 58AT5-T5 and 58DT5-T5 disconnect switches
- Close AC control MCB to 58T5 auxiliaries and remove tag
- Close 125V DC MCB to 58T5 primary and secondary protection and remove PC13 tag
- Advise SCC of readiness to restore 58T5 Bank to service

3.16.2. Restoration of 58T5 bank to service:

- AW58 Operator shall advise Customer(s) of readiness to restore 58T5 Bank to service
- SCC shall close (or advise AW58 Operator to close) the 58AT5 and 58DT5 breakers

3.17. To restore 58T5 Bank to service after automatic outage

If 58T5 bank trips auto due to fault:

AW58 Operator shall:

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

AW58 Operator shall advise Customer(s) of readiness to restore 58F3 feeder to service

SCC shall energize (or advise the AW58 Operator to energize) the bank **ONCE** by closing 58AT5 and 58DT5 breakers

AW58 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.

3.18. To Isolate 58T1F1 Breaker for work

- AW58 Operator shall request for Station Guarantee from Customer(s) on 58F1 feeder

SCC shall advise AW58 Operator to carry out the following:

- Inform Customer(s) about readiness to take off 58T1 bank
- Request Customer(s) on 58T1 Bank to take off their load
- Transfer Station Service from AC1 to AC2
- Open AC1 Contactor/MCB to take off supply to 58T1 transformer auxiliaries

SCC shall carry out (or advise AW58 Operator to carry out) the following:

- Open 58AT1 and 58DT1 breakers
- Open 58SC1F1 breaker
- Open 58T1F1 breaker

SCC shall advise AW58 Operator to carry out the following:

- Open 58SC1F1-F1 disconnect switch
- Open 58T1F1-F1 disconnect switch
- Open 58AT1-T1 and 58DT1-T1 disconnect switches and turn off its 125Vdc supply
- Check for no potential on 58T1 Bank

3.19. To restore 58T1F1 Breaker to service after work

3.19.1. Prepare 58T1F1 breaker for restoration:

AW58 Operator shall:

- Advise SCC when work on the 58T1F1 breaker has been completed and permit(s) surrendered (including all Station Guarantees)
- Check for no potential on 58T1F1 Breaker and temporary grounds removed
- Close 58T1F1-F1 disconnect switch
- Close 58SC1F1-F1 disconnect switch
- Turn on 125Vdc supply and close 58AT1-T1 and 58DT1-T1 disconnect switches
- Check for no potential on 58T1 Bank

3.19.2. Restoration of 58T1F1 breaker to service:

- SCC shall close (or advise AW58 Operator to close) the 58AT1 and 58DT1 breakers
- AW58 Operator shall advise Customer(s) of readiness to restore 58F1 feeder to service
- SCC shall close (or advise AW58 Operator to close) the 58T1F1 breaker

3.20. To Isolate 58T2F2 Breaker for work

- AW58 Operator shall request for Station Guarantee from Customer(s) on 58F2 feeder

SCC shall carry out (or advise AW58 Operator to carry out) the following:

- Open 58SC2F2 breaker
- Open 58T2F2 breaker
- Open 58AT2 and 58DT2 breakers

SCC shall advise AW58 Operator to carry out the following:

- Open 58SC2F2-SC2 disconnect switch
- Open 58T2F2-F2 disconnect switch

- Open 58AT2-T2 and 58DT2-T2 disconnect switches and turn off its 125Vdc supply
- Check for no potential on 58T2 Bank

3.21. To restore 58T2F2 Breaker to service after work

3.21.1. Prepare 58T2F2 breaker for restoration:

AW58 Operator shall:

- Advise SCC when work on the 58T2F2 breaker has been completed and permit(s) surrendered (including all Station Guarantees)
- Check for no potential on 58T2F2 Breaker and temporary grounds removed
- Close 58T2F2-F2 disconnect switch
- Close 58SC2F2-SC2 disconnect switch
- Turn on 125Vdc supply and close 58AT2-T2 and 58DT2-T2 disconnect switches

3.21.2. Restoration of 58T2F2 breaker to service:

- SCC shall close (or advise AW58 Operator to close) the 58AT2 and 58DT2 breakers
- AW58 Operator shall advise Customer(s) of readiness to restore 58F2 Feeder to service
- SCC shall close (or advise AW58 Operator to close) the 58T2F2 breaker

3.22. To isolate 58SC1 Capacitor Bank for work

SCC shall carry out (or advise AW58 Operator to carry out) the following:

- Open 58SC1F1 breaker

SCC shall advise AW58 Operator to carry out the following:

- Open 58SC1F1-SC1 disconnect switch
- Close 58SC1-G ground disconnect switch

3.23. To restore 58SC1 Capacitor Bank to service after work

3.23.1. Prepare 58SC1 Capacitor Bank for restoration:

AW58 Operator shall:

- Advise SCC when work on the 58SC1 Capacitor Bank has been completed and permit(s) surrendered (including all Station Guarantees)
- Check for no potential on 58SC1 Capacitor Bank and temporary grounds removed
- Open 58SC1-G ground disconnect switch
- Close 58SC1F1-SC1 disconnect switch

3.23.2. Restoration of 58SC1 Capacitor Bank to service:

- SCC shall close (or advise AW58 Operator to close) 58SC1F1 breaker if the voltage is below 32.8kV

3.24. To isolate 58SC2 Capacitor Bank for work

SCC shall carry out (or advise AW58 Operator to carry out) the following:

- Open 58SC2F2 breaker

SCC shall advise AW58 Operator to carry out the following:

- Open 58SC2F2-SC2 disconnect switch
- Close 58SC2-G ground disconnect switch

3.25. To restore 58SC2 Capacitor Bank to service after work

3.25.1. Prepare 58SC2 Capacitor for restoration:

AW58 Operator shall:

- Advise SCC when work on the 58SC2 Capacitor Bank has been completed and permit(s) surrendered (including all Station Guarantees)
- Check for no potential on 58SC2 Capacitor Bank and temporary grounds removed
- Open 58SC2-G ground disconnect switch
- Close 58SC2F2-SC2 disconnect switch

3.25.2. Restoration of 58SC2 Capacitor Bank to service:

- SCC shall close (or advise AW58 Operator to close) 58SC2F2 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" bus and "D" bus, a breaker and half configuration provides a normal point of supply to all circuits/equipment such as AW1K (Anwomaso – Kumasi), N2AW (Nkwakwa – Anwomaso), 58T1, 58T2 and 58T5 Transformers.

5. Approval

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Director, TSD