

TD-OP-0015



OPERATING PROCEDURE FOR TAFO SUBSTATION

GHANA GRID COMPANY LTD

Title: OPERATING PROCEDURE FOR TAFO SUBSTATION (F15)		
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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 F15 Substation to service for planned and auto outages.

2. Scope

The directive will be used by Operators at Akosombo Operating Area and System Control Center (SCC) for operation of equipment at F15 Substation.

3. Procedure

3.3. To take F1N line out of service

SCC shall carry out (or advise the F15 Operator to carry out) the following:

- Open 15L1A and 15L1L7 breakers

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

- Open 14L1A and 14L1L3 breakers
- Check for no potential on F1N line

3.4. To take out, isolate and de-energize F1N line for work

- F15 Operator request for Station Guarantee from N14

SCC shall carry out (or advise the F15 Operator to carry out) the following:

- Open 15DL1 and 15L1L7 breakers

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

- Open 14L1A and 14L1L3 breakers
- Check for no potential on F1N line

SCC shall advise N14 Operator to carry out the following:

- Open 14L1A-L1 and 14L1L3-L1 disconnect switches and turn off 125Vdc supply
- Close 14F1N-G ground disconnect switch

SCC shall advise F15 Operator to carry out the following:

- Open 15DL1-L1 and 15L1L7-L1 disconnect switches and turn off 125Vdc supply
- Close 15F1N-G ground disconnect switch

3.5. To restore F1N line to service after work

3.5.1. Prepare F1N line for restoration:

F15 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 F1N line

SCC shall advise N14 Operator to carry out the following:

- Check opened 14L1A and 14L1L3 breakers
- Open 14F1N-G ground disconnect switch
- Turn on 125Vdc supply and close 14L1A-L1 and 14L1L3-L1 disconnect switches

SCC shall advise F15 Operator to carry out the following:

- Check opened 15DL1 and 15L1L7 breakers
- Open 15F1N-G ground disconnect switch
- Turn on 125Vdc supply and close 15DL1-L1 and 15L1L7-L1 disconnect switches

3.5.2. Restoration of F1N line to service:

SCC shall:

- Advise the N14 and F15 Operators of readiness to restore F1N line to service
- Close (or advise the N14 Operator to close) 14L1A and 14L1L3 breakers
- Close (or advise the F15 Operator to close) 15DL1 and 15L1L7 breakers

3.6. To restore F1N line to service after automatic outage

If F1N line trips auto due to fault on the line:

F15 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 14L1A and 14L1L3 breakers
- Close (or advise the F15 Operator to close) 15DL1 and 15L1L7 breakers

F15 Operator shall:

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

3.7. To take F2Q line out of service

SCC shall carry out (or advise the F15 Operator to carry out) the following:

- Open 15DL2 and 15L2L11 breakers

SCC shall carry out (or advise the Q16 Operator to carry out) the following:

- Open 16F2Q breaker
- Check for no potential on F2Q line

3.8. To take out, isolate and de-energize F2Q line for work

- F15 Operator shall request for Station Guarantee from Q16

SCC shall carry out (or advise the F15 Operator to carry out) the following:

- Open 15DL2 and 15L2L11 breakers

SCC shall carry out (or advise the Q16 Operator to carry out) the following:

- Verify opened 16F2Q-S bypass disconnect switch and turn off its 125Vdc supply
- Open 16F2Q breaker

- Check for no potential on F2Q line

SCC shall advise F15 operator to carry out the following:

- Open 15DL2-L2 and 15L2L11-L2 disconnect switches and turn off 125Vdc supply
- Close 15F2Q-G ground disconnect switch

3.9. To restore F2Q line to service after work

3.9.1. Prepare F2Q line for restoration:

F15 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 F2Q line

SCC shall advise Q16 Operator to carry out the following:

- Check opened 16F2Q-S bypass disconnect switch and turn off its 125Vdc supply
- Check opened 16F2Q breaker
- Open 16F2Q-G ground disconnect switch
- Turn on 125Vdc supply and close 16F2Q-L2 disconnect switch

SCC shall advise F15 Operator to carry out the following:

- Check opened 15DL2 and 15L2L11 breakers
- Open 15F2Q-G ground disconnect switch
- Turn on 125Vdc supply and close 15DL2-L2 and 15L2L11-L2 disconnect switches

3.9.2. Restoration of F2Q line to service:

SCC shall:

- Advise the Q16 and F15 Operators of readiness to restore F2Q line to service
- Close (or advise the Q16 Operator to close) 16F2Q breaker
- Close (or advise the F15 Operator to close) 15DL2 and 15L2L11 breakers

3.10. To restore F2Q line to service after automatic outage

If F2Q line trips auto due to fault on the line:

F15 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 Q16 Operator to energize) the line **ONCE** by closing 16F2Q breaker
- Close (or advise the F15 Operator to close) 15DL2 and 15L2L11 breakers

F15 Operator shall:

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

3.11. To take A7F line out of service

SCC shall carry out (or advise the F15 Operator to carry out) the following:

- Open 15L7A and 15L1L7 breakers

SCC shall carry out (or advise the A1 Operator to carry out) the following:

- Open 1AL7 and 1L7L11 breakers
- Check for no potential on A7F line

3.12. To take out, isolate and de-energize A7F line for work

- F15 Operator request for Station Guarantee from A1

SCC shall carry out (or advise the F15 Operator to carry out) the following:

- Open 15L7A and 15L1L7 breakers

SCC shall carry out (or advise A1 Operator to carry out) the following:

- Open 1AL7 and 1L7L11 breakers
- Check for no potential on A7F line

SCC shall advise A1 Operator to carry out the following:

- Open 1AL7-L7 and 1L7L11-L7 disconnect switches and turn off 125Vdc supply
- Close 1A7F-G ground disconnect switch

SCC shall advise F15 Operator to carry out the following:

- Open 15L7A-L7 and 15L1L7-L7 disconnect switches and turn off 125Vdc supply
- Close 15A7F-G ground disconnect switch

3.13. To restore A7F line to service after work

3.13.1. Prepare A7F line for restoration:

F15 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 A7F line

SCC shall advise A1 Operator to carry out the following:

- Check opened 1AL7 and 1L7L11 breakers
- Open 1A7F-G ground disconnect switch
- Turn on 125Vdc supply and close 1AL7-L7 and 1L7L11-L7 disconnect switches

SCC shall advise F15 Operator to carry out the following:

- Check opened 15L7A and 15L1L7 breakers
- Open 15A7F-G ground disconnect switch
- Turn on 125Vdc supply and close 15L7A-L7 and 15L1L7-L7 disconnect switches

3.13.2. Restoration of A7F line to service:

SCC shall:

- Advise the A1 and F15 Operators of readiness to restore A7F line to service
- Close (or advise the F15 Operator to close) 15L7A and 15L1L7 breakers
- Close (or advise the A1 Operator to close) 1AL7 and 1L7L11 breakers

3.14. To restore A7F line to service after automatic outage

If A7F line trips auto due to fault on the line:

F15 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 F15 Operator to energize) the line **ONCE** by closing 15L7A and 15L1L7 breakers
- Close (or advise the A1 Operator to close) 1AL7 and 1L7L11 breakers

F15 Operator shall:

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

3.15. To take A11F line out of service

SCC shall carry out (or advise the F15 Operator to carry out) the following:

- Open 15L2L11 and 15L11A breakers

SCC shall carry out (or advise the A1 Operator to carry out) the following:

- Open 1DL11 and 1L7L11 breakers
- Check for no potential on A11F line

3.16. To take out, isolate and de-energize A11F line for work

- F15 Operator request for Station Guarantee from A1

SCC shall carry out (or advise the F15 Operator to carry out) the following:

- Open 15L2L11 and 15L11A breakers

SCC shall carry out (or advise A1 Operator to carry out) the following:

- Open 1DL11 and 1L7L11 breakers
- Check for no potential on A11F line

SCC shall advise A1 Operator to carry out the following:

- Check open 1DL11 and 1L7L11 breakers
- Open 1DL11-L11 and 1L7L11-L11 disconnect switches and turn off 125Vdc supply
- Close 1A11F-G ground disconnect switch

SCC shall advise F15 Operator to carry out the following:

- Open 15L2L11-L11 and 15L11A-L11 disconnect switches and turn off 125Vdc supply
- Close 15A11F-G ground disconnect switch

3.17. To restore A11F line to service after work

3.17.1. Prepare A11F line for restoration:

F15 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 A11F line

SCC shall advise A1 Operator to carry out the following:

- Check opened 1DL11 and 1L7L11 breakers
- Open 1A11F -G ground disconnect switch
- Turn on 125Vdc supply and close 1DL11-L11 and 1L7L11-L11 disconnect switches

SCC shall advise F15 Operator to carry out the following:

- Check opened 15L2L11 and 15L11A breakers
- Open 15A11F-G ground disconnect switch
- Turn on 125Vdc supply and close 15L11A-L4 and 15L2L11-L4 disconnect switches

3.17.2. Restoration of A11F line to service:

SCC shall:

- Advise the A1 and F15 Operators of readiness to restore A11F line to service
- Close (or advise the A1 Operator to close) 1DL11 and 1L7L11 breakers
- Close (or advise the F15 Operator to close) 15L2L11 and 15L11A breakers

3.18. To restore A11F line to service after automatic outage

If A11F **line** trips auto due to fault on the line:

F15 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 A1 Operator to energize) the line **ONCE** by closing 1DL11 and 1L7L11 breakers
- Close (or advise the F15 Operator to close) 15L2L11 and 15L11A breakers

F15 Operator shall:

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

3.19. To isolate 15T1 Bank for work

SCC shall advise F15 Operator to carry out the following:

- Inform customers about readiness to take off 15T1 bank
- Request customers on 15T1 Bank to take off their load
- Open AC1 Contactor/MCB to take off supply to 15T1 transformer auxiliaries
- Transfer Station Service from AC1 to AC2, if station service is on 15T1 transformer

SCC shall carry out (or advise F15 Operator to carry out) the following:

- Verify opened 15F1-S disconnect switch.
- Check open 15T1F1 breaker.
- Open 15T1-D disconnect switch to isolate 15T1 Transformer and turn off 125Vdc supply
- Open 15T1F1-T1 disconnect switch and turn off 125Vdc supply
- Open AC control MCB to 15T1 auxiliaries and tag
- Open 125VDC MCB to 15T1 primary and secondary protection and tag with PC13
- Check for no potential on 15T1 Bank

3.20. To restore 15T1 Bank to service after work

3.20.1. Prepare 15T1 bank for restoration:

F15 Operator shall:

- Advise SCC when work on the transformer has been completed and permit(s) surrendered (including all Station Guarantees)
- Check open 15T1F1 breaker.
- Check open 15F1-S disconnect switch.
- Turn on 125Vdc supply and close 15T1F1-T1 disconnect switch.
- Turn on 125Vdc supply 15T1-D disconnect switch

- Close AC control MCB to 15T1 auxiliaries and tag
- Close 125VDC MCB to 15T1 primary and secondary protection and tag with PC13
- Advise SCC of readiness to restore 15T1 Bank to service

3.20.2. **Restoration of 15T1 bank to service:**

- SCC shall close (or advise F15 Operator to close) the 15T1-D disconnect switch
- F15 Operator shall advise customers of readiness to restore 15T1 Bank to service
- SCC shall close (or advise F15 Operator to close) the 15T1F1 breaker

3.21. **To restore 15T1 Bank to service after automatic outage**

If 15T1 bank trips auto due to fault:

F15 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 F15 Operator to energize) the transformer ONCE by closing 15DT2, 15DL1 and 15DL2 breakers
- Advise customer of readiness to restore 15T1F1 feeder to service
- Close 15F1 breaker

F15 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.

3.22. **To isolate 15T2 Bank for work**

SCC shall advise F15 Operator to carry out the following:

- Inform customers about readiness to take off 15T2 bank
- Request customers on 15T2 Bank to take off their load
- Open AC1 Contactor/MCB to take off supply to 15T2 transformer auxiliaries
- Transfer Station Service from AC2 to AC1, if station service is on 15T2 transformer

SCC shall carry out (or advise F15 Operator to carry out) the following:

- Open 15T2F2 breaker
- Open 15AT2 and 15DT2 breakers
- Open 15T2F2-T2 disconnect switch.
- Open 15AT2–T2 and 15DT2-T2 disconnect switches and turn off 125Vdc supply
- Open AC control MCB to 15T2 auxiliaries and tag
- Open 125VDC MCB to 15T2 primary and secondary protection and tag with PC13
- Check for no potential on 15T2 Bank

3.23. To restore 15T2 Bank to service after work

3.23.1. Prepare 15T2 bank for restoration:

F15 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 15T2 Bank and temporary grounds removed
- Check 15T2F2 breaker opened.
- Close 15T2F2-T2 disconnect switch
- Turn on 125Vdc supply and close 15AT2–T2 and 15DT2-T2 disconnect switches
- Close AC control MCB to 15T2 auxiliaries and tag
- Close 125VDC MCB to 15T2 primary and secondary protection and tag with PC13
- Advise SCC of readiness to restore 15T2 Bank to service

3.23.2. Restoration of 15T2 bank to service:

- SCC shall close (or advise F15 Operator to close) the 15AT2 and 15DT2 breakers
- F15 Operator shall advise customers of readiness to restore 15T2 Bank to service
- SCC shall close (or advise F15 Operator to close) the 15F2 feeder

3.24. To restore 15T2 Bank to service after automatic outage

If 15T2 bank trips auto due to fault:

F15 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 F15 Operator to energize) the transformer ONCE by closing 15AT2 and 15DT2 breakers
- Advise customer of readiness to restore 15F2 feeder to service
- Close 15T2F2 breaker

F15 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.

3.25. To Isolate 15T1F1 Breaker for work

- F15 Operator shall request Station Guarantee from customer on 15F1 Bus

SCC shall advise F15 Operator to carry out the following:

- Inform customers about readiness to take off 15T1 bank

- Request customers on 15T1 Bank to take off their load
- Open AC1 Contactor/MCB to take off supply to 15T1 transformer auxiliaries
- Transfer Station Service from AC1 to AC2, if station service is on 15T1 transformer

SCC shall carry out (or advise F15 Operator to carry out) the following:

- Open 15T1F1 breaker

SCC shall advise F15 Operator to carry out the following:

- Verify opened 15F1-S disconnect switch.
- Open 15T1F1-T1 disconnect switch
- Open 15T1F1-F1 disconnect switch
- Open 15T1-D disconnect switch and turn off its 125Vdc supply
- Check for no potential on 15T1 Bank

3.26. To restore 15T1F1 Breaker to service after work

3.26.1. Prepare 15T1F1 breaker for restoration:

F15 Operator shall:

- Advise SCC when work on the 15T1F1 breaker has been completed and permit(s) surrendered (including all Station Guarantees)
- Check for no potential on 15T1F1 Breaker and temporary grounds removed
- Check open 15T1F1 breaker.
- Check open 15T1F1-S disconnect switch.
- Close 15T1F1-T1 disconnect switch
- Close 15T1F1-F1 disconnect switch
- Turn on 125Vdc supply to 15T1-D disconnect switch
- Check for no potential on 15T1 Bank

3.26.2. Restoration of 15T1F1 breaker to service:

- SCC shall close (or advise F15 Operator to close) the 15T1-D disconnect switch

- F15 Operator shall advise customers of readiness to restore 15T1 Bank to service
- SCC shall close (or advise F15 Operator to close) the 15T1F1 breaker

3.27. To Isolate 15T2F2 Breaker for work

- F15 Operator shall request Station Guarantee from customer on 15F2 Bus
SCC shall carry out (or advise F15 Operator to carry out) the following:

- Open 15T2F2 breaker
- Open 15AT2 and 15DT2 breakers

SCC shall advise F15 Operator to carry out the following:

- Check 15T2F2 breaker opened.
- Open 15T2F2-T2 disconnect switch.
- Open 15AT2–T2 and 15DT2-T2 disconnect switches and turn off 125Vdc supply
- Check for no potential on 15T2 Bank

3.28. To restore 15T2F2 Breaker to service after work

3.28.1. Prepare 15T2F2 breaker for restoration:

F15 Operator shall:

- Advise SCC when work on the 15F2 breaker has been completed and permit(s) surrendered (including all Station Guarantees)
- Check for no potential on 15F2 Breaker and temporary grounds removed
- Close 15T2F2-T2 disconnect switch.
- Turn on 125Vdc supply and close 15AT2–T2 and 15DT2-T2 disconnect switches

3.28.2. Restoration of 15F2 breaker to service:

- SCC shall close (or advise F15 Operator to close) the 15AT2 and 15DT2 breakers
F15 Operator shall advise customers of readiness to restore 15T2 Bank to service

- SCC shall close (or advise F15 Operator to close) the 15T2F2 breaker

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, a breaker and half configuration provides the normal points of supply to all circuits/equipment such as F1N, F2Q , A7F , A11F lines and 15T1 and 15T2 transformers.

5. Approval

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Director, TSD