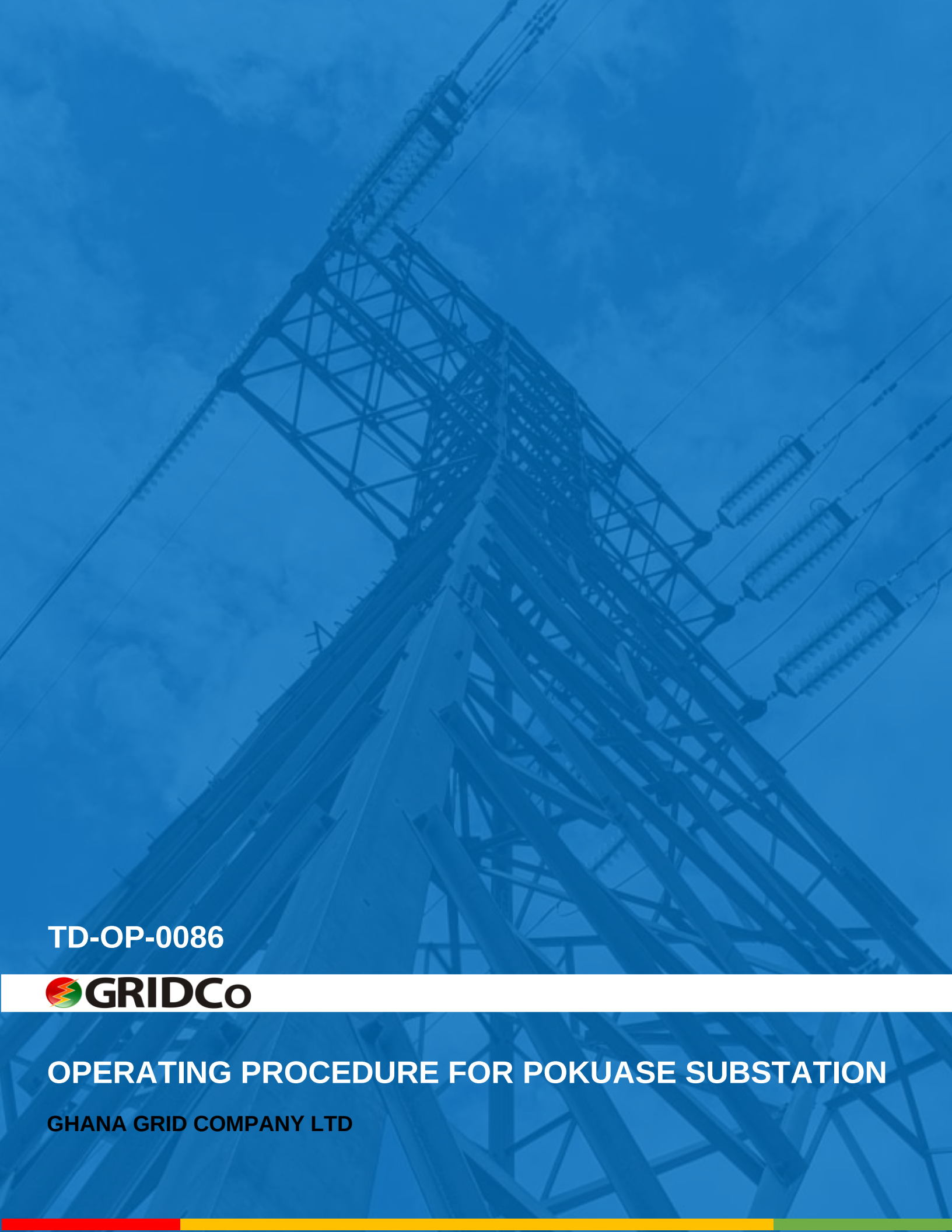

TD-OP-0086

GRIDCo

OPERATING PROCEDURE FOR POKUASE SUBSTATION

GHANA GRID COMPANY LTD

Title:	**OPERATING PROCEDURE FOR POKUASE SUBSTATION (PK86)**		
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-0086
		Subject Area:	Operating
		Issue Date:	Trial
		Origin:	Technical Services
Key Words:	Take Out, Isolate, Prepare, Energize, Restore, Automatic Outage		

Contents

1. Purpose

This directive specifies the operations to be carried out to take out of service, isolate or restore equipment at PK86 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 PK86 Substation.

3. Procedure

3.1. To take TT12PK line out of service

SCC shall carry out (or advise the PK86 Operator to carry out) the following:

- Open 86L12E and 86L12T1 breakers

SCC shall advise TT32 Operator to carry out the following:

- Open 32PL12 and 32T7L12 breakers
- Check for no potential on TT12PK line

3.2. To take out, isolate and de-energize TT12PK line for work

- PK86 Operator shall request for Station Guarantee from TT32

SCC shall carry out (or advise the PK86 Operator to carry out) the following:

- Open 86L12E and 86L12T1 breakers

SCC shall advise TT32 Operator to carry out the following:

- Open 32PL12 and 32T7L12 breakers
- Check for no potential on TT12PK line

SCC shall advise TT32 Operator to carry out the following:

- Open 32PL12-L12 and 32T7L12-L12 disconnect switches and turn off its 125Vdc supply

- Close 32TT12PK-G ground disconnect switch

SCC shall advise PK86 Operator to carry out the following:

- Open 86L12E-L12 and 86L12T1-L12 disconnect switches and turn off 125Vdc supply
- Close 86TT12PK-G ground disconnect switch

3.3. To restore TT12PK line to service after work

3.3.1. Prepare TT12PK line for restoration

PK86 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 TT12PK line

SCC shall advise TT32 Operator to carry out the following:

- Check opened 32PL12 and 32T7L12 breakers
- Open 32TT12PK-G ground disconnect switch
- Turn on 125Vdc supply and close 32PL12-L12 and 32T7L12-L12 disconnect switches

SCC shall advise PK86 Operator to carry out the following:

- Check opened 86L12E and 86L12T1 breakers
- Open 86TT12PK-G ground disconnect switch
- Turn on 125Vdc supply and close 86L12E-L12 and 86L12T1-L12 disconnect switches

3.3.2. Restoration of TT12PK line to service:

SCC shall:

- Advise the PK86 and TT32 Operators of readiness to restore TT12PK line to service

- Close (or advise the PK86 Operator to close) 86L12E and 86L12T1 breakers

- Close (or advise the TT32 Operator to close) 32PL12 and 32T7L12 breakers

3.4. To restore TT12PK line to service after automatic outage

If TT12PK line trips auto due to fault:

PK86 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 32PL12 and 32T7L12 breakers

- Close (or advise the PK86 Operator to close) 86L12E and 86L12T1 breakers

PK86 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 PK21Vline out of service

SCC shall carry out (or advise the PK86 Operator to carry out) the following:

- Open 86EL21 and 86PL21 breakers

SCC shall advise V2 Operator to carry out the following:

- Open 2L21E and 2L21P breakers

- Check for no potential on PK21V line

3.6. To take out, isolate and de-energize PK21V line for work

- PK86 Operator shall request for Station Guarantee from V2

SCC shall carry out (or advise the PK86 Operator to carry out) the following:

- Open 86EL21and 86PL21 breakers

SCC shall advise V2 Operator to carry out the following:

- Open 2L21E and 2L21P breakers

- Check for no potential on PK21Vline

SCC shall advise V2 Operator to carry out the following:

- Open 2L21E–L21 and 2L21P–L21 disconnect switches and turn off its 125Vdc supply

- Close 2PK21V-G ground disconnect switch

SCC shall advise PK86 Operator to carry out the following:

- Open 86L12E-L21 and 86L12T1-L21 disconnect switches and turn off 125Vdc supply

- Close 86PK21V-G ground disconnect switch

3.7. To restore PK21Vline to service after work

3.7.1. Prepare PK21Vline for restoration

PK86 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 PK21Vline

SCC shall advise V2 Operator to carry out the following:

- Check opened 2L21E and 2L21P breakers

- Open 2PK21V-G ground disconnect switch

- Turn on 125Vdc supply and close 2L21E-L21 and 2L21P-L21 disconnect switches

SCC shall advise PK86 Operator to carry out the following:

- Check opened 86EL21and 86PL21 breakers

- Open 86PK21V-G ground disconnect switch

- Turn on 125Vdc supply and close 86L12E-L21 and 86L12T1-L21 disconnect switches

3.7.2. Restoration of PK21Vline to service:

SCC shall:

- Advise the PK86 and V2 Operators of readiness to restore PK21V line to service

- Close (or advise the PK86 Operator to close) 86EL21and 86PL21 breakers

- Close (or advise the V2 Operator to close) 2L21E and 2L21P breakers

3.8. To restore PK21Vline to service after automatic outage

If PK21Vline trips auto due to fault:

PK86 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 V2 Operator to energize) the line **ONCE** by closing 2L21E and 2L21P breakers
- Close (or advise the PK86 Operator to close) 86EL21and 86PL21 breakers

PK86 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. Isolate 86T1 Transformer for work

PK86 Operator shall request for Station Guarantee from customer on 86F1 and 86F3 Feeders

SCC shall advise PK86 operator to carry out the following:

- Inform customers about readiness to take off 86T1 bank
- Request customers on 86T1 Bank to take off their load
- Transfer Station Service from AC1 to AC2, if Station Service is on 86T1
- Open AC1 Contactor/MCB to take off supply to 86T1 transformer auxiliaries

SCC shall carry out (or advise PK86 operator to carry out) the following:

- Open 86T1SC1 breaker
- Open 86T1SC3 breaker
- Open 86T1F1 breaker
- Open 86T1F3 breaker
- Open 86L12T1 breaker
- Open 86T1P breaker
- Check for no potential on 86T1 Bank
- Open 86T1P-T1 and 86L12T1-T1 disconnect switches and turn off 125Vdc supply

- Open 86T1-Y1 disconnect switch and turn off 125Vdc supply

- Open AC control MCB to 86T1 auxiliaries and tag

- Open 125V DC MCB to 86T1 primary and secondary protection and tag with PC13

3.10. To restore 86T1 Bank to service after work

3.10.1. Prepare 86T1 bank for restoration:

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

- Check for no potential on 86T1 Bank and temporary grounds removed

- Check opened 86Y1F1, 86Y1F3 and 86Y1SC1 and 86Y1SC3 breakers

- Check opened 86L12T1 and 86T1P

- Close 86T1-Y1 disconnect switch and turn off 125Vdc supply

- Close 86L12T1-T1 and 86T1P-T1 disconnect switches and turn off 125Vdc supply

- Close AC control MCB to 86T1 auxiliaries and remove tag

- Close 125V DC MCB to 86T1 primary and secondary protection and remove PC13 tag

- Advise SCC of readiness to restore 86T1 Bank to service

3.10.2. Restoration of 86T1 bank to service:

- SCC shall close (or advise PK86 Operator to close) 86L12T1 and 86T1P breakers

- PK86 Operator shall advise Customer of readiness to restore 86T1 Bank to service

- SCC shall close (or advise PK86 Operator to close) the 86Y1F1 and 86Y1F3 feeder breakers

- SCC shall close (or advise PK86 Operator to close) 86Y1SC1 and 86Y1SC3 breakers if the voltage is below 32.8kV

3.11. To restore 86T1 Bank to service after automatic outage

If 86T1 bank trips auto due to fault:

- 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 PK86 Operator to energize) the bank **ONCE** by closing 86L12T1 and 86T1P breakers

PK86 Operator shall advise Customer of readiness to restore 86F1 and 86F3 feeders to service

SCC shall close (or advise PK86 Operator to close) 86Y1F1 and 86Y1F3 breakers

PK86 Operator shall:

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

- If not successful, isolate the Transformer for maintenance men to work on the equipment. (Refer to **4. Explanation**.)

3.12. Isolate 86T2 Transformer for work

PK86 Operator shall request for Station Guarantee from customer on 86F2 and 86F4 Feeders

SCC shall advise PK86 operator to carry out the following:

- Inform customers about readiness to take off 86T2 bank

- Request customers on 86T2 Bank to take off their load

- Transfer Station Service from AC2 to AC1, if Station Service is on 86T2

- Open AC2 Contactor/MCB to take off supply to 86T2 transformer auxiliaries

SCC shall carry out (or advise PK86 operator to carry out) the following:

- Open 86Y2SC2 breaker

- Open 86Y2SC4 breaker

- Open 86Y2F2 breaker

- Open 86Y2F4 breaker

- Open 86T2T3 breaker

- Open 86T2P breaker

- Check for no potential on 86T2 Bank

- Open 86T2P-T2 and 86T2T3-T2 disconnect switches and turn off 125Vdc supply

- Open 86T2-Y2 disconnect switch and turn off 125Vdc supply

- Open AC control MCB to 86T2 auxiliaries and tag

- Open 125V DC MCB to 86T2 primary and secondary protection and tag with PC13

3.13. To restore 86T2 Bank to service after work

3.13.1. Prepare 86T2 bank for restoration:

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

- Check for no potential on 86T2 Bank and temporary grounds removed

- Check opened 86Y2F2, 86Y2F4 and 86Y2SC2 and 86Y2SC4 breakers

- Check opened 86T2T3 and 86T2P

- Close 86T2-Y2 disconnect switch and turn off 125Vdc supply

- Close 86T2T3-T2 and 86T2P-T2 disconnect switches and turn off 125Vdc supply

- Close AC control MCB to 86T2 auxiliaries and remove tag

- Close 125V DC MCB to 86T2 primary and secondary protection and remove PC13 tag

- Advise SCC of readiness to restore 86T2 Bank to service

3.13.2. Restoration of 86T2 bank to service:

- SCC shall close (or advise PK86 Operator to close) 86T2T3 and 86T2P breakers

- PK86 Operator shall advise Customer of readiness to restore 86T2 Bank to service

- SCC shall close (or advise PK86 Operator to close) the 86Y2F2 and 86Y2F4 feeder breakers

- SCC shall close (or advise PK86 Operator to close) 86Y2SC2 and 86Y2SC4 breakers if the voltage is below 32.8kV

3.14. To restore 86T2 Bank to service after automatic outage

If 86T2 bank trips auto due to fault:

- 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 PK86 Operator to energize) the bank **ONCE** by closing 86T2T3 and 86T2P breakers

PK86 Operator shall advise Customer of readiness to restore 86F2 and 86F4 feeders to service

SCC shall close (or advise PK86 Operator to close) 86Y2F2 and 86Y2F4 breakers

PK86 Operator shall:

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

- If not successful, isolate the Transformer for maintenance men to work on the equipment. (Refer to **4. Explanation**.)

3.15. Isolate 86T3 Transformer for work

PK86 Operator shall request for Station Guarantee from customer on 86F5 and 86F7 Feeders

SCC shall advise PK86 operator to carry out the following:

- Inform customers about readiness to take off 86T3 bank

- Request customers on 86T3 Bank to take off their load

- Transfer Station Service from AC3 to AC4, if Station Service is on 86T3

- Open AC2 Contactor/MCB to take off supply to 86T3 transformer auxiliaries

SCC shall carry out (or advise PK86 operator to carry out) the following:

- Open 86Y3SC5 breaker

- Open 86Y3SC7 breaker

- Open 86Y3F5 breaker

- Open 86Y3F7 breaker

- Open 86ET3 breaker

- Open 86T2T3 breaker

- Check for no potential on 86T3 Bank

- Open 86ET3-T3 and 86T2T3-T3 disconnect switches and turn off 125Vdc supply

- Open 86T3-Y3 disconnect switch and turn off 125Vdc supply

- Open AC control MCB to 86T3 auxiliaries and tag

- Open 125V DC MCB to 86T3 primary and secondary protection and tag with PC13

3.16. To restore 86T3 Bank to service after work

3.16.1. Prepare 86T3 bank for restoration:

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

- Check for no potential on 86T3 Bank and temporary grounds removed

- Check opened 86Y3F5, 86Y3F7 and 86Y3SC5 and 86Y3SC7 breakers

- Check opened 86T2T3 and 86ET3

- Close 86T3-Y3 disconnect switch and turn off 125Vdc supply

- Close 86T2T3-T3 and 86ET3-T3 disconnect switches and turn off 125Vdc supply

- Close AC control MCB to 86T3 auxiliaries and remove tag

- Close 125V DC MCB to 86T3 primary and secondary protection and remove PC13 tag

- Advise SCC of readiness to restore 86T3 Bank to service

3.16.2. Restoration of 86T3 bank to service:

- SCC shall close (or advise PK86 Operator to close) 86T2T3 and 86ET3 breakers

- PK86 Operator shall advise Customer of readiness to restore 86T3 Bank to service

- SCC shall close (or advise PK86 Operator to close) the 86Y3F5 and 86Y3F7 feeder breakers

- SCC shall close (or advise PK86 Operator to close) 86Y3SC5 and 86Y3SC7 breakers if the voltage is below 32.8kV

3.17. To restore 86T3 Bank to service after automatic outage

If 86T3 bank trips auto due to fault:

- 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 PK86 Operator to energize) the bank **ONCE** by closing 86T2T3 and 86T3E breakers

PK86 Operator shall advise Customer of readiness to restore 86F5 and 86F7 feeders to service

SCC shall close (or advise PK86 Operator to close) 86Y3F5 and 86Y3F7 breakers

PK86 Operator shall:

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

- If not successful, isolate the Transformer for maintenance men to work on the equipment. (Refer to **4. Explanation**.)

3.18. Isolate 86T4 Transformer for work

PK86 Operator shall request for Station Guarantee from customer on 86F6 and 86F8 Feeders

SCC shall advise PK86 operator to carry out the following:

- Inform customers about readiness to take off 86T4 bank

- Request customers on 86T4 Bank to take off their load

- Transfer Station Service from AC4 to AC3, if Station Service is on 86T4

- Open AC4 Contactor/MCB to take off supply to 86T4 transformer auxiliaries

SCC shall carry out (or advise PK86 operator to carry out) the following:

- Open 86Y4SC6 breaker

- Open 86Y4SC8 breaker

- Open 86Y4F6 breaker

- Open 86Y4F8 breaker

- Open 86ET4 breaker

- Open 86T4P breaker

- Check for no potential on 86T4 Bank

- Open 86ET4-T4 and 86T4P-T4 disconnect switches and turn off 125Vdc supply

- Open 86T4-Y4 disconnect switch and turn off 125Vdc supply

- Open AC control MCB to 86T4 auxiliaries and tag

- Open 125V DC MCB to 86T4 primary and secondary protection and tag with PC13

3.19. To restore 86T4 Bank to service after work

3.19.1. Prepare 86T4 bank for restoration:

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

- Check for no potential on 86T4 Bank and temporary grounds removed

- Check opened 86Y4F6, 86Y4F8 and 86Y4SC6 and 86Y4SC8 breakers

- Check opened 86T4P and 86ET4

- Close 86T4-Y4 disconnect switch and turn off 125Vdc supply

- Close 86T4P-T4 and 86ET4-T4 disconnect switches and turn off 125Vdc supply

- Close AC control MCB to 86T4 auxiliaries and remove tag

- Close 125V DC MCB to 86T4 primary and secondary protection and remove PC13 tag

- Advise SCC of readiness to restore 86T4 Bank to service

3.19.2. Restoration of 86T4 bank to service:

- SCC shall close (or advise PK86 Operator to close) 86T4P and 86ET4 breakers

- PK86 Operator shall advise Customer of readiness to restore 86T4 Bank to service

- SCC shall close (or advise PK86 Operator to close) the 86Y4F6 and 86Y4F8 feeder breakers

- SCC shall close (or advise PK86 Operator to close) 86Y4SC6 and 86Y4SC8 breakers if the voltage is below 32.8kV

3.20. To restore 86T4 Bank to service after automatic outage

If 86T4 bank trips auto due to fault:

- 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 PK86 Operator to energize) the bank **ONCE** by closing 86T4P and 86ET4 breakers

PK86 Operator shall advise Customer of readiness to restore 86F6 and 86F8 feeders to service

SCC shall close (or advise PK86 Operator to close) 86Y4F6 and 86Y4F8 breakers

PK86 Operator shall:

- Advise the Supervisor/Area Manager and SCC of item above
- If not successful, isolate the Transformer for maintenance men to work on the equipment. (Refer to **4. 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 provide the normal points of supply to all circuits/equipment such as PK21V and TT12PK lines, 86T1, 86T2, 86T3 and 86T4 transformers, 86SC1. 86SC2, 86SC3, 86SC4, 86SC5, 86SC6, 86SC7 and 86SC8 Capacitor Banks.

5. Approval

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Director, Technical Services