TD-OP-0025

GRIDCo

OPERATING PROCEDURE FOR KPANDU SUBSTATION

GHANA GRID COMPANY LTD

Title:	**OPERATING PROCEDURE FOR KPANDU SUBSTATION (PU25)**		
Issued To:	Director, System Operations Director, SNS Manager, SCC Manager, Dispatch Operations Area Manager, Tema Operating Staff, Tema Area Maintenance Staff, Tema Area Dispatch Staff, SCC	**Number:**	TD-OP-0025
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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 PU2 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 PU25 Substation.

3. Procedure

3.1. To take PE1PU line out of service

SCC shall carry out (or advise the PU25 Operator to carry out) the following:

- Open 25L1A breaker

SCC shall advise the PE24 Operator to carry out the following:

- Open 24PE1PU breaker
- Check for no potential on PE1PU line

3.2. To take out, isolate and de-energize PE1PU line for work

PU25 Operator shall request for Station Guarantee from PE24

SCC shall carry out (or advise the PU25 Operator to carry out) the following:

- Open 25L1A breaker

SCC shall carry out (or advise the PU24 Operator to carry out) the following:

- Open 24PE1PU breaker
- Check for no potential on PE1PU line

SCC shall advise PE24 Operator to carry out the following:

- Verify opened 24PE1PU-S bypass disconnect switch and turn off its 125Vdc supply
- Open 24PE1PU-L1 disconnect switch and turn off its 125Vdc supply
- Close 24PE1PU-G ground disconnect switch

SCC shall advise PU25 Operator to carry out the following:

- Verify opened 25L1A-S bypass disconnect switch and turn off its 125Vdc supply
- Open 25L1A-L1 disconnect switch and turn off its 125Vdc supply
- Close 25L1A-G ground disconnect switch

3.3. To restore PE1PU line to service after work

3.3.1. Prepare PE1PU line for restoration:

PU25 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 PE1PU line

SCC shall advise PE24 Operator to carry out the following:

- Check opened 24PE1PU-S bypass disconnect switch and turn on its 125Vdc supply
- Check opened 24PE1PU breaker
- Open 24PE1PU-G ground disconnect switch
- Turn on 125Vdc supply and close 24PE1PU-L1 disconnect switch

SCC shall advise PU25 Operator to carry out the following:

- Check opened 25L1A-S bypass disconnect switch and turn on its 125Vdc supply
- Check opened 25L1A breaker
- Open 25L1A-G ground disconnect switch
- Turn on 125Vdc supply and close 25L1A-L1 disconnect switch

3.3.2. Restoration of PE1PU line to service:

SCC shall:

- Advise the PU25 and PE24 Operators of readiness to restore PE1PU line to service
- Close (or advise the PE24 Operator to close) 24PE1PU breaker
- Close (or advise the PU25 Operator to close) 25L1A breaker

3.4. To restore PE1PU line to service after automatic outage

If PE1PU line trips auto due to fault on the line:

PU25 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 PU25 Operator to energize) the line **ONCE** by closing 25L1A breaker
- Close (or advise the PE24 Operator to close) 24PE1PU breaker

PU25 Operator shall:

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

3.4.1. To take PU2KD line out of service

SCC shall carry out (or advise the PU25 Operator to carry out) the following:

- Open 25PU2KD breaker

SCC shall carry out (or advise the KD70 Operator to carry out) the following:

- Open 70PU2KD breaker

- Check for no potential on PU2KD line

3.5. To take out, isolate and de-energize PU2KD line for work

PU25 Operator shall request for Station Guarantee from KD70

SCC shall carry out (or advise the PU25 Operator to carry out) the following:

- Open 25PU2KD breaker
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SCC shall carry out (or advise the KD70 Operator to carry out) the following:

- Open 70PU2KD breaker

- Check for no potential on PU2KD line

SCC shall advise KD70 Operator to carry out the following:

- Verify opened 70PU2KD-S bypass disconnect switch and turn on its 125Vdc supply

- Open 70PU2KD-L2 disconnect switch and turn off its 125Vdc supply

- Close 70PU2KD-G ground disconnect switch

SCC shall advise PU25 Operator to carry out the following:

- Verify opened 25PU2KD-S bypass disconnect switch and turn on its 125Vdc supply

- Open 25PU2KD-L2 disconnect switch and turn off its 125Vdc supply

- Close 25PU2KD-G ground disconnect switch

3.6. To restore PU2KD line to service after work

3.6.1. Prepare PU2KD line for restoration:

PU25 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 PU2KD line

SCC shall advise KD70 Operator to carry out the following:

- Check opened 70PU2KD -S bypass disconnect switch and turn off its 125Vdc supply
- Check opened 70PU2KD breaker
- Open 70PU2KD-G ground disconnect switch
- Turn on 125Vdc supply and close 70PU2KD-L2 disconnect switch

SCC shall advise PU25 Operator to carry out the following:

- Check opened 25PU2KD-S bypass disconnect switch and turn off its 125Vdc supply
- Check opened 25PU2KD breaker
- Open 25PU2KD-G ground disconnect switch
- Turn on 125Vdc supply and close 25PU2KD-L2 disconnect switch

3.6.2. Restoration of PU2KD line to service:

SCC shall:

- Advise the KD70 and PU25 Operators of readiness to restore PU2KD line to service

- Close (or advise the KD70 Operator to close) 70PU2KD breaker
- Close (or advise the PU25 Operator to close) 25PU2KD breaker

3.7. To restore PU2KD line to service after automatic outage

If PU2KD line trips auto due to fault on the line:

PU25 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 KD70 Operator to energize) the line **ONCE** by closing 70PU2KD breaker
- Close (or advise the PU25 Operator to close) 25PU2KD breaker

PU25 Operator shall:

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

3.8. To isolate 25T1 Bank for work

- PU25 Operator shall request Station Guarantee from customer on 25T1 transformer

SCC shall carry out or advise PU25 operator to carry out the following:

- Inform customers about readiness to take off 25T1 Bank

- Request customers on 25T1 Bank to take off their load

- Transfer Station Service from AC1 to AC2, if Station Service is on 25T1

- Open AC1 Contactor/MCB to take off supply to 25T1 transformer auxiliaries

SCC shall carry out (or advise PU25 Operator to carry out) the following:

- Check opened 25T2Y breaker

- Open 25AT1 breaker

- Open 25T1Y breaker

- Open 25YSC1 breaker

- Check for no potential on 25T1 Bank

- Open 25T1Y-T1 disconnect switch

- Open 25AT1-T1 disconnect switch and turn off its 125vdc supply

- Close 25T1Y-G ground disconnect switch

3.9. To restore 25T1 Bank to service

3.9.1. Prepare 25T1 Bank for service after work

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

- Check for no potential on 25T1 Bank and temporary grounds removed

- Open 25T1Y-G ground disconnect switch

- Close 25T1Y-T1 disconnect switch

- Turn on 125vdc supply and close 25AT1-T1 disconnect switch

- Advise SCC of readiness to restore 25T1 Bank to service

3.9.2. Restoration of 25T1 Bank to service:

- SCC shall close (or advise PU25 Operator to close) 25AT1 breaker

- Advise customers of readiness to restore feeders on 25T1 to service

- SCC shall close (or advise PU25 Operator to close) 25T1Y breaker

- SCC shall close (or advise PU25 Operator to close) 25YSC1 breaker if the voltage is below 32.8kV

3.10. To restore 25T1 Bank to service after automatic outage

- If 25T1 Bank trips auto due to fault on the equipment

PU25 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 PU25 Operator to energize) the Transformer **ONCE** by closing 25AT1 breaker

- Advise Customer of readiness to restore 25T1 Bank to service

- Close 25T2Y breaker and all feeders.

- SCC shall close (or advise PU25 Operator to close) 25YSC1 breaker if the voltage is below 32.8kV

PU25 Operator shall:

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

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

3.11. To isolate 25T2 Bank for work

- PU25 Operator shall request Station Guarantee from customer on 25T2 transformer

SCC shall carry out or advise PU25 operator to carry out the following:

- Inform customers about readiness to take off 25T2 Bank

- Request customers on 25T2 Bank to take off their load

- Transfer Station Service from AC2 to AC1, if Station Service is on 25T2

- Open AC2 Contactor/MCB to take off supply to 25T2 transformer auxiliaries

SCC shall carry out (or advise PU25 Operator to carry out) the following:

- Open 25AT2 breaker

- Open 25T2Y breaker

- Open 25YSC2 breaker

- Check for no potential on 25T2 Bank

- Open 25T2Y-T2 disconnect switch

- Open 25AT2-A disconnect switch and turn off its 125vdc supply

- Close 25T2Y-G ground disconnect switch

3.12. To restore 25T2 Bank to service

3.12.1. Prepare 25T2 Bank for service after work

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

- Check for no potential on 25T2 Bank and temporary grounds removed

- Open 25T2Y-G ground disconnect switch

- Close 25T2Y-T2 disconnect switch

- Turn on 125vdc supply and close 25AT2-A disconnect switch

- Advise SCC of readiness to restore 25T2 Bank to service

Restoration of 25T2 Bank to service:

- SCC shall close (or advise PU25 Operator to close) 25AT2 breaker

- Advise customers of readiness to restore feeders on 25T2 to service

- SCC shall close (or advise PU25 Operator to close) 25T2Y breaker

- SCC shall close (or advise PU25 Operator to close) 25YSC2 breaker if the voltage is below 32.8kV

3.13. To restore 25T2 Bank to service after automatic outage

- If 25T2 Bank trips auto due to fault on the equipment

PU25 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 PU25 Operator to energize) the Transformer **ONCE** by closing 25AT2 breaker

- Advise Customer of readiness to restore 25T1 Bank to service

- Close 25T2Y2 breaker and all feeders.

- SCC shall close (or advise PU25 Operator to close) 25YSC1 breaker if the voltage is below 32.8kV

PU25 Operator shall:

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

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

3.14. To Isolate 25T1Y Breaker for work

- PU25 Operator shall request Station Guarantee from customer on 25T1Y Bus

SCC shall advise PU25 Operator to carry out the following:

- Inform customers about readiness to take off 25T1 bank

- Request customers on 25T1 Bank to take off their load

SCC shall carry out (or advise PU25 Operator to carry out) the following:

- Open 25YSC1 breaker

- Open 25T1Y breaker

SCC shall advise PU25 Operator to carry out the following:

- Open 25T1Y-Y disconnect switch and turn off its 125Vdc supply

- Open 25T1Y-T1 disconnect switch and turn off its 125Vdc supply

- Check for no potential on 25T1Y breaker

3.15. To restore 25T1Y Breaker to service after work

3.15.1. Prepare 25T1Y breaker for restoration:

PU25 Operator shall:

- Advise SCC when work on the 25T1Y breaker has been completed and permit(s) surrendered (including all Station Guarantees)

- Check for no potential on 25T1Y Breaker and temporary grounds removed

- Close 25T1Y-Y disconnect switch and turn on its 125Vdc supply

- Close 25T1Y-T1 disconnect switch and turn on its 125Vdc supply

3.15.2. Restoration of 25T1Y breaker to service:

- PU25 Operator shall advise customers of readiness to restore 25T1Y breaker to service

- SCC shall close (or advise PU25 Operator to close) the 25T1Y breaker

- SCC shall close (or advise PU25 Operator to close) 25YSC1 breaker if the voltage is below 32.8kV

3.16. To Isolate 25T2Y Breaker for work

- PU25 Operator shall request Station Guarantee from customer on 25T2Y Bus

SCC shall advise PU25 Operator to carry out the following:

- Inform customers about readiness to take off 25T2 bank

- Request customers on 25T2 Bank to take off their load

SCC shall carry out (or advise PU25 Operator to carry out) the following:

- Open 25T2SC2 breaker

- Open 25T2Y breaker

SCC shall advise PU25 Operator to carry out the following:

- Open 25T2Y-Y disconnect switch and turn off its 125Vdc supply

- Open 25T2Y-T2 disconnect switch and turn off its 125Vdc supply

- Check for no potential on 25T2Y breaker

3.17. To restore 25T2Y Breaker to service after work

3.17.1. Prepare 25T2Y breaker for restoration:

PU25 Operator shall:

- Advise SCC when work on the 25T2Y breaker has been completed and permit(s) surrendered (including all Station Guarantees)

- Check for no potential on 25T2Y Breaker and temporary grounds removed

- Close 25T2Y-Y disconnect switch and turn on its 125Vdc supply

- Close 25T2Y-T2 disconnect switch and turn on its 125Vdc supply

3.17.2. Restoration of 25T2Y breaker to service:

- PU25 Operator shall advise customers of readiness to restore 25T2Y breaker to service

- SCC shall close (or advise PU25 Operator to close) the 25T2Y breaker

- SCC shall close (or advise PU25 Operator to close) 25T2SC2 breaker if the voltage is below 32.8kV

3.18. To Isolate 25YF1 Breaker for work

- PU25 Operator shall request Station Guarantee from customer on 25YF1 Bus

SCC shall advise PU25 Operator to carry out the following:

- Inform customers about readiness to take off 25T2 bank
- Request customers on 25T2 Bank to take off their load

SCC shall carry out (or advise PU25 Operator to carry out) the following:

- Open 25YSC1 breaker
- Open 25YF1 breaker

SCC shall advise PU25 Operator to carry out the following:

- Open 25YF1-Y disconnect switch and turn off its 125Vdc supply
- Open 25YF1-T2 disconnect switch and turn off its 125Vdc supply
- Check for no potential on 25YF1 breaker

3.19. To restore 25YF1 Breaker to service after work

3.19.1. Prepare 25YF1 breaker for restoration:

PU25 Operator shall:

- Advise SCC when work on the 25YF1 breaker has been completed and permit(s) surrendered (including all Station Guarantees)

- Check for no potential on 25YF1 Breaker and temporary grounds removed

- Close 25YF1-Y disconnect switch and turn on its 125Vdc supply

- Close 25YF1-T2 disconnect switch and turn on its 125Vdc supply

3.19.2. Restoration of 25YF1 breaker to service:

- PU25 Operator shall advise customers of readiness to restore 25YF1 breaker to service

- SCC shall close (or advise PU25 Operator to close) the 25YF1 breaker

- SCC shall close (or advise PU25 Operator to close) 25YSC1 breaker if the voltage is below 32.8kV

3.20. To isolate 25SC1 Cap Bank for work

SCC shall carry out (or advise PU25 Operator to carry out) the following:

- Open 25YSC1breaker

SCC shall advise PU25 Operator to carry out the following:

- Open 25YSC1-SC1 disconnect switch

- Close 25SC1-G disconnect switch

3.21. To restore 25SC1 Cap Bank to service after work

3.21.1. Prepare 25SC1 Cap Bank for restoration:

PU25 Operator shall:

- Advise SCC when work on the 25SC1 Cap Bank has been completed and permit(s) surrendered (including all Station Guarantees)

- Check for no potential on 25SC1 Cap Bank and temporary grounds removed

- Open 25SC1-G disconnect switch

- Close 25YSC1-SC1 disconnect switch

3.21.2. Restoration of 25SC1 Cap Bank to service:

- SCC shall close (or advise PU25 Operator to close) 25YSC1 breaker if the voltage is below 32.8kV

3.22. To isolate 25SC2 Cap Bank for work

SCC shall carry out (or advise PU25 Operator to carry out) the following:

- Open 25T2SC2 breaker

SCC shall advise PU25 Operator to carry out the following:

- Open 25T2SC2-SC2 disconnect switch

- Close 25SC2-G disconnect switch

3.23. To restore 25SC2 Cap Bank to service after work

3.23.1. Prepare 25SC2 Cap Bank for restoration:

PU25 Operator shall:

- Advise SCC when work on the 25SC2 Cap Bank has been completed and permit(s) surrendered (including all Station Guarantees)

- Check for no potential on 25SC2 Cap Bank and temporary grounds removed

- Open 25SC2-G disconnect switch

- Close 25T2SC2-SC2 disconnect switch

3.23.2. Restoration of 25SC2 Cap Bank to service:

- SCC shall close (or advise PU25 Operator to close) 25T2SC2 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 is only one 69Kv bus arrangement. The main 'A' bus provides the normal points of supply to all circuits/equipment such as PE1PU and PU2KD lines, 25T1 and 25T2 transformers.

5. Approval

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Director, Technical Services