

Performed by: _____

PT/0/A/0610/21

Date _____

DRAFT

DUKE POWER COMPANY

OCONEE NUCLEAR STATION

DEGRADED GRID AND SWITCHYARD ISOLATION FUNCTIONAL TEST

1.0 PURPOSE

- 1.1 To functionally verify Overhead ACB and PCB-9 operation during Switchyard Isolation.
- 1.2 To demonstrate operability of the Degraded Grid Protection System by switchyard isolation with Keowee Unit realignment from Grid generation to both Emergency Power paths.

2.0 REFERENCES

- 2.1 Technical Specifications 4.6.5
- 2.2 Design Basis Documents and TAC Sheets for 230KV Switchyard, Keowee Emergency Power, Degraded Grid Protection System
- 2.3 OEE-39, 39A, 39B 230KV Switchyard Control PCB No. 9 Trip Coil No.1, Trip Coil No. 2, Close Coil
- 2.4 OEE-48 230KV Switchyard Control PCB No. 18 Control
- 2.5 OEE-76-1, External Grid Trouble Protective Channel 1 Logic
- 2.6 OEE-76-2, External Grid Trouble Protective Channel 2 Logic
- 2.7 OEE-76-4, 4A External Grid Trouble Protective System Voltage Channel 1
- 2.8 OEE-76-5 External Grid Trouble Protective System Volt. Ch.1 Contact Development

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- 2.9 OEE-76-8, 8A External Grid Trouble Protective System Voltage Channel 2
- 2.10 OEE-76-9 External Grid Trouble Protective System Volt. Ch.2 Contact Development
- 2.11 OEE-76-12, 12A External Grid Trouble Swyd. Isolated Signal Channel 1, Channel 2
- 2.12 KEE-114, 214 Keowee Hydro Station ACB-1 Control, ACB-2 Control
- 2.13 OEE-1,2,317-1H Standby Breaker Closing and Loadshed Initiation (Channel 1)
- 2.14 OEE-117-92-OC 4160V Switchgear OTS1 Emergency Power Switching Logic Interposing Relays
- 2.15 OEE-120, 120-1 Channel "A" Keowee Emergency Start, Channel "B", Unit 1

3.0 TIME REQUIRED

- 3.1 8 hours - Unit 2 Refueling (Three Operators, One Keowee Operator)
- 3.2 Test complexity and potential for loss of DHR from power failure implies the Operations Unit Supervisor and at least one Reactor Operator should have no other duties during this test. Additionally, personnel responsibilities are as follows:
 - One Designated Systems Engineering person - available to resolve any technical questions during the test and provide support as required to Shift Supervisor/Management Designee.
 - One Management Designee - Designated by the Superintendent of Operations to monitor the test and provide support to the Shift Supervisor during critical portions of this test. This designee has the authority to abort the test and, if necessary, provide recommendations to the Shift Supervisor on actions to place the plant in a stable condition. This designee will give or oversee a pre-job briefing with the affected personnel.

- One Keowee Operator - perform actions per procedure and monitor the Hydro Units while operating during this test.

4.0 PREREQUISITE TESTS

None

5.0 TEST EQUIPMENT

5.1 Four Radios

5.2 ES Cabinet Key

6.0 LIMITS AND PRECAUTIONS

CT-1, 2, and 3 power is inoperable during the time between Switchyard isolation and reconnection of Startup Transformers to Red Bus.

7.0 REQUIRED STATION STATUS

_____ 7.1 Unit 2 in Refueling Outage

_____ 7.2 Unit 1 at steady-state conditions, on or off-line.

_____ 7.3 Unit 3 at steady-state conditions, on or off-line.

_____ 7.4 Both Keowee Units available for operation.

_____ 7.5 230 KV Switchyard in Normal alignment AND NO testing in progress.

_____ 7.6 Standby Shutdown Facility operable.

8.0 PREREQUISITE SYSTEM CONDITIONS

8.1 Unit 2 systems:

_____ Main transformer backcharged and 2T supplying both MFBs.

_____ CT-2 charged and available to supply both MFBs.

_____ RCS level on LT-5 > 80 inches.

_____ ES Channels 1 & 2 operable and reset.

_____ Unit 2 Operations Supervisor to prevent any ES testing.

_____ Verify Equipment Hatch closed.

_____ Verify External Grid Trouble Protection System (EGTPS) operable and reset.

8.2 Unit 1 systems:

_____ Verify ES testing is NOT in progress.

_____ Unit 1 Operations Supervisor notified to prevent any ES testing during this test.

_____ Verify Unit 1 is NOT under any Tech. Spec. 3.7 LCOs.

_____ MFBS supplied by EITHER Main "T" or via Standby Busses.

_____ Turbine Driven Emergency Feedwater pump available.

8.3 Unit 3 systems:

_____ Verify ES testing is NOT in progress.

_____ Unit 3 Operations Supervisor notified to prevent any ES testing during this test.

_____ Verify Unit 3 is NOT under any Tech. Spec. 3.7 LCOs.

_____ MFBS supplied by EITHER Main "T" or via Standby Busses.

_____ Turbine Driven Emergency Feedwater pump available.

_____ 8.4 Notify Keowee Operations to place Overhead Keowee Unit on the Grid at minimum load BEFORE step 12.2.

_____ 8.5 Energize the Standby Busses with Lee Gas Turbine on the Dedicated line per OP/0/A/1107/03, 100kV Power System.

8.6 Using OP/0/A/1107/11, Removal and Restoration of Auxiliary Electrical Systems, perform the following:

_____ Isolate BOTH Jocassee lines from the 230 KV Yellow Bus using disconnects, then re-close PCBs 12 and 15.

_____ Open and isolate PCB-33 from Yellow Bus with disconnects, then reclose PCB-33.

8.7 Notify the following:

_____ Spartanburg Dispatcher

_____ Charlotte Dispatcher

_____ Operations Shift Supervisor

_____ Operations Unit 1 Supervisor

_____ Operations Unit 2 Supervisor

_____ Operations Unit 3 Supervisor

_____ Keowee Personnel

_____ Unit 2 Outage Manager

_____ Switchyard Coordinator

_____ Shift Manager

_____ 8.8 List and evaluate statalarms in "Alarm" on SA-2, 3, 4, 5, 6, 15, 16; 1,2,3SA-7, 14, 15, 16 on Enclosure 13.1.

- _____ 8.9 List names below of personnel assigned per step 3.2 which are required to be available from steps 12.1 through 12.30:

Systems Engineering Representative: _____

Management Designee: _____

- _____ 8.10 Conduct pre-job briefing with Shift Operations, including:

Test method described in Section 9.0.

Declaration of LCO for Units 1, 2, and 3.

Review potential loss of power and Turbine trip actions with references to AP/1,2,3/A/1700/11, Loss of Power.

9.0 TEST METHOD

- 9.1 Initial alignment of the Station Electrical System requires Normal Power status for all PCBs and power paths. Potential Yellow Bus loads such as Jocassee and the AUTO-BANK are isolated; but still require the associated PCBs to be closed. Placement of the Overhead Keowee Unit on the Grid creates the initial condition to verify the Overhead ACB and PCB-9.
- 9.2 Actuation of the Emergency Start logic with a Keowee Unit on the Grid allows verification of the associated ACB-1 or 2 trip and reclose feature. Unit 1, 2, & 3 RCP feeder breaker from Startup AND Main Feeder Bus transfer switches are placed in MANUAL. This protects the Overhead Keowee Unit from overload if either Oconee Unit trips while the Keowee Unit is idling on the Yellow Bus.
- 9.3 ES Channel 1 is armed with a "TEST" signal to provide permissive to the Degraded Grid Protection System (DGPS). DC control power breaker is opened to one External Grid Trouble Protection System (EGTPS) channel to provide full input-to-end result verification of the active channel. The defeated channel will be alternated each time this test is performed to provide a complete system input-to-result verification every two outages.

9.4 Actual switchyard isolation is initiated from Unit 2 by inserting ES Channel 1, RZ module for "Loadshed & Standby bkr. Close", then simultaneously depressing the "TRIP" buttons on panel 2AT8 for Unit 1 and Unit 2 DGPS CT Undervoltage relays. LCO for CT-1, 2, and 3 power unavailable must be declared at the point of Switchyard Isolation.

9.5 Relay action, PCB operation, and Keowee response is verified.

9.6 After system actuation, only relay logic of the second channel is verified to minimize the impact and wear on systems.

10.0 DATA REQUIRED

None

11.0 ACCEPTANCE CRITERIA

11.1 Underground Keowee Unit starts and energizes CT-4.

11.2 Overhead Keowee Unit separates from the Grid and energizes all Unit Startup Transformers from the isolated Yellow Bus.

12.0 PROCEDURE

12.1 Rotate logic test module switch in Unit 2:

_____/_____
ES Cabinet 4, Channel 1, counterclockwise to Test Position #9.

12.2 Verify Overhead Keowee Unit operating on the Grid at minimum load.

12.3 Verify Jocassee and AUTO-BANK loads isolated from the Yellow Bus.

_____/_____
12.4 Open breaker 13 in Panel DYG to disable Channel 1 External Grid Trouble Protection circuits.

_____/_____
12.5 Open breaker #4 in 2DIA to prevent unnecessary tripping of OTS1-1.

12.6 Establish communications between Unit 2 Cable Room, Unit 1 & 2 Control Room, Keowee, and the 230 KV Switchyard Blockhouse.

12.7 Verify the following prepared for Switchyard Isolation:

| | |
|-------------------------|-------------------------|
| _____ Shift Supervisor | _____ Unit 1 Supervisor |
| _____ Unit 2 Supervisor | _____ Unit 3 Supervisor |
| _____ Keowee Operator | _____ 230 KV Blockhouse |

12.8 Place the following AUTO/MAN transfer switches in MAN:

- _____/_____ • Unit 1 "1TA AUTO/MAN"
- _____/_____ • Unit 1 "1TB AUTO/MAN"
- _____/_____ • Unit 1 "4 KV MFB1 AUTO-MAN"
- _____/_____ • Unit 1 "4 KV MFB2 AUTO-MAN"
- _____/_____ • Unit 2 "2TA AUTO/MAN"
- _____/_____ • Unit 2 "2TB AUTO/MAN"
- _____/_____ • Unit 2 "4 KV MFB1 AUTO-MAN"
- _____/_____ • Unit 2 "4 KV MFB2 AUTO-MAN"
- _____/_____ • Unit 3 "3TA AUTO/MAN"
- _____/_____ • Unit 3 "3TB AUTO/MAN"
- _____/_____ • Unit 3 "4 KV MFB1 AUTO-MAN"
- _____/_____ • Unit 3 "4 KV MFB2 AUTO-MAN"

_____/_____ 12.9 Depress Unit 2, ES Channel 1, RZ module for "Loadshed & Standby bkr. Close" MANUAL pushbutton.

12.10 At Cabinet 2AT8, depress and hold for ~ 20 seconds:

- "TRIP" button for Unit 1 DGPS CT Undervoltage relay.
- "TRIP" button for Unit 2 DGPS CT Undervoltage relay.

12.11 When PCB-9 recloses, verify:

BOTH Keowee Units operating.

- | | |
|---|---|
| <input type="checkbox"/> 1SA14-E6 Alarm | <input type="checkbox"/> 1SA15-E6 Alarm |
| <input type="checkbox"/> SA15-B4 Alarm | <input type="checkbox"/> SA16-A1 Alarm |
| <input type="checkbox"/> PCB-8 OPEN | <input type="checkbox"/> PCB-9 CLOSED |
| <input type="checkbox"/> PCB-12 OPEN | <input type="checkbox"/> PCB-18 CLOSED |
| <input type="checkbox"/> PCB-15 OPEN | <input type="checkbox"/> PCB-20 CLOSED |
| <input type="checkbox"/> PCB-17 OPEN | <input type="checkbox"/> PCB-23 CLOSED |
| <input type="checkbox"/> PCB-21 OPEN | <input type="checkbox"/> PCB-27 CLOSED |
| <input type="checkbox"/> PCB-24 OPEN | <input type="checkbox"/> PCB-30 CLOSED |
| <input type="checkbox"/> PCB-26 OPEN | <input type="checkbox"/> PCB-28 OPEN |
| <input type="checkbox"/> PCB-33 OPEN | <input type="checkbox"/> CT-1 ENERGIZED |
| <input type="checkbox"/> CT-2 ENERGIZED | <input type="checkbox"/> CT-3 ENERGIZED |

12.12 Verify the following relays energized:

- | | |
|--------------------------------|--------------------------------|
| <input type="checkbox"/> 94V2a | <input type="checkbox"/> 94V2c |
| <input type="checkbox"/> 94V2b | <input type="checkbox"/> 94V2d |

12.13 Reset both Switchyard Isolate logic Channels.

/ 12.14 Close breaker 13 in Panel DYG for DC Control to Channel 1 EGTPS.

____/____ 12.15 Simultaneously depress and hold "TRIP" buttons for Unit 1 AND Unit 2 DGPS CT Undervoltage relays.

____ 12.15.1 Verify SA16-C1 Alarm

____ 12.16 When Channel 1 switchyard isolate relays energize, release both "TRIP" buttons for Unit 1 and Unit 2 DGPS CT Undervoltage relays.

____ 12.16.1 Verify SA16-C1 Reset

12.17 Verify the following relays energized:

____ 94V1a ____ 94V1c

____ 94V1b ____ 94V1d

____/____ 12.18 Depress Unit 2, ES Channel 1, RZ module for "Loadshed & Standby bkr. Close" AUTO pushbutton.

____ 12.19 Reset both Switchyard Isolate Undervoltage logic Channels.

____/____ 12.20 Open PCB-9.

12.21 Synchronize and close or verify closed:

____/____ PCB-17 ____/____ PCB-18

____/____ PCB-26 ____/____ PCB-27

____/____ PCB-28 ____/____ PCB-30

____/____ PCB-21 ____/____ PCB-24

12.22 Verify the following energized:

____ CT-1

____ CT-2

____ CT-3

12.23 Place the following AUTO/MAN transfer switches in AUTO:

___/___ • Unit 1 "1TA AUTO/MAN"

___/___ • Unit 1 "1TB AUTO/MAN"

___/___ • Unit 1 "4 KV MFB1 AUTO-MAN"

___/___ • Unit 1 "4 KV MFB2 AUTO-MAN"

___/___ • Unit 3 "3TA AUTO/MAN"

___/___ • Unit 3 "3TB AUTO/MAN"

___/___ • Unit 3 "4 KV MFB1 AUTO-MAN"

___/___ • Unit 3 "4 KV MFB2 AUTO-MAN"

___/___ 12.24 Open the Overhead ACB.

12.25 Synchronize and close:

___/___ PCB-8

___/___ PCB-9

NOTE: Resetting Emergency Start will automatically shutdown Overhead Keowee Unit due to load rejection protective relaying on ACB.

___/___ 12.26 Depress Unit 1 "Keowee Logic Reset Channel 1" button. (1UB1)

___/___ 12.27 Depress Unit 1 "Keowee Logic Reset Channel 2" button. (1UB1)

12.28 Rotate logic test module switch in Unit 2:

___/___ ES Cabinet 4, Channel 1, clockwise to OPERATE Position.

___/___ 12.29 Close breaker #4 in 2DIA for ES signal to OTS1-1.

12.30 Perform either of the following:

_____ Verify Acceptance met.

_____ If Acceptance NOT met, notify Test Supervisor/Shift Manager.

_____ 12.31 List statalarms in "Alarm" on SA-2, 3, 4, 5, 6, 15, 16; 1,2,3SA-7, 14, 15, 16 on Enclosure 13.1 and evaluate any which changed state.

_____ 12.32 Restore both Jocassee lines through PCB-12 and 15 per OP/0/A/1107/11, Removal and Restoration of Auxiliary Electrical Systems.

_____ 12.33 Restore AUTO-BANK connection through PCB-33 and disconnects per OP/0/A/1107/11, Removal and Restoration of Auxiliary Electrical Systems.

_____ 12.34 Return control of Keowee Units to the Dispatcher.

_____ 12.35 Lee Gas Turbines are no longer required and may be secured per OP/0/A/1107/03, 100kV Power Supply.

12.36 Notify the following of test completion:

_____ Spartanburg Dispatcher

_____ Charlotte Dispatcher

_____ Operations Shift Supervisor

_____ Operations Unit 1 Supervisor

_____ Operations Unit 2 Supervisor

_____ Operations Unit 3 Supervisor

_____ Keowee Personnel

_____ Unit 2 Outage Manager

_____ Switchyard Coordinator

____ Shift Manager

13.0 ENCLOSURES

13.1 Statalarms

**Restricted Change
For RCP Restart**

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PT/0/A/0610/21

Page 6 of 13

- _____ 8.9 List names below of personnel assigned per step 3.2 which are required to be available from steps 12.1 through 12.30:

Systems Engineering Representative: _____

Management Designee: _____

- _____ 8.10 Conduct pre-job briefing with Shift Operations, including:

Test method described in Section 9.0.

Declaration of LCO for Units 1, 2, and 3.

Review potential loss of power and Turbine trip actions with references to AP/1,2,3/A/1700/11, Loss of Power.

- _____ 8.11 Install Recorders per WR # _____.

- _____ 8.12 Using OP/0/A/1107/11, Removal and Restoration of Auxiliary Electrical Systems, open and isolate PCB-21 from Yellow Bus with disconnects, then reclose PCB-21.

9.0 TEST METHOD

- 9.1 Initial alignment of the Station Electrical System requires Normal Power status for all PCBs and power paths. Potential Yellow Bus loads such as Jocassee and the AUTO-BANK are isolated; but still require the associated PCBs to be closed. Placement of the Overhead Keowee Unit on the Grid creates the initial condition to verify the Overhead ACB and PCB-9.
- 9.2 Actuation of the Emergency Start logic with a Keowee Unit on the Grid allows verification of the associated ACB-1 or 2 trip and reclose feature. Unit 1, 2, & 3 RCP feeder breaker from Startup AND Main Feeder Bus transfer switches are placed in MANUAL. This protects the Overhead Keowee Unit from overload if either Oconee Unit trips while the Keowee Unit is idling on the Yellow Bus.
- 9.3 ES Channel 1 is armed with a "TEST" signal to provide permissive to the Degraded Grid Protection System (DGPS). DC control power breaker is opened to one External Grid Trouble Protection System (EGTPS) channel to provide full input-to-end result verification of the active channel. The defeated channel will be alternated each time this test is performed to provide a complete system input-to-result verification every two outages. RCP 2A2 is started on the Overhead Keowee Unit for data recording before restoring the Yellow Bus to Normal Power alignment.

____ / ____ 12.15 Simultaneously depress and hold "TRIP" buttons for Unit 1 AND
Unit 2 DGPS CT Undervoltage relays.

____ 12.15.1 Verify SA16-C1 Alarm

____ 12.16 When Channel 1 switchyard isolate relays energize, release both
"TRIP" buttons for Unit 1 and Unit 2 DGPS CT Undervoltage relays.

____ 12.16.1 Verify SA16-C1 Reset

12.17 Verify the following relays energized:

____ 94V1a ____ 94V1c

____ 94V1b ____ 94V1d

____ / ____ 12.18 Depress Unit-2, ES Channel 1, RZ module for "Loadshed & Standby bkr.
Close" AUTO pushbutton.

____ 12.19 Reset both Switchyard Isolate Undervoltage logic Channels.

12.20 Perform the following:

____ / ____ 12.20.1 Open PCB-18

____ / ____ 12.20.2 Close PCB-17

____ / ____ 12.20.3 Open PCB-30

____ / ____ 12.20.4 Close PCB-28

12.21 Place the following AUTO/MAN transfer switches in AUTO:

____ / ____ • Unit 1 "1TA AUTO/MAN"

____ / ____ • Unit 1 "1TB AUTO/MAN"

____ / ____ • Unit 1 "4 KV MFB1 AUTO-MAN"

____ / ____ • Unit 1 "4 KV MFB2 AUTO-MAN"

____ / ____ • Unit 3 "3TA AUTO/MAN"

____ / ____ • Unit 3 "3TB AUTO/MAN"

____ / ____ • Unit 3 "4 KV MFB1 AUTO-MAN"

____ / ____ • Unit 3 "4 KV MFB2 AUTO-MAN"

____ / ____ 12.22 Locally close PCB-21.

12.23 Verify stopped or stop per OP/2/A/1103/06, Reactor Coolant Pump Operation and OP/2/A/1102/10, Controlling Procedure for Unit Shutdown, Enclosure for H₂O₂ Addition to the RCS.

____ / ____ RCP 2B2

____ / ____ RCP 2A2

12.24 Transfer switchgear 2TB from N to E by:

____ / ____ 12.24.1 Open 2TB Normal 6.9 kV Feeder Breaker

____ / ____ 12.24.2 Close 2TB Startup 6.9 kV Feeder Breaker

____ 12.25 Verify all recording stations ready for starting a RCP on the Overhead Keowee Unit.

____ / ____ 12.26 Start 2A2 RCP per OP/2/A/1103/06, Reactor Coolant Pump Operation on the Overhead Keowee Unit.

____ / ____ 12.27 When data collection is complete, stop RCP 2A2 per OP/2/A/1103/06, Reactor Coolant Pump Operation and OP/2/A/1102/10, Controlling Procedure for Unit Shutdown, Enclosure for H₂O₂ Addition to the RCS.

12.28 Transfer switchgear 2TB from E to N by:

____ / ____ 12.28.1 Open 2TB Startup 6.9 kV Feeder Breaker

____ / ____ 12.28.2 Close 2TB Normal 6.9 kV Feeder Breaker

12.29 Position the following PCBs:

____ / ____ 12.29.5 Open PCB-27

____ / ____ 12.29.6 Close PCB-26

____ / ____ 12.30 Open PCB-9.

12.31 Synchronize and close or verify closed:

____ / ____ PCB-17

____ / ____ PCB-18

____ / ____ PCB-26

____ / ____ PCB-27

____ / ____ PCB-28

____ / ____ PCB-30

12.32 Verify the following energized:

_____ CT-1

_____ CT-2

_____ CT-3

_____/_____ 12.33 Open the Overhead ACB.

12.34 Synchronize and close or verify closed:

_____/_____ PCB-8

_____/_____ PCB-9

NOTE: Resetting Emergency Start will automatically shutdown Overhead Keowee Unit due to load rejection protective relaying on ACB.

_____/_____ 12.35 Depress Unit 1 "Keowee Logic Reset Channel 1" button. (1UB1)

_____/_____ 12.36 Depress Unit 1 "Keowee Logic Reset Channel 2" button. (1UB1)

12.37 Perform the following:

_____/_____ 12.37.1 Locally Open PCB-21.

_____ 12.37.2 Reclose Yellow bus disconnects to PCB-21 per
OP/0/A/1107/11, Removal and Restoration of Auxiliary
Electrical Systems.

_____/_____ 12.37.3 Synchronize and close PCB-21.

_____/_____ 12.37.4 Synchronize and close PCB-24.

12.38 Rotate logic test module switch in Unit 2:

_____/_____ ES Cabinet 4, Channel 1, clockwise to OPERATE Position.

_____/_____ 12.39 Close breaker #4 in 2DIA for ES signal to OTS1-1.

12.40 Perform either of the following:

_____ Verify Acceptance met.

_____ If Acceptance NOT met, notify Test Supervisor/Shift Manager.

_____ 12.41 List statalarms in "Alarm" on SA-2, 3, 4, 5, 6, 15, 16; 1,2,3SA-7,
14, 15, 16 on Enclosure 13.1 and evaluate any which changed state.

_____ 12.42 Restore both Jocassee lines through PCB-12 and 15 per
OP/0/A/1107/11, Removal and Restoration of Auxiliary
Electrical Systems.

- 12.43 Restore AUTO-BANK connection through PCB-33 and disconnects per OP/0/A/1107/11, Removal and Restoration of Auxiliary Electrical Systems.
- 12.44 Return control of Keowee Units to the Dispatcher.
- 12.45 Lee Gas Turbines are no longer required and may be secured per OP/0/A/1107/03, 100kV Power Supply.
- 12.46 Notify the following of test completion:
 - Spartanburg Dispatcher
 - Charlotte Dispatcher
 - Operations Shift Supervisor
 - Operations Unit 1 Supervisor
 - Operations Unit 2 Supervisor
 - Operations Unit 3 Supervisor
 - Keowee Personnel
 - Unit 2 Outage Manager
 - Switchyard Coordinator
 - Shift Manager

13.0 ENCLOSURES

13.1 Statalarms