TD-OP-0032

GRIDCo

OPERATING PROCEDURE FOR TAKORADI THERMAL POWER STATION 330kV SUBSTATION

GHANA GRID COMPANY LTD

Title:	**OPERATING PROCEDURE FOR TAKORADI THERMAL POWER 330kV SUBSTATION (TT32)**		
Issued To:	Director, System Operations Director, SND Manager, SCC Manager, Dispatch Operations Manager, Aboadze Operating Staff, Aboadze Maintenance Staff, Aboadze Dispatch Staff, SCC	**Number:**	TD-OP-0032
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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 Substation to service for planned and auto outages.

2. Scope

The directive will be used by Operators at Aboadze and System Control Center (SCC) for operation of equipment at TT32 Substation.

3. Procedure

3.1. To take TT8AW line out of service

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

- Open 32EL9 and 32L11L9 breakers
- SCC shall carry out (or advise the AW58 Operator to carry out) the following:
- Open 58L8E and 58L8T8 breakers
- Check for no potential on TT8AW line

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

TT32 Operator request for Station Guarantee from AW58

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

- Open 32EL8 and 32T8P breakers

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

- Open 58L8E and 58L8T8 breakers
- Check for no potential on TT8AW line

SCC shall advise AW58 Operator to carry out the following:

- Open 58L8E-L8 and 58L8T8-L8 disconnect switches and turn off 125Vdc supply
- Close 58TT8AW-G ground disconnect switch

SCC shall advise TT32 Operator to carry out the following:

- Open 32EL8-L8 and 32T8P-L8 disconnect switches and turn off 125Vdc supply
- Close 32TT8AW-G ground disconnect switch

3.3. To restore TT8AW line to service after work

3.3.1. Prepare TT8AW line for restoration:

TT32 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 AW58 Operator to carry out the following:

- Check opened 58L8E and 58L8T8 breakers
- Open 58TT8AW-G ground disconnect switch
- Turn on 125Vdc supply and close 58L8E-L8 and 58L8T8-L8 disconnect switches

SCC shall advise TT32 Operator to carry out the following:

- Check opened 32EL8 and 32T8P breakers
- Open 32TT8AW-G ground disconnect switch
- Turn on 125Vdc supply and close 32EL8-L8 and 32T8P-L8 disconnect switches

3.3.2. 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 32L8T7 breakers
- Close (or advise the TT32 Operator to close) 58L8E and 58L8T8 breakers

3.4. To restore TT8AW line to service after automatic outage

If TT8AW line trips auto due to fault on the line:

TT32 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 58L8E and 58L8T8 breakers
- Close (or advise the TT32 Operator to close) 32EL8 and 32L8T7 breakers

TT32 Operator shall:

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

3.5. To take TT9D line out of service

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

- Open 32EL9 and 32L11L9 breakers

SCC shall carry out (or advise the D11 Operator to carry out) the following:

- Open breakers
- Check for no potential on TT9D line

3.6. To take out, isolate and de-energize TT9D line for work

- TT32 Operator shall request for Station Guarantee from D11

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

- Open 32EL9 and 32L11L9 breakers

SCC shall carry out (or advise D11 Operator to carry out) the following:

- Open ----------breakers

- Check for no potential on TT9D line

SCC shall advise D11 Operator to carry out the following:

- Open --------- disconnect switches and turn off its 125Vdc supply
- Close 11TT9D-G ground disconnect switch

SCC shall advise TT32 Operator to carry out the following:

- Open 32EL9-L9 and 32L11L9-L9 disconnect switches and turn off its 125Vdc supply
- Close 32TT9D-G ground disconnect switch

3.7. To restore TT9D line to service after work

3.7.1. Prepare TT9D line for restoration:

TT32 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 TT9D line

SCC shall advise D11 Operator to carry out the following:

- Check opened ---------- breakers
- Open 11TT9D-G ground disconnect switch
- Turn on 125Vdc supply and close ---------- disconnect switches

SCC shall advise TT32 Operator to carry out the following:

- Check opened 32EL9 and 32L11L9 breakers
- Open 32TT9D-G ground disconnect switch
- Turn on 125Vdc supply and close 32EL9-L9 and 32L11L9-L9 disconnect switches

3.7.2. Restoration of TT9D line to service:

SCC shall:

Advise the TT32 and D11 Operators of readiness to restore TT9D line to service

- Close (or advise the TT32 Operator to close) 32EL9 and 32L11L9 breakers
- Close (or advise the D11 Operator to close) ----------breakers

3.8. To restore TT9D line to service after automatic outage

If TT9D line trips auto due to fault on the line:

TT32 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:

- Close (or advise the TT32 Operator to close) 32EL9 and 32L11L9 breakers
- Energize (or advise the D11 Operator to energize) the line **ONCE** by closing ---------- breakers

TT32 Operator shall:

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

3.9. To make AM10TT line out of service

- SCC shall carry out (or advise the TT32 Operator to carry out) the following:
- Open 32PL10 and 32L10L10 breakers
- SCC shall carry out (or advise the AM84 Operator to carry out) the following:
- Open 84G1T1breaker
- Check for no potential on AM10TT line

3.10. To take out, isolate and de-energize AM10TT line for work

TT32 Operator request for Station Guarantee from AM84

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

- Open 32PL10 and 32L10L10 breakers

SCC shall carry out (or advise AM84 Operator to carry out) the following:

- Open 84G1T1breaker
- Check for no potential on AM10TT line

SCC shall advise AM84 Operator to carry out the following:

- Open 84G1T1-G1 disconnect switch and turn off 125Vdc supply
- Close 84T1-G ground disconnect switch

SCC shall advise TT32 Operator to carry out the following:

- Open 32PL10-L10 and 32L10L10-L10 disconnect switches and turn off 125Vdc supply
- Close 32AM10TT-G ground disconnect switch

3.11. To restore AM10TT line to service after work

3.11.1. Prepare AM10TT line for restoration:

TT32 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 AM10TT line

SCC shall advise AM84 Operator to carry out the following:

- Check opened 84G1T1 breaker
- Open 84T1-G ground disconnect switch
- Turn on 125Vdc supply and close 84G1T1-G1disconnect switch

SCC shall advise TT32 Operator to carry out the following:

- Check opened 32PL10 and 32L10L10 breakers

- Open 32AM10TT-G ground disconnect switch

- Turn on 125Vdc supply and close 32PL10-L10 and 32L10L10-L10 disconnect switches

3.11.2. Restoration of AM10TT line to service:

SCC shall:

- Advise the TT32 and AM84 Operators of readiness to restore AM10TT line to service

- Close (or advise the TT32 Operator to close) 32PL10 and 32L10T7 breakers

- Close (or advise the TT32 Operator to close) 84G1T1breaker

3.12. To restore AM10TT line to service after automatic outage

If AM10TT line trips auto due to fault on the line:

TT32 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 AM84 Operator to energize) the line **ONCE** by closing 84G1T1breaker

- Close (or advise the TT32 Operator to close) 32PL10 and 32L10T7 breakers

TT32 Operator shall:

- Advise the Supervisor/Manager of operation above

- Advise maintenance men to patrol the line if the operation above is not successful

3.13. To take KA11TT line out of service

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

- Open 32PL11 and 32L11L9 breakers
- SCC shall carry out (or advise the KA77 Operator to carry out) the following:
- Open 77T5L11 breaker
- Check for no potential on KA11TT line

3.14. To take out, isolate and de-energize KA11TT line for work

TT32 Operator request for Station Guarantee from KA77

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

- Open 32PL11 and 32L11L9 breakers

SCC shall carry out (or advise KA77 Operator to carry out) the following:

- Open 77T5L11breakers
- Check for no potential on KA11TT line

SCC shall advise KA77 Operator to carry out the following:

- Open 77T5L11-L11 disconnect switch and turn off 125Vdc supply
- Close 77KA11TT-G ground disconnect switch

SCC shall advise TT32 Operator to carry out the following:

- Open 32PL11-L11 and 32L11L9-L11 disconnect switches and turn off 125Vdc supply
- Close 32KA11TT-G ground disconnect switch

3.15. To restore KA11TT line to service after work

3.15.1. Prepare KA11TT line for restoration:

TT32 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 KA11TT line

SCC shall advise KA77 Operator to carry out the following:

- Check opened 77T5L11breakers
- Open 77KA11TT-G ground disconnect switch
- Turn on 125Vdc supply and close 77T5L11-L11disconnect switch

SCC shall advise TT32 Operator to carry out the following:

- Check opened 32PL11 and 32L11L9 breakers
- Open 32KA11TT-G ground disconnect switch
- Turn on 125Vdc supply and close 32PL11-L11 and 32L11L9-L11 disconnect switches

3.15.2. Restoration of KA11TT line to service:

SCC shall:

- Advise the TT32 and KA77 Operators of readiness to restore KA11TT line to service
- Close (or advise the TT32 Operator to close) 32PL11 and 32L11T7 breakers
- Close (or advise the TT32 Operator to close) 77T5L11breakers

3.16. To restore KA11TT line to service after automatic outage

If KA11TT line trips auto due to fault on the line:

TT32 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 KA77 Operator to energize) the line **ONCE** by closing 77T5L11breaker
- Close (or advise the TT32 Operator to close) 32PL11 and 32L11T7 breakers

TT32 Operator shall:

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

3.17. To take TT21V line out of service

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

- Open 32PL21 and 32T7L21 breakers
- SCC shall carry out (or advise the V2 Operator to carry out) the following:
- Open 2L21E and 2L21L23 breakers
- Check for no potential on TT21V line

3.18. To take out, isolate and de-energize TT21V line for work

TT32 Operator request for Station Guarantee from V2

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

- Open 32PL21 and 32T7L21 breakers

SCC shall carry out (or advise V2 Operator to carry out) the following:

- Open 2L21E and 2L21L23 breakers
- Check for no potential on TT21V line

SCC shall advise V2 Operator to carry out the following:

- Open 2L21E-L21 and 2L21L23-L21 disconnect switches and turn off 125Vdc supply
- Close 2TT21V-G ground disconnect switch

SCC shall advise TT32 Operator to carry out the following:

- Open 32PL21-L21 and 32T7L21-L21 disconnect switches and turn off 125Vdc supply
- Close 32TT21V-G ground disconnect switch

3.19. To restore TT21V line to service after work

3.19.1. Prepare TT21V line for restoration:

TT32 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 TT21V line

SCC shall advise V2 Operator to carry out the following:

- Check opened 2L21E and 2L21L23 breakers
- Open 2TT21V-G ground disconnect switch
- Turn on 125Vdc supply and close 2L21E-L21 and 2L21L23-L21 disconnect switches

SCC shall advise TT32 Operator to carry out the following:

- Check opened 32PL21 and 32T7L21 breakers
- Open 32TT21V-G ground disconnect switch
- Turn on 125Vdc supply and close 32PL21-L21 and 32T7L21-L21 disconnect switches

3.19.2. Restoration of TT21V line to service:

SCC shall:

- Advise the TT32 and V2 Operators of readiness to restore TT21V line to service
- Close (or advise the TT32 Operator to close) 32PL21 and 32L21T7 breakers
- Close (or advise the V2 Operator to close) 2L21E and 2L21L23 breakers

3.20. To restore TT21V line to service after automatic outage

If TT21V line trips auto due to fault on the line:

TT32 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 2L21L23 breakers

- Close (or advise the TT32 Operator to close) 32PL21 and 32L21T7 breakers

TT32 Operator shall:

- Advise the Supervisor/Manager of operation above

- Advise maintenance men to patrol the line if the operation above is not successful

3.21. To isolate 32T7 Bank for work

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

- Open 32T7E and 32T2L21 breakers

- Open 32DT7 and 32T6T8 breakers

- Open 32T7E-T7 and 32T2L21-T7 disconnect switches and turn off 125vdc supply

- Open 32DT7-T7 and 32T6T8-T7 disconnect switches and turn off 125vdc supply

- Open AC control MCB to 32T7 auxiliaries and tag

- Open 125V DC breaker to 32T7 primary and secondary protection and tag with PC13

- Check for no potential on 32T7 Bank

3.22. To restore 32T7 Bank to service after work

3.22.1. Prepare 32T7 bank for restoration:

TT32 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 32T7 Bank and temporary grounds removed
- Turn on 125Vdc supply and close 32T7E-T7 and 32T2L21-T7 disconnect switches
- Turn on 125Vdc supply and close 32DT7-T7 and 32T6T8-T7 disconnect switches
- Close AC control MCB to 32T7 auxiliaries and remove tag
- Close 125V DC breaker to 32T7 primary and secondary protection and remove tag PC13
- Advise SCC of readiness to restore 32T7 Bank to service

3.22.2. Restoration of 32T7 bank to service:

- SCC shall close (or advise TT32 Operator to close) the 32T7E and 32T2L21 breakers (330kV)
- SCC shall close (or advise TT32 Operator to close) the 32DT7 and 32T6T8 breakers to tie to 161kV Bus

3.23. To restore 32T7 Bank to service after automatic outage

If 32T7 bank trips auto due to fault:

TT32 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 transformer **ONCE** by closing 32T7E and 32T2L21 breakers (330kV)

TT32 Operator shall:

- Check for potential on 32T7 and advice SCC

SCC shall:

- Energize (or advise the TT32 Operator to energize) the transformer **ONCE** by closing 32DT7 and 32T6T8 breakers to tie to 161kV Bus

TT32 Operator shall:

- Advise the Supervisor/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.

3.24. To isolate 32T8 Bank for work

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

- Open 32T8E and 32T8P breakers
- Open 32DT8 and 32T6T8 breakers
- Open 32T8E-T8 and 32T8P-T8 disconnect switches and turn off 125vdc supply
- Open 32DT8-T8 and 32T6T8-T8 disconnect switches and turn off 125vdc supply
- Open AC control MCB to 32T8 auxiliaries and tag
- Open 125V DC breaker to 32T8 primary and secondary protection and tag with PC13
- Check for no potential on 32T8 Bank

3.25. To restore 32T8 Bank to service after work

3.25.1. Prepare 32T8 bank for restoration:

TT32 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 32T8 Bank and temporary grounds removed
- Turn on 125vdc supply and close 32T8E-T8 and 32T8P-T8 disconnect switches

- Turn on 125vdc supply and close 32DT8-T8 and 32T6T8-T8 disconnect switches
- Close 125V DC breaker to 32T8 primary and secondary protection and remove tag PC13
- Advise SCC of readiness to restore 32T8 Bank to service

3.25.2. Restoration of 32T8 bank to service:

- SCC shall close (or advise TT32 Operator to close) the 32T8E and 32T8P (330kV)
- SCC shall close (or advise TT32 Operator to close) the 32DT8 and 32T6T8 breakers to tie to 161kV Bus

3.26. To restore 32T8 Bank to service after automatic outage

If 32T8 bank trips auto due to fault:

TT32 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 transformer **ONCE** by closing 32T8E and 32T8P breakers (330kV)

TT32 Operator shall:

- Check for potential on 32T8 and advice SCC

SCC shall:

- Energize (or advise the TT32 Operator to energize) the transformer **ONCE** by closing 32DT8 and 32T6T8 breakers to tie to 161kV Bus

TT32 Operator shall:

- Advise the Supervisor/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, TT9D, 32T7 and 32T8 transformers.

5. Approval

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Director, TSD