Applicability

1(1) Section 502.1 applies to the ISO, and subject to the provisions of subsections 1(2), (3) and (4) to any:

(a) a new wind aggregated generating facility to be connected to the transmission system, and to their legal owner; and

(b) a wind aggregated generating facility in existence and connected to the transmission system as of December 1, 2011, and to their legal owner, if such facilities were connected to the transmission system under the Wind Power Facility Technical Requirements dated November 15, 2004.

(2) The legal owner of any existing wind aggregated generating facilities, who executed a Construction Commitment Agreement and completed the ISO’s approval process for connection to the transmission system under the Technical Requirements for connecting generators (1999), is exempt from this section 502.1 but must remain in compliance with those 1999 requirements.

(3) If any existing wind aggregated generating facilities undergo any:

(a) facilities addition such that the resulting accumulative real power capability is increased by an amount equal to or greater than five (5) MW; or

(b) facilities’ equipment replacement of five (5) MW or more;

then the facilities addition or equipment replacement and associated real power will be subject to and must comply with the provisions of this section 502.1 in its entirety.

(4) Notwithstanding subsection 1(2) above, all new and existing wind aggregated generating facilities with a maximum authorized real power of five (5) MW or more must comply with the meteorological collection tower and measurement devices provisions contained in subsection 25 below and the historical data and records requirements contained in subsection 29 below.

Requirements

Functional Specification

2(1) The ISO may, in accordance and consistent with this section 502.1 and any other applicable ISO rules, approve of a written functional specification containing further details, direction and discrete work requirements and specifications for the design, construction and operation of any wind aggregated generating facilities and associated transmission system connection facilities.

(2) The functional specification must be generally consistent with the provisions of this section 502.1 but may contain material variances approved of by the ISO based upon its discrete analysis of any one or more of the technical, economic, safety, operational and system reliability requirements related to the specific facility project.
Successor to Prior Requirements

3 Subject to subsection 4(2), the provisions of this section 502.1 succeed the Wind Power Facility Technical Requirements dated November 15, 2004, and those requirements no longer will be in force and effect as of December 1, 2011.

Maximum Authorized Real Power for Wind Aggregated Generating Facilities

4(1) The legal owner of any new wind aggregated generating facilities must submit to the ISO the maximum authorized real power for those wind aggregated generating facilities, and once the ISO approves the value, it will form part of the functional specification for the project.

(2) The maximum authorized real power for any existing wind aggregated generating facilities will be the “WPF Aggregated MW Capacity” as provided to the ISO under the requirements of section 5.1 set out in the Wind Power Facility Technical Requirements dated November 15, 2004.

(3) In accordance with the illustration set out in Appendix 2, the ISO will determine the reactive power capability requirements for any wind aggregated generating facilities, based on the maximum authorized real power determined under this subsection 4.

Operating Voltage Requirements

5(1) The legal owner of any wind aggregated generating facilities must submit to the ISO the value to be used for rated root mean square phase-to-phase voltage at:

(a) the point of connection to the transmission system, based on the normal operating voltage levels at the specific location of the wind aggregated generating facilities; and

(b) all collector busses.

(2) Once that value is approved by the ISO, it will form part of the functional specification for the project.

(3) The rated root mean square phase-to-phase voltage will be used in the application of this section 502.1 to determine and apply:

(a) the voltage ride-through requirements;

(b) voltage regulation; and

(c) the reactive power capability;

of the wind aggregated generating facilities.

Voltage Ride-Through Requirements

6(1) Wind aggregated generating facilities with a maximum authorized real power amount equal to or greater than five (5) MW must meet the voltage ride-through requirements specified in this subsection 6.

(2) Each legal owner of wind aggregated generating facilities must ensure they are capable of continuous operation between ninety percent (90%) and one hundred and ten percent (110%) of the root mean squared rated phase-to-phase voltage at the point of connection.
(3) Subject to subsection 6(4), wind aggregated generating facilities must not trip off-line any wind turbine generator that is producing real power due to voltage dips or post-transient voltage rises described in Appendix 1, resulting from normally cleared transmission system faults on any phase or combination of phases at or beyond the point of connection.

(4) Notwithstanding any other provision of this subsection 6, wind aggregated generating facilities are not required to ride through transmission system faults that:

(a) cause an automatic forced outage of a radial transmission line to the wind aggregated generating facilities;

(b) occur on the wind aggregated generating facilities side of the point of connection, including the lower voltage network and the substation; or

(c) result in a transfer trip or anti-islanding protection scheme to activate at the wind aggregated generating facilities.

Voltage Regulation

7(1) The ISO will assess voltage regulation performance of wind aggregated generating facilities at the collector busses in accordance with this subsection 7.

(2) Wind aggregated generating facilities must be able to regulate voltage at the voltage regulation system point of control and as documented in the functional specification for the project, under both non-disturbance and disturbance conditions.

(3) Wind aggregated generating facilities must have a continuously variable, continuously acting, closed loop, centralized control voltage regulation system that measures voltage compared to a set point, and will control reactive devices including wind turbine generators, dynamic reactive power resources, capacitor and reactor banks.

(4) The voltage regulation system must be continuously in service and controlling while the wind aggregated generating facilities are connected to the transmission system and regardless of the quantity of actual real power output from the wind aggregated generating facilities.

(5) The voltage regulation system set point must be adjustable by the operator of the wind aggregated generating facilities to a percentage between ninety five percent (95%) and one hundred and five percent (105%) of rated voltage.

(6) The voltage regulation system must operate in a voltage set point control mode to the exclusion of any other modes.

(7) The voltage regulation system must measure voltage that represents the overall voltage response of the wind aggregated generating facilities.

(8) The voltage regulating system must be capable of:

(a) adjustable gain, or reactive droop compensation adjustable from zero to ten percent (0 to 10%); and

(b) reactive current compensation to compensate for any step-up transformers connected to the transmission system.
(9) The combined settings of the voltage regulation system must be able to achieve a steady state voltage regulation of plus or minus zero point five percent (± 0.5%) of the voltage controlled by the voltage regulation system.

(10) The ISO will specify whether the reactive current compensation in the voltage regulation system must be implemented, which will form part of the functional specification for the project.

(11) The ISO may, upon no less than ninety (90) days’ notice in writing to the legal owner of any commissioned wind aggregated generating facilities, require a change to the setting of the reactive droop compensation gain or the reactive current compensation settings for those commissioned wind aggregated generating facilities.

(12) The voltage regulation system must be calibrated such that a change in reactive power will achieve ninety five percent (95%) of its final value, no sooner than zero point one (0.1) seconds and no later than one (1) second following a step change in voltage.

(13) When the voltage regulation system requires the switching of a shunt reactive device, the switching operation must be delayed by ten (10) seconds.

External Voltage Regulation

8 No wind aggregated generating facilities may use or rely upon any voltage regulation system or reactive power resources that are external to the wind aggregated generating facilities without the approval of the ISO, which approval will form part of the functional specification for the project.

Wind Aggregated Generating Facilities Reactive Power Capability

9(1) Dynamic and non-dynamic reactive power requirements must be based on the rated voltage at the collector busses.

(2) As illustrated in Appendix 2, the minimum continuous reactive power capability of any wind aggregated generating facilities to supply reactive power must meet or exceed plus zero point nine (+0.9) power factor, based on the gross real power up to and including the maximum authorized real power of the wind aggregated generating facilities.

(3) As illustrated in Appendix 2, the minimum continuous reactive power capability of any wind aggregated generating facilities to absorb reactive power must meet or exceed minus zero point nine five (-0.95) power factor, based on the gross real power up to and including the maximum authorized real power of the wind aggregated generating facilities.

(4) Continuous reactive power capability referred to in subsections 10 and 11 may be aggregated to meet the requirements set out in subsections 9(2) and (3).

(5) All reactive power resources used to vary the reactive power output of the wind aggregated generating facilities within the requirements set out in subsections 9(2) and (3) must be under control of the voltage regulation system.

(6) The operator must not intentionally, and the control systems of wind aggregated generating facilities must not be designed to, reduce the reactive power capability from the dynamic reactive devices described in subsection 10, or the non-dynamic reactive resources described in subsection 11.
Dynamic Reactive Power Capability

10(1) As illustrated in Appendix 2, the minimum dynamic reactive power capability of any wind aggregated generating facilities must meet or exceed plus zero point nine five (+0.95) power factor based on the gross real power up to and including the maximum authorized real power of the wind aggregated generating facilities.

(2) As illustrated in Appendix 2, the minimum dynamic reactive power capability of any wind aggregated generating facilities must meet or exceed minus zero point nine eight five (-0.985) power factor based on the gross real power up to and including the maximum authorized real power of the wind aggregated generating facilities.

(3) Wind aggregated generating facilities must have reactive power resources that are continuously acting and continuously variable under control of the voltage regulation system, and be able to respond to transmission system voltage fluctuations.

(4) For the purposes of subsections 10(1) and (2), a short term reactive power capability for a period of up to one (1) second will be deemed to meet the dynamic reactive power capability set out in those subsections.

(5) The short term reactive power capability referred to in subsection 10(4) does not qualify for continuous reactive power described in subsection 9.

Non-Dynamic Reactive Power Capability

11(1) For any wind aggregated generating facilities, the MVAr size of the individual shunt reactive power resources under control of the voltage regulation system must not be larger than the total range of the continuous capability of dynamic reactive power set forth in subsection 10.

(2) Any shunt reactive power resources installed in any wind aggregated generating facilities must be capable of being switched on no later than five (5) minutes after having been switched off.

Operator Availability

12 The legal owner of any wind aggregated generating facilities must have a designated and qualified operator available twenty four (24) hours a day every day for contact and communication with the ISO, in accordance with ISO rules and other communication policies and protocols.

WECC Stability Control Requirements

13 After December 1, 2011, if any WECC standards or policies specify the use of a power system stabilizer for wind aggregated generating facilities using a synchronous wind turbine generator, then based on those standards or policies the ISO, by written notice, to the legal owner may require the wind aggregated generating facilities to use such a power system stabilizer.

Transmission System Step-Up Transformer

14(1) The voltage ratio, tap changer type, range and step size specifications for any transmission step-up transformer of any wind aggregated generating facilities must be such that the reactive power requirements specified in subsection 9 are fully available throughout the operating voltage range documented in the functional specification for the project.
(2) The connection of the wind turbine generator step-up transformer, transmission system step-up transformer or any combination of the two (2) transformers for any wind aggregated generating facilities must be designed to provide:
   (a) a favorable circuit to block the transmission of harmonic currents; and
   (b) isolation of transmission system and wind turbine generator side ground fault current contributions.

(3) The wind aggregated generating facilities must utilize an effectively grounded wye connection on the high side of the transmission system step up transformer.

Off Nominal Frequency Requirements

15(1) For wind aggregated generating facilities that have a requirement to protect equipment for off-nominal frequency operation, the legal owner must install protective relays so as to accommodate operation for the specified time frames shown in the Table set out in Appendix 3.

(2) The trip setting of the protective relays must either:
   (a) be set to the requirements set out in Appendix 3 with respect to the frequency versus time setting; or
   (b) automatically trip load to match the anticipated generation loss and at comparable frequency levels.

(3) Any frequency relays installed to protect equipment for off-nominal frequency operation must:
   (a) be solid state or microprocessor based;
   (b) use a definite time characteristic; and
   (c) not be disabled for transmission system voltages that are below eighty percent (80%) of the rated voltage without the approval of the ISO, which approval will form part of the functional specification for the project.

Over Frequency Control System Requirements

16(1) Any wind aggregated generating facilities must have an over frequency control system that continuously monitors the frequency of the transmission system at a sample rate of at least thirty (30) per second and a resolution of at least zero point zero zero zero four (0.004) Hertz, and the over frequency control system must automatically control the gross real power output of the wind aggregated generating facilities at all times.

(2) The over frequency control system may have an intentional deadband of up to zero point zero three six (0.036) Hertz.

(3) The over frequency control system must be designed and calibrated to reduce the gross real power output at the collector bus based on the capability of all on-line wind turbine generators producing real power during an over frequency excursion, and such reductions must be:
   (a) proportional to the frequency increase by a factor of thirty three percent (33%) per Hertz of the gross real power output;
(b) at a rate of five percent (5%) of the gross real power output per second; and
(c) with no intentional time delay added to the control system.

(4) In accordance with subsection 15, for transmission system over frequency events greater than sixty-one point seven (61.7) Hertz, wind aggregated generating facilities may trip due to the over frequency, but if the wind aggregated generating facilities remain connected to the transmission system then the over frequency control system must continue to ramp down the gross real power output in accordance with the requirements of this subsection 16.

(5) The over frequency control system requirements of this subsection 16 must have control priority over the power limiting control function and must reduce the gross real power output for an over frequency condition even when the requirements of subsection 18 are in effect.

Wind Aggregated Generating Facilities Disconnection

17(1) Wind aggregated generating facilities must have systems, controls and related procedures to electrically disconnect the wind aggregated generating facilities from the transmission system either at:

(a) the point of connection; or
(b) the collector bus feeder breakers; or

both of them as documented in the functional specification, after consultation among the ISO, the legal owner of the wind aggregated generating facilities and the legal owner of the applicable transmission facility.

(2) Wind aggregated generating facilities connecting to a transmission facility must provide the functionality and remote control capabilities to enable the operator of the transmission facility to open or trip any connecting breaker either at the point of connection or any collector bus feeder breakers, as applicable.

(3) Once a connecting breaker or feeder breaker of any wind aggregated generating facilities has been opened or tripped, then the operator may only electrically reconnect to the transmission facility after receiving approval from the ISO.

Wind Aggregated Generating Facilities Real Power and Ramp Rate Limitations

18(1) Wind aggregated generating facilities must have the control capability to limit the real power output at the point of connection in accordance with any limits or instructions contained in any directive, and in any event the real power output must not exceed the tolerances described in this subsection 18.

(2) The real power control limit referred to in subsection 18(1) must be adjustable from the minimum operating output to the maximum authorized real power, at an average resolution of one (1) MW.

(3) When a real power control limit is in effect in accordance with a directive and wind speed conditions at the wind aggregated generating facilities are increasing, then subject to subsection 18(4), the real power limiting controls of the wind aggregated generating facilities must be capable of keeping the one (1) minute average real power output from exceeding the wind aggregated generating facilities limit specified in the directive by two percent (2%) of the maximum authorized real power.
(4) If a wind gust results in the real power control limit set out in the directive being instantaneously exceeded, then the wind aggregated generating facilities will remain in compliance if the real power output at the point of connection does not exceed the real power control limit by more than five percent (5%) of the maximum authorized real power.

(5) Wind aggregated generating facilities must be equipped with ramp rate limiting controls.

(6) The ramp rate limiting controls must be capable of limiting the ramp up of the real power of the wind aggregated generating facilities, and must be adjustable such that the ramp rate does not exceed, in MW per minute, a range equal to five percent (5%) of the maximum authorized real power to twenty percent (20%) of the maximum authorized real power.

(7) The default setting for the ramp rate limiting controls must be set at ten percent (10%), unless otherwise approved by the ISO, which approval will form part of the functional specification for the project.

(8) Any difference in the real power at the point of connection and any collector busses must be compensated for in the real power limiting and ramp rate limiting controls.

Wind Aggregated Generating Facilities Power Quality

19(1) Wind aggregated generating facilities must be designed and operated to meet or exceed the minimum power quality standards set out in this subsection 19.

(2) With regard to voltage flicker as measured at the point of connection, the legal owner of any wind aggregated generating facilities must comply with the specifications set out in the version of the International Electrotechnical Commission 61000-3-7, Electromagnetic compatibility (EMC) – Part 3-7: Limits - Assessment of emission limits for the connection of fluctuating installations to MV, HV and EHV power systems that is in effect as of the date of the first ISO approved revision of the functional specification for the project.

(3) Upon request from the legal owner of any new wind aggregated generating facilities, the ISO must provide a written description of the specific harmonic-impedance envelope at a proposed point of connection for those wind aggregated generating facilities.

(4) With regard to harmonics as measured at the point of connection, the legal owner of any wind aggregated generating facilities must comply with the version of the IEEE Standard 519, Recommended Practices and Requirements for Harmonic Control in Electrical Power Systems – Section 11 that is in effect as of the date of the first ISO approved revision of the functional specification for the project.

(5) Any wind aggregated generating facilities must include systems and components designed to avoid introducing resonance into the transmission system, with such design specifications to apply to self-excitation of induction machines, transformer ferroresonance, resonant effects of capacitor additions and the capacitance of collector cables.

(6) Wind aggregated generating facilities must not cause any voltage unbalance on the transmission system, as measured at the point of connection, in excess of the value specified by the ISO, which will form part of the functional specification for the project.

Grounding

20 Any wind aggregated generating facilities must be designed and constructed to take in to
account that the transmission system operates as an effectively grounded system.

Lightning Surge Protection

21 The lightning surge protection for any substation facilities associated with any wind aggregated generating facilities must be designed to take into account the average isokeraunic level for the site location of the wind aggregated generating facilities, and to be compatible with the connecting transmission facility to ensure coordination of insulation levels.

Fault Interrupting Devices

22(1) Any wind aggregated generating facilities must be designed to:

(a) account for the fault contributions from both the transmission system and the wind aggregated generating facilities; and

(b) have fault interrupting and momentary withstand ratings that are adequate to meet the maximum expected fault levels, with a margin for future anticipated fault levels as approved by the ISO which approval will form part of the functional specification for the project.

(2) The wind aggregated generating facilities must not use high voltage fuses at sixty (60) kilovolts or higher.

Isolating Devices

23(1) Any wind aggregated generating facilities must be designed with manually operable isolation switches at all points of isolation as documented in the functional specification, after consultation among the ISO, the legal owner of the wind aggregated generating facilities and the legal owner of the applicable transmission facility.

(2) The isolation switches must permit visual verification of electrical isolation and have the capability of being locked open with multiple locks.

Supervisory Control and Data Acquisition Additional Requirements

24 Deleted – see Revision History.

Meteorological Collection Tower and Measurement Devices and Availability Requirements

25(1) Any wind aggregated generating facilities must have a meteorological collection tower and related devices installed in accordance with the provisions of this subsection 25.

(2) The tower must be equipped with two (2) sets of weather measurement devices in accordance with the following:

(a) for any new wind aggregated generating facilities:

(i) one device must take measurements at the wind turbine generator hub height; and

(ii) the second device must take measurements at a height that the ISO specifies in the functional specification; and

(b) for any existing wind aggregated generating facilities, the measurements must be taken at
heights specified by the ISO in writing after consultation with the legal owner.

(3) The measurement devices must measure, on a ten (10) minute average value;
(a) wind speed in meters per second (m/s), with a precision for instantaneous measurements to the nearest zero point one (0.1) meters per second;
(b) wind direction in degrees from true north, with a precision for instantaneous measurements to the nearest one (1) degree;
(c) barometric pressure in HectoPascals (HPa), with a precision for instantaneous measurements to the nearest six (6)-Pa; and
(d) ambient temperature in degrees Celsius (°C), with a precision for instantaneous measurements to the nearest zero point one (0.1) degrees Celsius.

(4) Any wind aggregated generating facility must provide to the ISO the current and planned available capability down to the real power equivalent of one (1) wind turbine generator.

(5) When the current or planned available capability that was provided to the ISO in accordance with subsection 25(4) changes, the wind aggregated generating facility must provide to the ISO the new current or planned available capability as soon as practicable.

(6) The legal owner must submit to the ISO the data specified in this subsection 25 in the method and format the ISO specifies:
(a) in the functional specification for any new wind aggregated generating facilities; or
(b) in writing to the legal owner for any existing wind aggregated generating facilities.

Wind Aggregated Generating Facilities Synchrophasor Measurement

26(1) Any wind aggregated generating facilities must have equipment installed for synchrophasor measurements that complies with the specifications referenced in the functional specification for the project

(2) Synchrophasor measurements must take place at the following points:
(a) all three (3) phase-to-ground voltages at each collector bus of the wind aggregated generating facilities;
(b) all three (3) phase currents for each transmission step-up transformer on the low voltage side of the transformer; and
(c) all three (3) phase-to-ground voltages and currents at each point of connection of the wind aggregated generating facilities.

Wind Aggregated Generating Facilities Testing Post Connection

27(1) Following the connection of any wind aggregated generating facilities to the transmission system, the legal owner must test the wind aggregated generating facilities in accordance with the provisions of subsection 27(2), and must provide the test results and report as per the ISO document “Requirements for Model Validation” no later than sixty (60) days following the date upon which wind speed conditions reasonably will allow for the tests to be conducted.
(2) The following specific tests must be completed:

   (a) a voltage regulation system and reactive power response test, which demonstrates the ability of the wind aggregated generating facilities to control the collector bus and transmission system voltage in a stable manner, and which test consists of injecting a test signal to the voltage reference point of the voltage regulation system;

   (b) a reactive power capability test, which demonstrates the ability of the wind aggregated generating facilities to provide continuous reactive power in accordance with subsection 9; and

   (c) a voltage set-point capability test, which demonstrates the ability of the wind aggregated generating facilities to adjust the voltage set-point of the voltage regulation system to any applicable provisions of the ISO rules.

(3) The ISO may specify the additional following tests in the functional specification for the project:

   (a) a harmonic test which must demonstrate that harmonic levels for the wind aggregated generating facilities are within the specifications set out in subsection 19(4); and

   (b) a voltage flicker test, which must demonstrate that the flicker levels for the wind aggregated generating facilities are within the specifications set out in subsection 19(2).

(4) The ISO, by written notice, may require the legal owner of any wind aggregated generating facilities to repeat any of the tests set out in this subsection 27 if:

   (a) there is evidence that the results of the tests do not correlate with the actual response, except in instances where the lack of correlation was caused by equipment problems that were subsequently corrected; or

   (b) there are changes in any applicable NERC or WECC policy or standards requirements which necessitate a repeat of any of the tests.

Provision of Modeling Information from Wind Aggregated Generating Facilities

28(1) The legal owner must provide the ISO with power system studies which demonstrate that the wind aggregated generating facilities are capable of meeting the voltage ride-through requirements specified in subsection 6.

(2) The legal owner must provide a voltage regulation system model with validated data demonstrated by a physical performance test of at least one (1) voltage regulation system device used at the wind aggregated generating facilities.

(3) The legal owner must re-validate all model data if the ISO provides written notice that there is evidence that the modeled response of the wind aggregated generating facility does not correlate with the actual response, except in instances where the lack of correlation was caused by equipment problems that were subsequently corrected.

Wind Aggregated Generating Facilities Data and Records Requirements

29(1) Subject to the provisions of this subsection 29, the legal owner of any wind aggregated generating facilities must retain historical data and records consisting of ten (10) minute averaged meteorological data, including wind speed, wind direction, temperature, barometric pressure, and details
on the height of the measurements.

(2) The legal owner must provide the historical data and records referred to in this subsection 29 to the ISO.

(3) Upon the ISO’s written request, the legal owner must, subject to availability, provide such historical data and records for up to two (2) calendar years prior to the commissioning period for any new wind aggregated generating facilities, and the most recent two-year period for existing wind aggregated generating facilities.

(4) The legal owner in addition must provide the ISO with specific wind turbine generator data and records, including hub height, turbine land coordinates, turbine power curves, high wind speed cut-out and any applicable temperature cut-outs.

(5) The legal owner must provide to the ISO the data and records referred to in this subsection 29 in a method and format the ISO specifies, which for new wind aggregated generating facilities will be contained in the in the functional specification for the project.

Appendices

Appendix 1 – Voltage Ride Through Requirements
Appendix 2 – Reactive Power Capability
Appendix 3 - Trip Settings of Off-Nominal Frequency Protective Relays

Revision History

<table>
<thead>
<tr>
<th>Date</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>December 1, 2011</td>
<td>Initial Release</td>
</tr>
<tr>
<td>September 24, 2013</td>
<td>Updated to remove bolding on the term “power system stabilizer”.</td>
</tr>
<tr>
<td>July 2, 2014</td>
<td>In subsection 7(11) deleted reference to “aggregated generation facilities” and replaced it with “aggregated generating facilities”; in subsection 25(2)(a)(ii) deleted the period at the end and replaced it with a semicolon and the word “and”; in subsection 29(3) deleted the words “two (2) year” and replaced it with “two-year”; and deleted references to “forced outage” and replaced it with “automatic forced outage”.</td>
</tr>
<tr>
<td>March 27, 2015</td>
<td>Replaced “effective date” with the initial release date in sections 1(1)(b), 3 and 13; and replaced the word “Effective” in the Revision History to “Date”.</td>
</tr>
<tr>
<td>April 1, 2015</td>
<td>Subsections 25(4) and (5) were added to increase the accuracy of the wind power forecast by requiring the current and planned available capability</td>
</tr>
</tbody>
</table>
Appendix 1

Voltage Ride Through Requirements

Wind aggregated generating facilities may trip above High Voltage Requirement.

Wind aggregated generating facilities may trip below Low Voltage Requirement.

Fault incidence at time = 0 second.

RMS Voltage (Point of Connection) Percent of Rated

Time (Seconds)

0.625 seconds
Appendix 2
Reactive Power Capability

Continuous Reactive Power Capability

Dynamic Reactive Power Capability

-0.985 power factor at maximum authorized real power

+0.95 power factor at maximum authorized real power

-0.95 power factor at maximum authorized real power

Absorbing MVARs per unit

Producing MVARs per unit

MW (per unit)

0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
1.0

Where 1 per unit is the maximum authorized real power

Minimum continuous reactive capability

Minimum dynamic reactive capability

ISO Rules
Part 500 Facilities
Division 502 Technical Requirements
Section 502.1 Wind Aggregated Generating Facilities
Technical Requirements

Effective: 2015-04-01
### Appendix 3

**Trip Settings of Off-Nominal Frequency Protective Relays**

<table>
<thead>
<tr>
<th>Frequency (Hz)</th>
<th>Minimum Time Delay</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;61.7 Hz</td>
<td>0 seconds</td>
</tr>
<tr>
<td>61.6 Hz to 61.7 Hz</td>
<td>30 seconds</td>
</tr>
<tr>
<td>60.6 Hz to &lt;61.6 Hz</td>
<td>3 minutes</td>
</tr>
<tr>
<td>&gt;59.4 Hz to &lt;60.6 Hz</td>
<td>Continuous Operation</td>
</tr>
<tr>
<td>&gt;58.4 Hz to 59.4 Hz</td>
<td>3 minutes</td>
</tr>
<tr>
<td>&gt;57.8 Hz to 58.4 Hz</td>
<td>30 seconds</td>
</tr>
<tr>
<td>&gt;57.3 Hz to 57.8 Hz</td>
<td>7.5 seconds</td>
</tr>
<tr>
<td>&gt;57.0 Hz to 57.3 Hz</td>
<td>45 cycles</td>
</tr>
<tr>
<td>≤57.0 Hz</td>
<td>0 seconds</td>
</tr>
</tbody>
</table>