CONFIDENTIAL FORM GC1

MODIFICATION PROPOSAL FORM

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WFPS FAULT RIDE-THROUGH

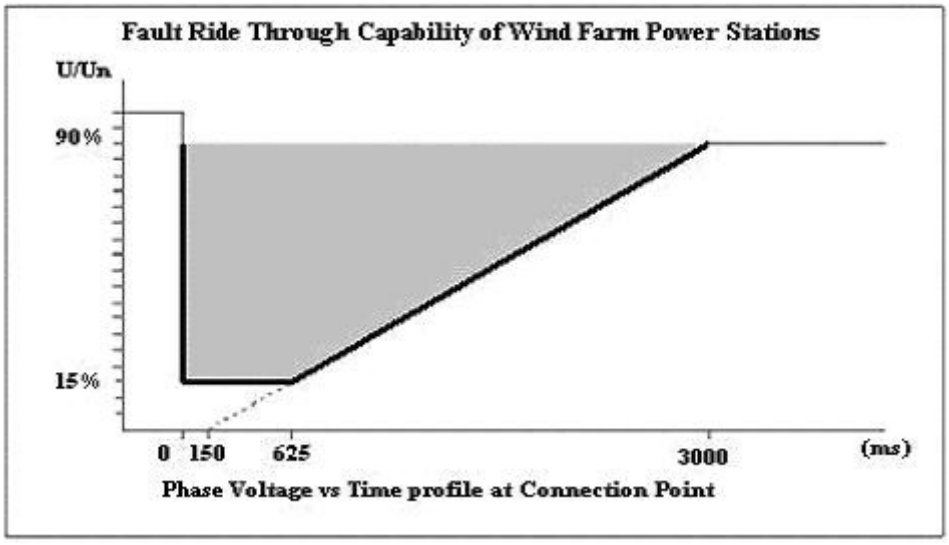
FORM GC1, PROPOSAL OF MODIFICATION TO GRID CODE.

MODIFICATION PROPOSAL ORGINATOR:	EirGrid		
MODIFICATION PROPOSAL ORIGINATOR (CONTACT NAME)	David Cashman	**MODIFICATION PROPOSAL ORIGINATOR FAX NUMBER:**	
MODIFICATION PROPOSAL ORIGINATOR TELEPHONE NUMBER:	01-2370122	**DATE:**	04/09/2012
MODIFICATION PROPOSAL ORIGINATOR E-MAIL ADDRESS:	david.cashman@eirgrid.com	**MODIFICATION PROPOSAL NUMBER (EIRGRID USE ONLY)**	MIPD 230
GRID CODE SECTION(S) AFFECTED BY PROPOSAL:	**WFPS1.4.1, WFPS1.4.2**		
GRID CODE VERSION :	**4.0**		
MODIFICATION PROPOSAL DESCRIPTION **(MUST CLEARLY STATE THE DESIRED AMENDMENT, ALL TEXT/FORMULA CHANGES TO THE GRID CODE. THE REQUIRED REASON FOR THE MODIFICATION MUST STATED. ATTACH ANY FURTHER INFORMATION IF NECESSARY.)**	**To amend WFPS1.4 to specify new fault ride through specifications for WFPS connected to the transmission system. Active and Reactive Power responses for the WFPS are to be re-defined to offer a more rapid response from WFPS during and after a system event.** **Amended Text and Diagrams are shown below.**		
IMPLICATION OF NOT IMPLEMENTING THE MODIFICATION	**Without improved fault ride through capabilities of WFPS there will be issues around system stability during times of high wind generation. This will likely cause increased curtailment of WFPS.**		
Please submit the Modification Proposal by fax, post or electronically, using the information supplied above			
EIRGRID REVIEWER			

EIRGRID ASSESSMENT	

FAULT RIDE THROUGH REQUIREMENTS

WFPS1.4.1 A **Controllable WFPS** shall remain connected to the **Transmission System** for **Transmission System Voltage Dips~~dips~~** on any or all phases, and shall remain **stable**, where the **Transmission System Phase Voltage** measured at the HV terminals of the **Grid Connected Transformer** remains above the heavy black line in *Figure WFPS1.1*.



~~*Figure WFPS1.1 - Fault Ride-Through Capability of* **Controllable WFPSs**~~

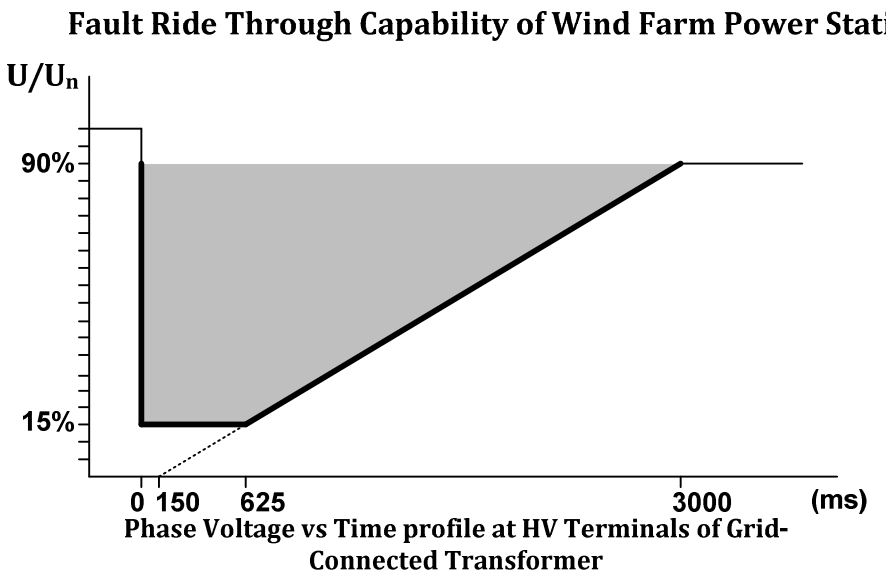


*Figure WFPS1.1 - **Fault Ride-Through** Capability of **Controllable WFPSs***

WFPS1.4.2 In addition to remaining connected to the **Transmission System**, the **Controllable WFPS** shall have the technical capability to provide the following functions:

a) During ~~the~~ **Transmission System Voltage Dips**, the **Controllable WFPS** shall provide **Active Power** in proportion to retained **Voltage** and provide reactive current to the **Transmission System,** as set out in WFPS1.4.2(c). The ~~maximisation~~ provision of reactive current shall continue until the **Transmission System Voltage** recovers to within the normal operational range of the **Transmission System** as specified in CC.8.3.1,~~(ref. WFPS1.6.1),~~ or for at least 500ms, whichever is the sooner. The **Controllable WFPS** may use all or any available reactive sources, including installed statcoms or SVCs, when providing reactive support during **Transmission System Fault Disturbances** which result in **Voltage Dips**;

b) The **Controllable WFPS** shall provide at least 90% of its maximum **Available Active Power** as quickly as the technology allows and in any event within ~~1 second~~ 500ms of the **Transmission System Voltage** recovering to ~~the normal operating range (ref. WFPS1.6.1).~~ 90% of the nominal **Voltage,** for **Fault Disturbances** cleared within 140ms. For longer duration **Fault Disturbances**, the **Controllable WFPS** shall provide at least 90% of its maximum **Available Active Power** within 1 second of the **Transmission System Voltage** recovering to 90% of the nominal **Voltage**;

c) During and after faults, priority shall always be given to the **Active Power** response as defined in WFPS1.4.2(a) and WFPS1.4.2(b). The reactive current response of the **Controllable WFPS** shall attempt to control the **Voltage** back towards the nominal **Voltage**, and should be at least proportional to the **Voltage Dip**. The reactive current response shall be supplied within the rating of the **Controllable WFPS,** with a **Rise Time** no greater than 100ms and a **Settling Time** no greater than 300ms. For the

avoidance of doubt, the **Controllable WFPS** may provide this reactive response directly from individual **WTG**s, or other additional installed dynamic reactive devices on the site, or a combination of both.

d) The **Controllable WFPS** shall be capable of providing its transient reactive response irrespective of the reactive control mode in which it was operating at the time of the **Transmission System Voltage Dip**. The **Controllable WFPS** shall revert to its pre-fault reactive control mode and setpoint within 500ms of the **Transmission System Voltage** recovering to its normal operating range as specified in CC.8.3.1.

e) The **TSO** may seek to reduce the magnitude of the dynamic reactive response of the **Controllable WFPS** if it is found to cause over-voltages on the **Transmission System**. In such a case, the **TSO** will make a formal request to the **Controllable WFPS.** The **Controllable WFPS** and the **TSO** shall agree on the required changes, and the **Controllable WFPS** shall formally confirm that any requested changes have been implemented within 120 days of receiving the **TSO's** formal request.

Glossary

Rise Time: In relation to reactive current response from **Controllable WFPS**, it is the length of time from **Fault Inception** for reactive current to reach 90% of its steady-state value.

Settling Time: In relation to reactive current response from **Controllable WFPS**, it is the length of time from **Fault Inception** for reactive current to settle within +/-10% of its steady-state value.

Fault Inception: The point in time at which the **Transmission System Voltage** at the **Connection Point** goes outside the range as defined in CC.8.3.2, on any or all phases. At nominal voltages less than 110kV, this shall be the point in time at which the **Voltage** under consideration is less than 0.9pu of the nominal **Voltage.**

Stable / Stability: A **Generation Unit** is adjudged to be stable if the various machine states and variables, including but not limited to rotor angle, active power output, and reactive power output, do not exhibit persistent or poorly damped oscillatory behaviour, when the **Generation Unit** is subjected to a **Fault Disturbance** or other transient event on the **Transmission System.**

Voltage Dip: This is a short-duration reduction in **Voltage** on any or all phases due to a **Fault Disturbance** or other **Significant System Incident,** resulting in **Transmission System Voltages** outside the ranges as specified in CC.8.3.2, and more generally, bus **Voltages** or terminal **Voltages** of less than 90% of nominal voltage on any or all phases. Percentage **Voltage Dip** shall be calculated with respect to nominal voltage.