

WIND FARM POWER STATION SETTINGS SCHEDULE

Dated: 15.03.06

Due to be reviewed: 15.03.08

INTRODUCTION

The Grid Code and in particular the Connection Conditions place requirements on Generators seeking to have a WFPS be or remain connected to the NI System.

The technology is developing, as is the understanding of system operators of the effects of large-scale penetration of the technology into electricity networks. Until more certainty has been achieved, certain settings to be applied to WFPSs are not embedded into the Grid Code but rather contained in this WFPS Settings Schedule. The version of the WFPS Settings Schedule at any time current is therefore deemed to form part of the Grid Code Connection Conditions.

The Grid Code also sets out the procedure by which the TSO seeks to ensure compliance with these criteria either before connecting a WFPS or by Monitoring, in the post-connection period. A Generator will be deemed to be complying with the relevant requirements of the Grid Code where it has complied with the settings contained in the current version of the WFPS Settings Schedule.

1. Start-Up and Ramp Rates

CC.S2.3.7(a) provides:

“The Generator shall ensure that a WFPS shall not start up more frequently than once in any 10 minute period. A WFPS shall have a positive ramp rate controller capable of being set within a range from 1 MW per minute to 10 MW per minute to control the ramp rate under normal operating conditions and including a zero ramp rate setting, which shall automatically take effect during a time period when a ramp blocking signal is present. Unless notified otherwise by the TSO, the Generator will set the controller to the setting as specified by the TSO from time to time in the WFPS Settings Schedule published on the SONI website (or such other place or by such other means as may be notified to the Generator from time to time). The ramp rate is the average rate of change in Output measured over any 10 minute period. The ramp rate averaged over 1 minute should not exceed 3 times the average ramp rate over 10 minutes.”

Setting:

The ramp rate on Start-Up and the positive Ramp Rate under normal operation shall be controlled to a maximum of 5 MW per minute averaged over 10 minutes for the WFPS.

2. Ramp Frequency Controller

CC.S2.3.7(b) provides:

"A Controllable WFPS or a Dispatchable WFPS shall have a ramp Frequency controller, which on Start-Up and during normal operation of any Controllable WFPS or Dispatchable WFPS shall only allow ramping when the System Frequency is below a set value and in the absence of a ramp blocking signal. The ramp Frequency controller should be capable of being set in the range 50.2 Hz to 52.0 Hz in steps of 0.1 Hz. Unless notified otherwise by the TSO, the Generator will set the controller to the setting as specified by the TSO from time to time in the WFPS Settings Schedule published on the SONI website (or such other place or by such other means as may be notified to the Generator from time to time)."

Setting:

The ramp Frequency controller shall be set to prevent ramping upwards of the WFPS at any time when the System Frequency is 50.2 Hz or higher.

3. WFPS Control Arrangements

CC.S2.5.2(a) provides:

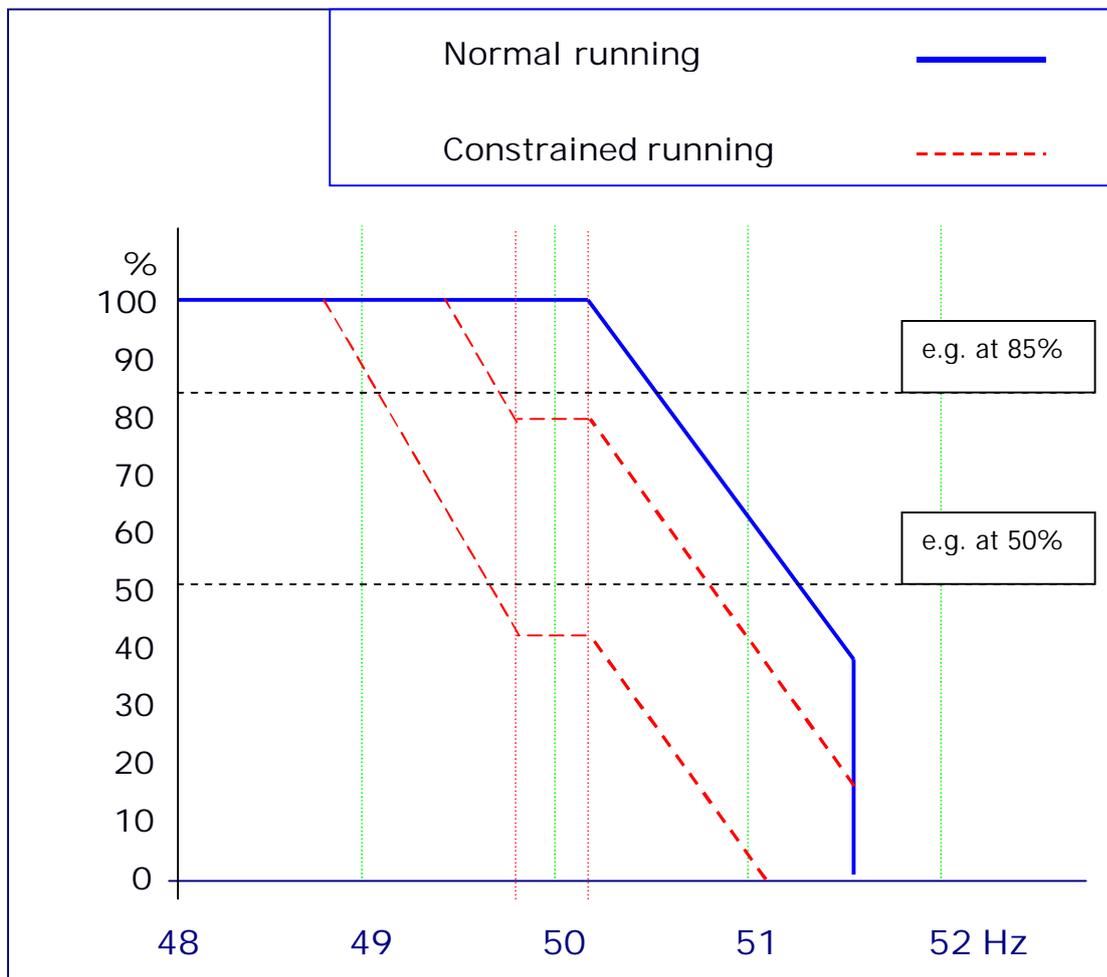
"Each Controllable WFPS or Dispatchable WFPS must be fitted with a fast acting proportional wind power governor to provide Frequency Control under normal operational conditions. This fast acting proportional governor should be equipped with controls which allow the droop to be set in the range 2% to 20% below 50.0 Hz and from 2% to 20% at 50.0 Hz and above, each setting being capable of being set independently above and below 50.0 Hz. A deadband within which no control will be exercised must be capable of being set with a lower limit between 49.0 Hz and 50.0 Hz in steps of 0.05 Hz and an upper limit between 50.0 Hz and 51.0 Hz in steps of 0.05 Hz. In addition a high Frequency trip facility must be provided capable of being set in the range 51.0 Hz to 52.0 Hz in steps of 0.1 Hz. Unless the Generator is notified otherwise by the TSO, the Governor Droop, deadband and high Frequency trip settings shall be as specified by the TSO from time to time in the WFPS Settings Schedule published on the SONI website (or such other place or by such other means as may be notified to the Generator from time to time). Where a Controllable WFPS or Dispatchable WFPS becomes isolated from the rest of the NI System the Controllable WFPS or

Dispatchable WFPS must immediately detect the condition and shut itself down."

Settings:

The following settings shall be applied to achieve the response shown.

Control	Normal Setting	Constrained
Droop setting below 50 Hz	4%	4%
Droop setting above 50 Hz	4%	4%
Lower deadband setting	49.75 Hz	50.0 Hz
Upper deadband setting	50.25 Hz	50.0 Hz
High frequency trip setting	51.5 Hz	51.5 Hz
Constraint level at 50.0 Hz	100%	50% - 100% of Registered Capacity



4. Constrained Operating Mode

CC.S2.5.2(b) provides:

“Under certain System conditions the TSO may require a Controllable WFPS or Dispatchable WFPS to operate below its maximum instantaneous Output and in a manner where the droop setting will come into operation should the System Frequency fall below the lower deadband setting (as specified by the TSO in accordance with CC.S2.5.2(a)). In this mode of operation the Controllable WFPS or Dispatchable WFPS will be providing some of the System reserve. The use of this constrained operating mode shall be kept to a minimum and is most likely to occur during summer night operation. The Controllable WFPS or Dispatchable WFPS controller must be capable of being set to operate in a constrained manner within the range of at least 50% to 100% of maximum instantaneous Output. Unless the Generator is notified otherwise by the TSO, the setting of the controller shall be as specified by the TSO from time to time in the WFPS Settings Schedule published on the SONI website (or such other place or by such other means as may be notified to the Generator from time to time).”

Setting:

The setting to be applied is 85%.

5. Telemetry & Control

For WFPSs with a Registered Capacity of less than 30 MW other than WFPSs with a control room facility it is required that:

- Voice telephone will be provided using the public telephone network. The Generator shall be responsible for the provision and maintenance of the telephony circuit in respect of its WFPS;
- Command and control will be by the Corporate Control Telephone Network and the Corporate Telephone Network notified by the TSO;
- No facsimile machine will be required to be provided or maintained.

For WFPSs with a Registered Capacity of 30 MW or more or WFPSs with a control room facility the TSO will in addition require a facsimile machine to be provided and maintained in full working order by the Generator at the control room facility for its WFPS. The TSO may also require the use of radio telephones, which will be provided/maintained by the TSO.

The schedule to a Connection Agreement in respect of telemetry and control for a Controllable WFPS or Dispatchable WFPS shall require the following and, in addition, such other requirements as to SCADA signals as the TSO may specify prior to entry into the Connection Agreement (the items marked with an asterisk being matters which the TSO provides as part of the connection arrangements, but which are included here for completeness):

Signal Format

Analogue output – either –10 to 0 to +10 ma or 4 to 20 ma

Analogue input – either 0 to 10 ma or 4 to 20 ma

Digital output – 24 volts dc

Digital input – 0 and 24 volts dc

WFPS SCADA Signals Required

Analogue Input Signals (to the TSO)

MW*	Indication of MW output at WFPS Connection Point
MVAr*	Indication of MVAr output at WFPS Connection Point
Voltage*	Indication of voltage (kV) at WFPS Connection Point
Wind Speed	Indication of wind speed at WFPS met mast
Wind Direction	Indication of wind direction at WFPS met mast
WFPS Capacity	Indication of maximum MW capacity available
WFPS % Shut Down	Indication of the % of turbines shutdown due to high wind speed
MW Set Point	Confirmation of MW set point signal

Curtailment Time Interval	Confirmation of time to reach set point due to high wind speed
Voltage Set Point	Confirmation of voltage set point signal
Power Factor Set Point	Confirmation of power factor set point signal
% MW Curtailment Set Point	Confirmation of % curtailment MW set point when providing reserve

Analogue Output Signal (from the TSO)

MW Set Point	Curtailment MW set point under emergency conditions
Voltage Set Point	Voltage set point instruction
Power Factor Set Point	Power factor set point instruction
% MW Curtailment Set Point	% curtailment MW set point when providing reserve
Curtailment Time Interval	Time to reach set point due to high wind speed

Digital Input Signals (to the TSO)

Stop Ramp	Acknowledgement signal that ramping has stopped
Allow Ramp	Acknowledgement signal that ramping is allowed
Emergency Action ON	Acknowledgement signal that the emergency action is ON
Emergency Action OFF	Acknowledgement signal that the emergency action is OFF
Voltage Control Selected	Acknowledgement signal that WFPS is in voltage control mode
PF Control Selected	Acknowledgement signal that WFPS is in power factor control mode

CB1 Open*	Status of the circuit breaker controlling the TO circuit
CB1 Closed*	Status of the circuit breaker controlling the TO circuit
Voltage Control Auto Change Over	Indication that the control mode has changed to voltage control
The TO Trip Relay Operated*	Indication that the trip relay associated with the circuit breaker controlling the TO circuit has operated
Island Detected Trip	Indication that the G59 protection has operated
Wind Turbine Shutdown Alarm	Indication that turbines have begun to shutdown due to high wind speed
% MW Curtailment Controller ON	Acknowledgement signal that % MW controller for reserve is ON
% MW Curtailment Controller OFF	Acknowledgement signal that the % MW curtailment for reserve is OFF

Digital Output Signals (from the TSO)

Stop Ramp	Blocking signal to protect against excess frequency movements
Allow Ramp	Blocking signal OFF to allow ramping
Emergency Action ON	Initiate emergency action
Emergency Action OFF	Cease emergency action
Voltage Control Select	To operate in voltage control mode
Power Factor Control Select	To operate in power factor control mode
CB1 Trip*	Trip signal to circuit breaker controlling the TO circuit
CB1 Close*	Close signal to circuit breaker controlling the TO circuit
The TO Trip Relay Reset	Signal to reset relay associated with circuit breaker controlling the TO circuit

% MW Curtailment Controller ON Initiate % MW curtailment for reserve

% MW Curtailment Controller OFF Cease % MW curtailment for reserve

The schedule in respect of telemetry to a Connection Agreement for a WFPS whose wind turbines comprise a Registered Capacity of 2 MW or more, but less than 5 MW shall require the following and, in addition, such other requirements as to SCADA signals as the TSO may specify prior to entry into the Connection Agreement (the items marked with an asterisk being matters which the TSO provides as part of the connection arrangements, but which are included here for completeness):

Signal Format

Analogue output – either – 10 to 0 to +10 ma or 4 to 20 ma

Digital output – 24 volts dc

WFPS SCADA Signals Required

Analogue Input Signals (to the TSO)

MW*	Indication of MW output at WFPS Connection Point
MVAr*	Indication of MVAr output at WFPS Connection Point
Voltage*	Indication of voltage (kV) at WFPS Connection Point
Wind Speed	Indication of wind speed at met mast
Wind Direction	Indication of wind direction at met mast

Digital Input Signals (to the TSO)

CB1 Open*	Status of the circuit breaker controlling the TO circuit
CB1 Closed*	Status of the circuit breaker controlling the TO circuit

Digital Output Signals (from the TSO)

CB1 Trip*

Trip signal to circuit breaker controlling
the TO circuit

CB1 Close* Close signal to circuit breaker controlling the TO circuit