TD-OP-0058

GRIDCo

# OPERATING PROCEDURE FOR ANWOMASO 330kV SUBSTATION

**GHANA GRID COMPANY LTD**

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| **Title:** | **OPERATING PROCEDURE FOR ANWOMASO 330kV SUBSTATION (AW58)** | | |
| **Issued To:** | Director, System Operations<br>Director, NNS<br>Manager, SCC<br>Manager, Dispatch Operations<br>Area Manager, Kumasi<br>Operating Staff, Kumasi Area<br>Maintenance Staff, Kumasi Area<br>Dispatch Staff, SCC | **Number:** | TD-OP-0058 |
| | | **Subject Area:** | Operating |
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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 M37 Substation to service for planned and auto outages.

## 2. Scope

The directive will be used by Operators at Accra Operating Area and System Control Center (SCC) for operation of equipment at M37 Substation.

## 3. Procedure

### 3.1. To take AW5KP line out of service

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

Open 58EL5 and 58L5T3 breakers

SCC shall carry out (or advise the KP56 Operator to carry out) the following:

- Open 56L5E and 56L5T3 breakers
- Check for no potential on AW5KP line

### 3.2. To take out, isolate and de-energize AW5KP line for work

AW58 Operator shall request for Station Guarantee from AW5KP

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

- Open 58EL5 and 58L5T3 breakers

SCC shall carry out (or advise the KP56 Operator to carry out) the following:

- Open 56L5E and 56L5T3 breakers
- Open 56L5R1breaker
- Check for no potential on AW5KP line

SCC shall advise KP56 Operator to carry out the following:

- Open 56L5E-L5 and 56L5T3-L5 disconnect switches and turn off 125Vdc supply
- Open 56L5R1-L5 disconnect switch and turn off 125Vdc supply
- Close 56AW5KP-G ground disconnect switch

SCC shall advise AW58 Operator to carry out the following:

- Open 58L5E-L5 and 58L5T3-L5 disconnect switches and turn off 125Vdc supply
- Close 58AW5KP-G ground disconnect switch

### 3.3. To restore AW5KP line to service after work

#### 3.3.1. Prepare AW5KP 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 AW5KP line

SCC shall advise KP56 Operator to carry out the following:

- Check opened 56L5E and 56L5T3 breakers
- Check opened 56L5R1 breaker
- Open 56AW5KP-G ground disconnect switch
- Turn on 125Vdc supply and close 56L5E-L5 and 56L5T3-L5 disconnect switches
- Turn on 125Vdc supply and close 56L5R1-L5 disconnect switch

SCC shall advise AW58 Operator to carry out the following:

- Check opened 58EL5 and 58L5T3 breakers
- Open 58AW5KP-G ground disconnect switch
- Turn on 125Vdc supply and close 58EL5-L5 and 58L5T3-L5 disconnect switches

#### 3.3.2. Restoration of AW5KP line to service:

SCC shall:

- Advise the AW58 and KP56 Operators of readiness to restore AW5KP line to service
- Close (or advise the AW58 Operator to close) 58EL5 and 58L5T3 breakers
- SCC shall close (or advise KP56 Operator to close) if line voltage is +8.25% of 330kV the 56L5R1 breaker
- Close (or advise the KP56 Operator to close) 56L5E and 56L5T3 breakers

### 3.4. To restore AW5KP line to service after automatic outage

If AW5KP line trips auto due to fault on the line:

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 line **ONCE** by closing 58EL5 and 58L5T3 breakers
- Close (or advise the **KP56** Operator to close) 56L5E and 56L5T3 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 TT8AW line out of service**

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

- Open 58L8E and 58L8T4 breakers

SCC shall carry out (or advise the TT32 Operator to carry out) the following:

- Open 32EL8 and 32L11L8 breakers
- Check for no potential on TT8AW line

**3.6. To take out, isolate and de-energize TT8AW line for work**

- AW58 Operator shall request for Station Guarantee from TT32

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

- Open 58L8E and 58L8T4 breakers

SCC shall carry out (or advise TT32 Operator to carry out) the following:

- Open 32EL8 and 32L11L8 breakers
- Check for no potential on TT8AW line

SCC shall advise TT32 Operator to carry out the following:

- Open 32EL8-L8 and 32L11L8-L8 disconnect switches and turn off 125Vdc supply
- Close 32TT8AW-G ground disconnect switch

SCC shall advise AW58 Operator to carry out the following:

- Open 58L8E-L8 and 58L8T4-L8 disconnect switches and turn off 125Vdc supply

- Close 58TT8AW-G ground disconnect switch

**3.7. To restore TT8AW line to service after work**

**3.7.1. Prepare TT8AW 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 TT8AW line

SCC shall advise TT32 Operator to carry out the following:

- Check opened 32EL8 and 32L11L8 breakers
- Open 32TT8AW-G ground disconnect switch
- Turn on 125Vdc supply and close 32EL8-L8 and 32L11L8-L8 disconnect switches

SCC shall advise AW58 Operator to carry out the following:

- Check opened 58L8E and 58L8T4 breakers
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- Open 58TT8AW-G ground disconnect switch
- Turn on 125Vdc supply and close 58L8E-L8 and 58L8T4-L8 disconnect switches

3.7.2. Restoration of TT8AW line to service:

SCC shall:

- Advise the TT32 and AW58 Operators of readiness to restore TT8AW line to service
    - Close (or advise the TT32 Operator to close) 32EL8 and 32L11L8 breakers

- Close (or advise the AW58 Operator to close) 58L8E and 58L8T4 breakers

**3.8. To restore TT8AW line to service after automatic outage**

If AW5KP line trips auto due to fault on the line:

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 TT32 Operator to energize) the line **ONCE** by closing 32EL8 and 32L11L8 breakers
- Close (or advise the AW58 Operator to close) 58L8E and 58L8T4 breakers (Potential on the line)

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 58T3 Bank for work**

SCC shall advise AW58 Operator to carry out the following:

- Open AC1 Contactor/MCB to take off supply to 58T3 transformer auxiliaries

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

- Open 58PT3 and 58L5T3 breakers
- Open 58AT3 and 58DT3 breakers
- Open 58PT3-T3 and 58L5T3-T3 disconnect switches and turn off 125vdc supply

- Open 58AT3-T3 and 58DT3-T3 disconnect switches and turn off 125vdc supply

- Open AC control MCB to 58T3 auxiliaries and tag

- Open 125V DC breaker to 58T3 primary and secondary protection and tag with PC13

- Check for no potential on 58T3 Bank

## 3.10. To restore 58T3 Bank to service after work

### 3.10.1. Prepare 58T3 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 58T3 Bank and temporary grounds removed

- Turn on 125vdc supply and close 56PT3-T3 and 56L5T3-T3 disconnect switches

- Turn on 125vdc supply and close 58AT3-T3 and 56DT3-T3 disconnect switches

- Close AC control MCB to 58T3 auxiliaries and remove tag

- Close 125V DC breaker to 58T3 primary and secondary protection and remove tag PC13

- Advise SCC of readiness to restore 58T3 Bank to service

### 3.10.2. Restoration of 58T3 bank to service:

- SCC shall close (or advise AW58 Operator to close) the 58PT3 and 58L5T3 breakers (330kV)

- SCC shall close (or advise AW58 Operator to close) the 58AT3 and 58DT3 (161kV) to tie to 161kV Bus

### 3.11. To restore 58T3 Bank to service after automatic outage

If 58T3 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 transformer **ONCE** by closing 58PT3 and 58L5T3 breakers (330kV)

AW58 Operator shall:

- Check for potential on 58T3 and advice SCC

SCC shall:

- Energize (or advise the AW58 Operator to energize) the transformer **ONCE** by closing 58AT3 and 58DT3 breakers (161kV)

AW58 Operator shall:

- Advise the Supervisor/Area Manager and SCC of item above

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

#### 3.11.1. Isolate 58T4 Bank for work

SCC shall advise AW58 Operator to carry out the following:

- Inform customers about readiness to take off 58T4 bank

- Open AC1 Contactor/MCB to take off supply to 58T4 transformer auxiliaries

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

- Open 58PT4 and 58L8T4 breakers

- Open 58AT4 and 58DT4 breakers

- Open 58PT4-T4 and 58L8T4-T4 disconnect switches and turn off its 125vdc supply to MOD

- Open 58AT4-T4 and 58DT4-T4 disconnect switches and turn off its 125vdc supply

- Open AC control MCB to 58T4 auxiliaries and tag

- Open 125V DC breaker to 58T4 primary and secondary protection and tag with PC13

- Check for no potential on 58T4 Bank

### 3.12. To restore 58T4 Bank to service after work

#### 3.12.1. Prepare 58T4 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 58T4 Bank and temporary grounds removed

- Turn on 125vdc supply and close 58PT4-T4 and 58L8T4-T4 disconnect switches

- Turn on 125vdc supply and close 58AT4-T4 and 58DT4-T4 disconnect switches

- Close AC control MCB to 58T4 auxiliaries and remove tag

- Close 125V DC breaker to 58T4 primary and secondary protection and remove tag PC13

- Advise SCC of readiness to restore 58T4 Bank to service

#### 3.12.2. Restoration of 58T4 bank to service:

- SCC shall close (or advise AW58 Operator to close) the 58PT4 and 58L8T4 breakers (330kV)

- SCC shall close (or advise AW58 Operator to close) the 58AT4 and 58DT4 (161kV) to tie to 161kV Bus

### 3.13. To restore 58T4 Bank to service after automatic outage

If 58T4 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 transformer **ONCE** by closing 58PT4 and 58L8T4 breakers (330kV)

AW58 Operator shall:

- Check for potential on 58T4 and advice SCC

SCC shall:

- Energize (or advise the AW58 Operator to energize) the transformer **ONCE** by closing 56AT4 and 5DT4 breakers (161kV)

AW58 Operator shall:

- Advise the Supervisor/Area Manager and SCC of item above
- Isolate the Transformer for maintenance men to work on the equipment if the 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 station has two 330kV buses. The main 'E' and 'P' buses, a breaker and half configuration provides the normal points of supply to all circuits/equipment such as TT8AW and AW5KP lines, 58T3 and 58T4 transformers.

## 5. Approval

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**Director, TSD**

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