EIRGRID_2015 Functional Document Template (21

WFPS Black Start Shutdown Test Procedure

[Insert Windfarm Name]

Version 0.1

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# Document Version History

EirGrid template version 0.3, published 1 September 2016.

|  |  |  |
| --- | --- | --- |
| **Document Version History** | | |
| **Version** | **Date** | **Comment** |
| 0.1 | dd/mm/yyyy | First submission for review/approval |
|  |  |  |
|  |  |  |

# Introduction

**WFPS shall highlight any changes made to this document or approval will be void.**

The WFPS shall submit the latest version of this test procedure template as published on the EirGrid website[[1]](#footnote-1).

WFPS shall submit a VO request form[[2]](#footnote-2) to [neartime@eirgrid.com](mailto:neartime@eirgrid.com) for the time and date of the test, giving 7 working days’ notice. VOs are issued by Near Time, EirGrid. A VO shall be issued for the WFPS and grid connected transformer to be taken out of service during this test.

All yellow sections shall be filled in before the test procedure shall be approved. All grey sections shall be filled in during testing. If any test requirements or steps are unclear, or if there is an issue with meeting any requirements or carrying out any steps, please contact [generator\_testing@eirgrid.com](mailto:generator_testing@eirgrid.com).

Where a site consists of two separate controllable WFPS with a single connection point, this may impact on the test procedure outlined below.

The WFPS representative shall coordinate testing. On the day of testing, suitably qualified technical personnel may be needed at the wind farm to assist in undertaking the tests. Such personnel shall have the ability to fully understand the function of the wind farm and its relationship to the network to which the wind farm is connected. Furthermore, such personnel shall have the ability to set up the control system of the wind farm so as to enable Grid Code compliance test to be correctly undertaken. In addition, the function of the technical personnel is to liaise with NCC.

The availability of personnel at NCC will be necessary in order to initiate the necessary instructions for the test. NCC shall determine if network conditions allow the testing to proceed.

Following testing, the following shall be submitted to [generator\_testing@eirgrid.com](mailto:generator_testing@eirgrid.com):

|  |  |
| --- | --- |
| **Submission** | **Timeline** |
| A scanned copy of the test procedure, as completed and signed on site on the day of testing | 1 working day |
| Test report | 10 working days |

# Abbreviations

AAP Available Active Power

APC Active Power Control

CB Circuit Breaker

ESBN ESB Networks

MEC Maximum Export Capacity

MW Mega Watt

NCC National Control Centre

RCES Remote Control Enable Switch

TSO Transmission System Operator

VO Voluntary Outage (required to take any equipment out of service)

WFPS Wind Farm Power Station

# WFPS DATA

|  |  |
| --- | --- |
| WFPS Name | WFPS to Specify |
| WFPS Test Coordinator and contact number: | WFPS to Specify |
| WFPS Location | WFPS to Specify |
| WFPS connection point | WFPS to Specify  (*i.e.* T121 HV bushings) |
| WFPS connection voltage | WFPS to Specify |
| Installed Turbine type, MW size and quantity | WFPS to Specify |
| Contracted MEC | WFPS to Specify |
| Registered Capacity | WFPS to Specify |
| Grid Connected Transformer Tap range | WFPS to Specify |
| Energisation Tap Position of the Grid Connected Transformer | WFPS to Specify |

**Black Start Shutdown Functional Specification**

|  |  |
| --- | --- |
| Which CBs are tripped on receipt of Black Start Shutdown signal | WFPS to Specify  (Specify all WFPS and EirGrid controlled CBs, and details of slave tripping) |
| Does the RCES block Black Start Shutdown signal from tripping the ESBN 110 kV CB, when it is in the OFF (LOCAL) position | WFPS to Specify |
| Does the WFPS provide backup LV supplies to the ESBN control room? | WFPS to Specify |

# Grid Code References

|  |  |
| --- | --- |
| Grid Code Version: | WFPS to specify |

WFPS1.7.2.5 **Black Start Shutdown**

Means shall be provided by the **Controllable WFPS** to facilitate the disconnection of the **Controllable WFPS** by the **TSO** and to also prevent re-connection in the event of **Black Start**. The **TSO** shall send a **Black Start Shutdown** signal and upon receipt, the **Controllable WFPS** shall be required to trip the circuit-breaker(s) at the **Controllable WFPS’s Connection Point** and shutdown the **Controllable WFPS** in a controlled manner. The precise circuit-breakers for which this facility shall be provided shall be specified by the **TSO** at least 120 **Business Days** prior to the **Controllable WFPS’s** scheduled **Operational Date.**  **Controllable WFPSs** may only be reconnected (i.e. made live) when the **Network** is fully restored following instruction from the **TSO[[3]](#footnote-3)** and only earlier if the **TSO** deems it acceptable to do so.

# site Safety requirements

The following is required for the EirGrid witness to attend site:

|  |  |
| --- | --- |
| Personal Protective Equipment Requirements   1. Site Safety boots 2. Hard Hat with chin strap 3. Hi Vis 4. Arc Resistive clothing 5. Safety Glasses 6. Gloves 7. Safe Pass | 1. Yes / No 2. Yes / No 3. Yes / No 4. Yes / No 5. Yes / No 6. Yes / No 7. Yes / No |
| Site Induction requirements | Yes / No  (If Yes, WFPS to specify how and when the induction shall be carried out) |
| Any further information | WFPS to specify |

# Test desciption and pre conditions

## Purpose of the Test

The purpose of this test is to confirm correct operation of the Black Start Shutdown scheme at the controllable WFPS.

## Pass Criteria

The following is the pass criteria for the test. Any subsequent report for this test shall be assessed against each of these criteria.

| **Criteria** |
| --- |
| **Black Start Shutdown** |
| WFPS opens the specified CB upon receipt of the Black Start Shutdown signal |
| The blue alert lamp shall light upon receipt of the Black Start Shutdown signal |
| The specified CB is inhibited from closing while the Black Start Shutdown signal is ON |

## Instrumentation and onsite data trending

No instrumentation and onsite data trending is necessary for this test. All required information is recorded manually in this test procedure.

## Initial Conditions

If “No” is answered by the WFPS to any of the following, contact NCC and agree next steps in advance of making any corrective actions.

|  |  |
| --- | --- |
| **Conditions** | **Check on day of test** |
| VO is in place for all equipment to be switched out | Yes / No |
| Operators available for switching of all required CBs | Yes / No |
| Diesel Generator is Available | Yes / No / Not Applicable |

# Test Steps

## Initiate Black Start Shutdown with RCES OFF and then ON

The WFPS demonstrates the functioning of the Black Start Shutdown command and the RCES blocking the trip command to the WFPS Transformer MV CB.

| **Step No.** | **Action** | **Time** | **Comments** |
| --- | --- | --- | --- |
| 1 | Ensure LV supply (backup generator or other) is ready |  |  |
| 2 | Confirm that any relevant Special Protection Schemes are turned off, as required. |  |  |
| 3 | WFPS requests permission from NCC to proceed with the Black Start Shutdown test and confirms the following with NCC:   1. AAP of the WFPS 2. MW output of the WFPS 3. ESBN 110 kV CB is CLOSED 4. WFPS Transformer MV CB is CLOSED 5. WFPS RCES is in the ON (REMOTE) position 6. Black Start Shutdown is OFF 7. Blue lamp is OFF in WFPS control room 8. Grid Connected Transformer on load tap changer is in automatic mode 9. Grid Connected Transformer Tap range and Tap Position |  | 1. \_\_\_\_ MW 2. \_\_\_\_ MW 3. 110 kV CB \_\_\_\_ 4. WFPS CB \_\_\_\_ 5. RCES status: \_\_\_\_ 6. ON / OFF 7. ON / OFF 8. Automatic / Manual 9. \_\_\_\_ to \_\_\_\_ ; Tap \_\_\_\_ |
| 4 | WFPS shuts down the WFPS locally |  | MW output ramps at Wind Following Ramp Rate |
| 5 | WFPS puts the RCES into the OFF (LOCAL) position |  | RCES status: \_\_\_\_ |
| 6 | WFPS requests NCC to replace the RCES signal in NCC to ON |  |  |
| 7 | WFPS requests NCC to enable the Black Start Shutdown command |  | Blue Lamp Status: \_\_\_\_  110 kV CB: \_\_\_\_  WFPS CB: \_\_\_\_ |
| 8 | If the 110 kV CB is open, WFPS puts the Grid Connected Transformer on load tap changer into manual mode and taps to Energisation Tap Position.  Wait 15 minutes before re-energising the Grid Connected Transformer |  | This step is carried out to minimise inrush current when transformer is re-energised  Automatic / Manual  Tap \_\_\_\_ |
| 9 | WFPS confirms the following with NCC: (Note. These are initial conditions for next step)   1. ESBN 110 kV CB is CLOSED 2. WFPS Transformer MV CB is CLOSED 3. RCES is in the OFF (LOCAL) position 4. Black Start Shutdown is OFF 5. Blue lamp is OFF in WFPS control room 6. Grid Connected Transformer on load tap changer is in manual mode 7. Grid Connected Transformer is on Energisation Tap Position |  | 1. 110 kV CB \_\_\_\_ 2. WFPS CB \_\_\_\_ 3. RCES status: \_\_\_\_ 4. ON / OFF 5. ON / OFF 6. Automatic / Manual 7. Tap \_\_\_\_ |
| 10 | WFPS puts the RCES into the ON (REMOTE) position |  | RCES status: \_\_\_\_ |
| 11 | WFPS requests NCC to remove the replaced RCES signal in NCC |  |  |
| 12 | WFPS requests NCC to enable the Black Start Shutdown command |  | Blue Lamp Status: \_\_\_\_  110 kV CB: \_\_\_\_  WFPS CB: \_\_\_\_ |

## Attempt to Close WFPS CB with Black Start Shutdown Signal Enabled

The WFPS demonstrates that the Black Start Shutdown scheme inhibits the WFPS Transformer MV CB whether the RCES is on or off.

| **Step No.** | **Action** | **Time** | **Comments** |
| --- | --- | --- | --- |
| 1 | WFPS confirms the following with NCC: (Note. These are initial conditions for next step)   1. ESBN 110 kV CB is OPEN 2. WFPS Transformer MV CB is OPEN 3. RCES is in the ON (REMOTE) position 4. Black Start Shutdown is ON 5. Blue lamp is ON in WFPS control room 6. Grid Connected Transformer on load tap changer is in manual mode 7. Grid Connected Transformer is on Energisation Tap Position |  | 1. 110 kV CB \_\_\_\_ 2. WFPS CB \_\_\_\_ 3. RCES status: \_\_\_\_ 4. ON / OFF 5. ON / OFF 6. Automatic / Manual 7. Tap \_\_\_\_ |
| 2 | Check LV supply is being provided in the WFPS and ESBN control rooms, as applicable |  | WFPS LV Supply: \_\_\_\_  ESBN LV Supply: \_\_\_\_ |
| 3 | WFPS puts the Grid Connected Transformer on load tap changer into manual mode and taps to Energisation Tap Position.  After 15 minutes, ESBN requests permission from NCC and closes the 110 kV CB |  | This step is carried out to minimise inrush current when transformer is re-energised  Automatic / Manual  Tap \_\_\_\_  If it is not possible to close the 110 kV CB with Black Start Shutdown ON, continue to the next step  110 kV CB: \_\_\_\_ |
| 4 | WFPS clears all protection alarms and attempts to close the WFPS Transformer MV CB |  | The WFPS CB shall be inhibited from closing (if the CB closes and trips immediately, this is not considered “inhibited”)  WFPS CB: \_\_\_\_ |
| 5 | WFPS confirms the following with NCC: (Note. These are initial conditions for next step)   1. ESBN 110 kV CB is CLOSED 2. WFPS Transformer MV CB is OPEN 3. RCES is in the ON (REMOTE) position 4. Black Start Shutdown is ON 5. Blue lamp is ON in WFPS control room 6. Grid Connected Transformer on load tap changer is in manual mode 7. Grid Connected Transformer is on Energisation Tap Position |  | 1. 110 kV CB \_\_\_\_ 2. WFPS CB \_\_\_\_ 3. RCES status: \_\_\_\_ 4. ON / OFF 5. ON / OFF 6. Automatic / Manual 7. Tap \_\_\_\_ |
| 6 | WFPS puts the RCES into the OFF (LOCAL) position |  | Blue Lamp Status: \_\_\_\_  110 kV CB: \_\_\_\_  WFPS CB: \_\_\_\_ |
| 7 | WFPS confirms the following with NCC: (Note. These are initial conditions for next step)   1. ESBN 110 kV CB is CLOSED 2. WFPS Transformer MV CB is OPEN 3. RCES is in the OFF (LOCAL) position 4. Black Start Shutdown is ON 5. Blue lamp is ON in WFPS control room 6. Grid Connected Transformer on load tap changer is in manual mode 7. Grid Connected Transformer is on Energisation Tap Position |  | 1. 110 kV CB \_\_\_\_ 2. WFPS CB \_\_\_\_ 3. RCES status: \_\_\_\_ 4. ON / OFF 5. ON / OFF 6. Automatic / Manual 7. Tap \_\_\_\_ |
| 8 | WFPS clears all protection alarms and attempts to close the WFPS Transformer MV CB |  | The WFPS CB shall be inhibited from closing (if the CB closes and trips immediately, it is not considered “inhibited”)  WFPS CB: \_\_\_\_ |

## Remove Black Start Shutdown Signal and return WFPS to Normal Operation

The WFPS is returned to normal operation. NCC then issue a MW set-point to the WFPS to confirm this functionality has not been compromised by a loss of mains on site.

| **Step No.** | **Action** | **Time** | **Comments** |
| --- | --- | --- | --- |
| 1 | WFPS confirms the following with NCC: (Note. These are initial conditions for next step)   1. ESBN 110 kV CB is CLOSED 2. WFPS Transformer MV CB is OPEN 3. RCES is in the OFF (LOCAL) position 4. Black Start Shutdown is ON 5. Blue lamp is ON in WFPS control room 6. Grid Connected Transformer on load tap changer is in manual mode 7. Grid Connected Transformer is on Energisation Tap Position |  | 1. 110 kV CB \_\_\_\_ 2. WFPS CB \_\_\_\_ 3. RCES status: \_\_\_\_ 4. ON / OFF 5. ON / OFF 6. Automatic / Manual 7. Tap \_\_\_\_ |
| 2 | WFPS puts the RCES into the ON (REMOTE) position |  | Blue Lamp Status: \_\_\_\_  110 kV CB: \_\_\_\_  WFPS CB: \_\_\_\_ |
| 3 | WFPS requests NCC to remove the replaced the RCES signal in NCC |  |  |
| 4 | WFPS requests NCC to remove the Black Start Shutdown command |  | Blue Lamp Status: \_\_\_\_ |
| 5 | ESBN requests permission from NCC and closes the 110 kV CB if it is not already closed |  | 110 kV CB: \_\_\_\_ |
| 6 | WFPS closes the WFPS Transformer MV CB |  | WFPS CB: \_\_\_\_ |
| 7 | WFPS puts the Grid Connected Transformer on load tap changer into automatic mode |  |  |
| 8 | WFPS requests permission from NCC and starts up all turbines |  | MW output ramps at Wind Following Ramp Rate |
| 9 | WFPS confirms the following with NCC: (Note. These are initial conditions for next step)   1. ESBN 110 kV CB is CLOSED 2. WFPS Transformer MV CB is CLOSED 3. RCES is in the ON (REMOTE) position 4. Black Start Shutdown is OFF 5. Blue lamp is OFF in WFPS control room 6. Grid Connected Transformer on load tap changer is in automatic mode 7. Grid Connected Transformer is in automatic mode |  | 1. 110 kV CB \_\_\_\_ 2. WFPS CB \_\_\_\_ 3. RCES status: \_\_\_\_ 4. ON / OFF 5. ON / OFF 6. Automatic / Manual 7. Tap \_\_\_\_ |
| 10 | Confirm that any relevant Special Protection Schemes are returned to the correct status, as required by NCC. |  |  |
| 11 | WFPS requests NCC to turn APC ON and issue a set-point of [insert 90% of Registered Capacity] MW |  | APC: \_\_\_\_  Set-point received: \_\_\_\_ |
| 12 | WFPS requests NCC to issue a set-point of [insert 100% of Registered Capacity] MW and turn APC OFF |  | Set-point received: \_\_\_\_ |
| 13 | WFPS informs NCC that the Black Start Shutdown Mode test is complete |  |  |

## Comments & Signatures

|  |
| --- |
| **Comments:** |
| WFPS Witness signoff that this test has been carried out according to the test procedure, above.  Signature: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| EirGrid Witness signoff that this test has been carried out according to the test procedure, above.  Signature: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |

1. <http://www.eirgridgroup.com/library> [↑](#footnote-ref-1)
2. <http://www.eirgridgroup.com/__uuid/b1d14629-fe49-41a9-ac30-c3cb14393c82/index.xml?__toolbar=1> [↑](#footnote-ref-2)
3. Typically this instruction will be in the form of a Black Start Shutdown OFF command [↑](#footnote-ref-3)