TEMPLATE FOR PERFORMANCE STANDARDS FOR CWO REZ

This template is intended for the use of *Connection Applicants* proposing to connect an asynchronous *generating system* (or energy storage system) to the Central West Orana Renewable Energy Zone (CWO REZ). The template has been drafted to reflect the required renewable energy zone (REZ) *access standards* for the CWO REZ.

It contains two tables:

Table 1 – *Connection Applicants* should complete Table 1 to specify the proposed *generating units* (or energy storage units) and *generating system* (or energy storage system) to which the REZ *access standards* are intended to apply.

Table 2 – Table 2 has been drafted to reflect the structure of the technical requirements in Schedule 5.2 of the National Electricity Rules (NER), as presented in the AEMO generator performance standards (GPS) template, with Transgrid's standard technical requirements incorporated where applicable. As a guide for *Connection Applicants*, the fifth column has been completed to indicate the required REZ *access standard* for each technical requirement.

It is expected that the *Connection Applicants* will amend the fifth column as necessary and respond to the comments in square brackets [ ] (and complete variables highlighted in yellow). The International System of Units is used in the template to identify quantities. In this document, capitalised terms have the meaning given in Table 1 and italicised terms have the meaning given in the NER, unless otherwise defined.

Table 1 Background

Name of Applicant & ABN:	[insert company name and ABN of *Connection Applicant* who will, ultimately, apply for registration as a Generator]
Name of Network Service Provider & ABN:	[insert company name and ABN of NSP] (NSP)
Name of generating system:	[insert name of power station / generating system]
Generating unit designations:	[insert unit designations e.g. Units 1 to 4]
Generating unit make(s) and model(s):	[insert unit make and model name/version]
Reactive plant:	[insert make and model name/version, *nameplate rating*]
Connection point:	[insert connection point/s] (Connection Point)
Connection point nominal voltage:	[insert *connection point nominal voltage*] kV (Nominal Voltage)
Connection point normal voltage	[insert *connection point normal voltage*] pu or kV (Normal Voltage)
Nameplate rating:	[insert the *nameplate rating* of all *generating units* this document applies to] MW ([insert the number of units] x [insert unit rating, equipment make(s) and model(s)])
Maximum capacity:	[insert maximum *generation* of the *generating system*, that is, the total capacity at the connection point of all *generating units* this document applies to] MW
System strength remediation scheme:	[insert a description of the system strength remediation scheme or 'Not applicable']
Date of acceptance:	[to be completed by the NSP once final]

Table 2 CWO REZ Generator Performance Standards[1][2]

NER version	NER clause reference	Description	Required REZ Access Standard (Automatic – A, Minimum – M)	Detailed description of required performance standard
	S5.2.5.1	Reactive Power Capability	A	*Generating system's rated active power* = [insert] MW as measured at the Connection Point [For energy storage systems the *rated active power* to be specified considering bi-directional power flow]. [For energy storage systems the *reactive power* capability to be specified under paragraphs (1), (2) and (3) considering bi-directional power flow.] (1) While operating at any *voltage* at the Connection Point within the limits of ±10% of its Normal Voltage, and for ambient temperatures up to [insert] °C, the *generating system* is capable of: (a) supplying continuously at its Connection Point an amount of *reactive power* shown by the "S5.2.5.1 Standard" curve in Figure 1 below, being of at least: (i) the amount equal to the product of *rated active power* of the *generating system* and 0.3 when generating at the *rated active power* of the *generating system*; (ii) the amount equal to the product of *rated active power* of the *generating system* and 0.395 when generating between 10% and 80% % of the *rated active power* of the *generating system*; (iii) the amount equal to the product of *rated active power* of the *generating system* and 0.05 when not generating *active power;* and (iv) the amount defined by lines between the capabilities specified at: (A) 80% of the *rated active power* and the *rated active power* of the *generating system; and* (B) 10% of the *rated active power* and when the *generating system* is not generating *active power*. (b) absorbing continuously at its Connection Point an amount of *reactive power* shown by the "S5.2.5.1 Standard" curve in Figure 1 below, being of at least:

[1] Capitalised terms are defined in Table 1. Italicised terms have the meaning given in the NER.

[2] If the proposed performance standards are for a bi-directional energy system, please replace generating system with energy storage system and generating unit with energy storage unit. If the proposed performance standards are for a hybrid system, please specify performance for each aggregated generating unit or energy storage unit and for the hybrid system, as applicable.

NER version	NER clause reference	Description	Required REZ Access Standard (Automatic – A, Minimum – M)	Detailed description of required performance standard
				(i) the amount equal to the product of *rated active power* of the *generating system* and 0.35 when generating at the *rated active power* of the *generating system*; (ii) the amount equal to the product of *rated active power* of the *generating system* and 0.395 when generating between 35% and 80% of the *rated active power* of the *generating system*; (iii) the amount equal to the product of *rated active power* of the *generating system* and 0.362 when generating at 10% of the *rated active power* of the *generating system;* (iv) the amount equal to the product of *rated active power* of the *generating system* and 0.05 when not generating *active power; and* (v) the amount defined by lines between the capabilities specified at: (A) 80% of the *rated active power* and the *rated active power* of the *generating system;* (B) 35% of the *rated active power* and 10% of the *rated active power*; and (C) 10% of the *rated active power* and when the *generating system* is not generating *active power*. (2) [Specify de-rated capability at higher ambient temperatures, delete if not applicable] While operating at any level of *active power* output and at any *voltage* at the Connection Point within the limits of ±10% of its Normal Voltage, the *generating system* is capable of supplying and absorbing at the Connection Point an amount of *reactive power* as shown by the "S5.2.5.1 Standard" curve in Figure 2 below for ambient temperature of [insert] °C. (3) The *generating system* will [Applicable if capability is de-rated at higher ambient temperatures, delete if not applicable]: (a) linearly de-rate its *active power* and *reactive power* at the Connection Point from [insert] MW to [insert] MW and from ±[insert] MVAr to ±[insert] MVAr respectively over the ambient temperature range from [insert] °C and [insert] °C; [delete if not applicable] (b) reduce its *active* and *reactive power* at the Connection Point to zero for ambient temperatures above [insert] °C. (4) [Delete non-applicable paragraphs from (4) or (5). For all *generating systems* excluding energy storage systems paragraph (4) is applicable. For energy storage systems paragraph (5) is applicable] The *generating system*, while not generating *active power* and not supplying or absorbing *reactive power* under an *ancillary services agreement*:

NER version	NER clause reference	Description	Required REZ Access Standard (Automatic – A, Minimum – M)	Detailed description of required performance standard
				(a) will not draw *active power* that exceeds [insert] MW at the Connection Point; (b) when the *generating units* are *connected* to the *power system*, will operate in accordance with clause S5.2.5.13 of *this Generator Performance Standards* with: (i) *voltage* control mode with *reactive power* droop characteristics (as described in clause S5.2.5.13, subparagraph (4)) selected as the normal control mode; (ii) *reactive power capability* of supplying at least [insert] MVAr and absorbing at least [insert] MVAr [The *generating system* is required to provide, at a minimum, sufficient reactive capability to offset the *reactive power* contribution from balance of plant such that the net *reactive power* supplied at the Connection Point is 1 MVAr]; and (c) when the *generating units* are *disconnected* from the *power system*, will not supply an amount of *reactive power* that exceeds [insert] MVAr at the Connection Point, and will not absorb an amount of *reactive* power that exceeds [insert] MVAr at the Connection Point. (5) [Paragraph (5) is applicable for energy storage systems. Delete if not applicable] When the energy storage units are not *connected* to the *power system,* the energy storage system will not supply an amount of *reactive power* that exceeds [insert] kVAr at the Connection Point, draw an amount of *active power* that exceeds [insert] kW at the Connection Point, and absorb an amount of *reactive power* that exceeds [insert] kVAr. (6) If the *reactive power* supplied or absorbed at the Connection Point falls outside the range specified above in subparagraph (4)(c) or (5) [Delete reference to (4)(c) or (5), if not applicable] that applies when the *generating units* or energy storage units are not *connected*, the *generating system* or the energy storage system must, where required by the NSP in order to maintain satisfactory *voltage* levels at the Connection Point or to restore *intra-regional* or *inter-regional power transfer capability*, take action to ensure that the *reactive power* falls within that range within 30 minutes.

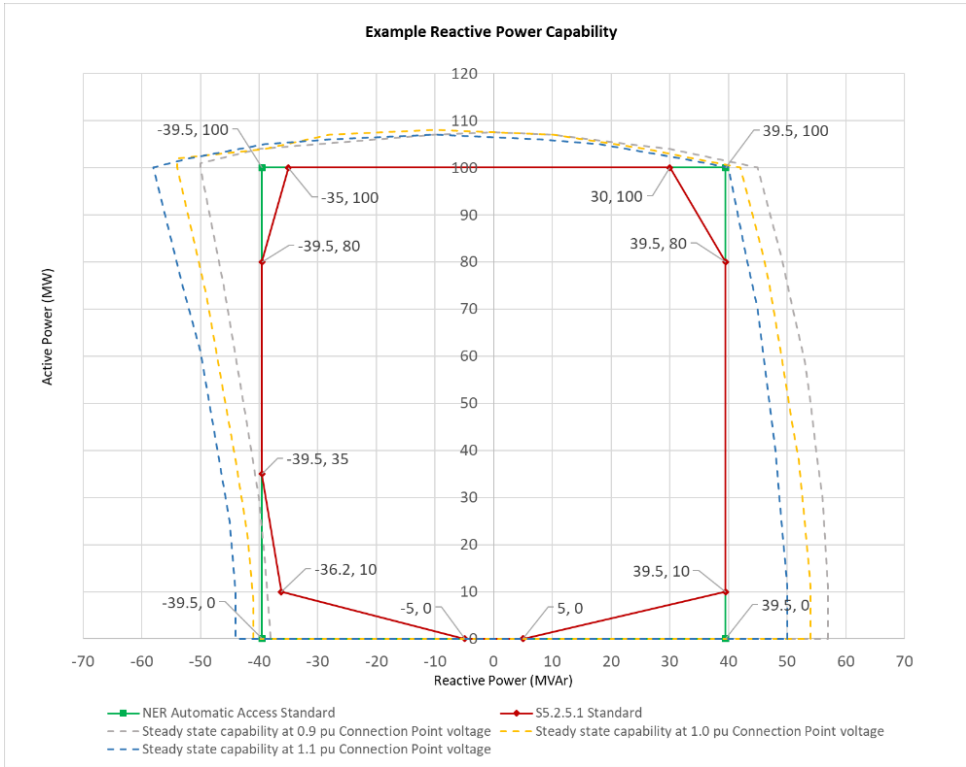
NER version	NER clause reference	Description	Required REZ Access Standard (Automatic – A, Minimum – M)	Detailed description of required performance standard
				

Figure 1: [Example 1 provided for guidance] *Reactive power* capability of the *generating system* at the Connection Point for ambient temperature up to [insert] °C.

<table>
<tr><th>NER version</th><th>NER clause reference</th><th>Description</th><th>Required REZ Access Standard (Automatic – A, Minimum – M)</th><th>Detailed description of required performance standard</th></tr>
<tr><td></td><td></td><td></td><td></td><td>[Insert Figure 2 to reflect de-rated capability at higher ambient temperature]

Figure 2: [De-rated capability at higher ambient temperatures to be reflected, delete if not applicable] Reactive power capability of the generating system at the Connection Point for ambient temperature of [insert] °C.</td></tr>
<tr><td></td><td>S5.2.5.2</td><td>Quality of Electricity Generated</td><td>A</td><td>[Transgrid standard requirements reflected in paragraphs (a), (b), (c), (d) and (e) for clause S5.2.5.2]
[Requirements also apply to energy storage systems, considering bidirectional operation. Substitute ‘energy storage system’ for ‘generating system’]

When generating and when not generating, the generating system does not produce at any of its connection points for generation:
(a) Voltage fluctuations greater than the Automatic Access Standard emission limits listed in Table 2.1:
Table 2.1: Voltage Fluctuation Limits
<table>
<tr><th>$E_{Pst99\%}$</th><th>$E_{PIt99\%}$</th></tr>
<tr><td></td><td></td></tr>
</table>
(b) Rapid voltage changes greater than the emission limits listed in Table 2.2: [Delete non-applicable column depending on Connection Point Nominal Voltage]
Table 2.2: Emission Limits for Rapid Voltage Changes
<table>
<tr><th>Connection Point Nominal Voltage (kV)</th><th>[insert POC voltage] (for Vpoc >35kV)</th><th>[insert POC voltage] (for Vpoc ≤35kV)</th></tr>
<tr><td>Frequency (r) of voltage changes per hour</td><td>$\Delta U_{dyn}/U_{pre\text{-}disturbance}$ (%)</td><td>$\Delta U_{dyn}/U_{pre\text{-}disturbance}$ (%)</td></tr>
</table>
</td></tr>
</table>

NER version	NER clause reference	Description	Required REZ Access Standard (Automatic – A, Minimum – M)	Detailed description of required performance standard

r ≤ 1	3.0	4.00
1 < r ≤ 10	2.5	3.00
10 < r ≤ 100	1.5	2.00
100 < r	1.0	1.25

These limits do not apply for events that occur less frequently than once per day.

For events that occur less frequently than once per day, the rapid *voltage* change emission limits are:

(i) the dynamic *voltage* change (ΔUdyn/Upre-disturbance) must not exceed 10% of Nominal Voltage; and

(ii) the dynamic *voltage* changes must not cause the Connection Point *voltage* to exceed the range 90% to 110% of Nominal Voltage for any duration.

(c) Harmonic *voltage* distortion greater than the [*Automatic Access Standard]* emission limits listed in Table 2.3:

Table 2.3: Harmonic Voltage Distortion Limits

Harmonic order	Harmonic *voltage* emission limit (% of nominal Connection Point *voltage*)
2	
3	
4	
5	

NER version	NER clause reference	Description	Required REZ Access Standard (Automatic – A, Minimum – M)	Detailed description of required performance standard		
					6	
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					26	
					27	

NER version	NER clause reference	Description	Required REZ Access Standard (Automatic – A, Minimum – M)	Detailed description of required performance standard		
					28	
					29	
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					31	
					32	
					33	
					34	
					35	
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					47	
					48	
					49	

<table>
<tr><th>NER version</th><th>NER clause reference</th><th>Description</th><th>Required REZ Access Standard (Automatic – A, Minimum – M)</th><th>Detailed description of required performance standard</th></tr>
<tr><td></td><td></td><td></td><td></td><td>
<table>
<tr><td>50</td><td></td></tr>
<tr><td>Total Harmonic Distortion (THD)</td><td></td></tr>
</table>
Notes: (1) THD is calculated considering the complete spectrum of harmonic voltage distortion at the Connection Point. Interharmonic emission limit = 0.1% for each individual interharmonic between harmonic orders 1 to 50.

(d) Voltage unbalance greater than the Automatic Access Standard emission limits listed in Table 2.4:
Table 2.4: Voltage Unbalance Limits
<table>
<tr><td rowspan="2">Connection Point Nominal Voltage (kV)</td><td colspan="4">Negative Sequence voltage emission limit (% of Nominal Connection Point Voltage)</td></tr>
<tr><td>No contingency event</td><td>Credible contingency event</td><td>General</td><td>Once per hour</td></tr>
<tr><td></td><td>30-min average</td><td>30-min average</td><td>10-min average</td><td>1-min average</td></tr>
<tr><td></td><td></td><td></td><td></td><td></td></tr>
</table>
(e) Balancing of load currents when energy storage is drawing power from the system [For energy storage systems, delete if not applicable]:
When the energy storage system is consuming, the load current imbalance is taken to be within the acceptable limits required by clause S5.3.6 if voltage unbalance remains within the limits specified above.
</td></tr>
<tr><td></td><td>S5.2.5.3</td><td>Generating System Response to Frequency Disturbances</td><td>A</td><td>[Requirements also apply to energy storage systems, considering bidirectional operation. Substitute ‘energy storage system’ for ‘generating system’]</td></tr>
</table>

<table>
<tr><th>NER version</th><th>NER clause reference</th><th>Description</th><th>Required REZ Access Standard (Automatic – A, Minimum – M)</th><th>Detailed description of required performance standard</th></tr>
<tr><td></td><td></td><td></td><td></td><td>Unless the rate of change of frequency is outside the range of ±4 Hz/s for more than 0.25 s, ±3 Hz/s for more than 1.00 s, the generating system and each of its generating units is capable of continuous uninterrupted operation for frequencies in the ranges indicated in Table 2.5:
Table 2.5: Frequency Limits for Continuous Uninterrupted Operation
<table><tr><th>Frequency range[1] (Hz)</th><th>Duration[1]</th></tr><tr><td>47 to 48</td><td>2 minutes</td></tr><tr><td>48 to 49.5</td><td>10 minutes [2]</td></tr><tr><td>49.5 to 50.5</td><td>continuous</td></tr><tr><td>50.5 to 52</td><td>10 minutes</td></tr></table>Notes: [1] Based on the frequency operating standard effective 1 January 2020.
[2] 10 minutes, including any time spent in the range 47-48 Hz.</td></tr>
<tr><td></td><td>S5.2.5.4</td><td>Generating System Response to Voltage Disturbances</td><td>A</td><td>[Requirements also apply to energy storage systems, considering bidirectional operation. Substitute ‘energy storage system’ for ‘generating system’]

(a) The generating system and each of its generating units is capable of continuous uninterrupted operation where a power system disturbance causes the voltage at the point of application to vary within the ranges indicated in Table 2.6:

Table 2.6: Voltage Limits for Continuous Uninterrupted Operation (over-voltage)
<table><tr><th>Voltage range (% of Normal Voltage)</th><th>Duration</th></tr><tr><td>> 130%</td><td>0.02 seconds [1]</td></tr><tr><td>125% to 130%</td><td>0.2 seconds [1]</td></tr></table></td></tr>
</table>

				<table><tr><td>120% to 125%</td><td>2.0 seconds [1]</td></tr><tr><td>115% to 120%</td><td>20 seconds [1]</td></tr><tr><td>110% to 115%</td><td>20 minutes</td></tr></table> where the point of application is: [insert location, based on these criteria • for a *generating system* with Connection Point nominal *voltage* equal to or less than 66 kV, and not having a transformer with onload tap changing between the *generating units* and the Connection Point, the *transmission system* point electrically nearest to the Connection Point. • otherwise, the Connection Point.] (b) The *generating system* and each of its *generating units* is capable of *continuous uninterrupted operation* where a power system *disturbance* causes the *voltage* at the Connection Point to vary within the ranges indicated in Table 2.7: Table 2.7: Voltage Limits for Continuous Uninterrupted Operation (normal operation and under-voltage) <table><tr><th>Voltage range (% of Normal Voltage)</th><th>Duration</th></tr><tr><td>90% to 110%</td><td>continuous</td></tr><tr><td>80% to 90%</td><td>10 s[2]</td></tr><tr><td>70% to 80%</td><td>2 s[2]</td></tr></table> Notes: [1] After the Connection Point *voltage* first varied above 110% of Normal Voltage before returning to between 90% and 110% of Normal Voltage. [2] After the Connection Point *voltage* first varied below 90% of Normal Voltage before returning to between 90% and 110% of Normal Voltage. [Insert any operational arrangements necessary to ensure the *generating system* and each of its *generating units* will meet these levels under abnormal *network* or *generating system* conditions].
	S5.2.5.5	Generating System Response to Disturbances following Contingency Events	A	[Requirements also apply to energy storage systems, considering bidirectional operation. Substitute 'energy storage system' for '*generating system*'] For the purposes of this *performance standard,* a fault includes a fault of the relevant type having a metallic conducting path.

<table>
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<tr><td></td><td></td><td></td><td></td><td>
Fault clearance times for relevant equipment are specified in Table 2.8:
Table 2.8: Fault clearance times - primary and breaker fail protection system
<table>
<tr><th rowspan="2">Voltage level</th><th colspan="2">Primary protection system(1)</th><th colspan="2">Circuit breaker fail protection system(1)</th></tr>
<tr><th>Near end faults</th><th>Far end faults</th><th>Near end faults</th><th>Far end faults</th></tr>
<tr><td>500 kV</td><td></td><td></td><td></td><td></td></tr>
<tr><td>330 kV</td><td></td><td></td><td></td><td></td></tr>
<tr><td>220 kV</td><td></td><td></td><td></td><td></td></tr>
<tr><td>132 kV</td><td></td><td></td><td></td><td></td></tr>
<tr><td>[Insert] kV Line [Insert line number](2)</td><td></td><td></td><td></td><td></td></tr>
<tr><td>[Insert] kV Line [Insert line number](2)</td><td></td><td></td><td></td><td></td></tr>
<tr><td>[Insert] kV Line [Insert line number](2)</td><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="5">[Insert line number]: [Insert substation name] to [Insert substation name]
[Insert line number]: [Insert substation name] to [Insert substation name]
[Insert line number]: [Insert substation name] to [Insert substation name]</td></tr>
</table>
[Note: (1) Specify clearance times as per Table S5.1a.2 of the NER, or as applicable in the local network, whichever is the longest.]
[Note: (2) Specific line clearance times applicable in the local network to be inserted, if longer than the standard clearance times nominated above.]
</td></tr>
</table>

<table>
<tr><th>NER version</th><th>NER clause reference</th><th>Description</th><th>Required REZ Access Standard (Automatic – A, Minimum – M)</th><th>Detailed description of required performance standard</th></tr>
<tr><td></td><td></td><td></td><td></td><td>
Table 2.9: Line automatic reclose schemes and times
<table>
<tr><th>Line voltage level</th><th>66 kV</th><th>132 kV</th><th>330 kV</th><th>220 kV (NSW)</th><th>500 kV</th></tr>
<tr><td>Automatic reclose scheme</td><td>3-phase</td><td>3-phase</td><td>3-phase</td><td>3-phase</td><td>3-phase</td></tr>
<tr><td>Automatic reclose dead-time*</td><td>5 s</td><td>5 s</td><td>15 s</td><td>1.25 s</td><td>15 s</td></tr>
<tr><td>Lock-out time**</td><td>20 s</td><td>20 s</td><td>35 s</td><td>35 s</td><td>35 s</td></tr>
<tr><td>Number of reclose attempts within dead-time and lock-out time</td><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td></tr>
</table>
*Circuit breaker recloses if incoming line remains 'dead' for specified time duration of initial trip.
** No further reclosure will occur (lockout) if there is a second trip within specified time duration of initial trip.

Single disturbance (reflects clause S5.2.5.5(c) of the NER):
(1) Provided that the event is not one that would disconnect the generating system from the power system by removing network elements from service, the generating system and each of its generating units will remain in continuous uninterrupted operation for any disturbance caused by:
(i) a credible contingency event;
(ii) a three-phase fault in a transmission system cleared by all relevant primary protection systems;
(iii) a two-phase-to-ground, phase-to-phase or phase-to-ground fault in the transmission system cleared in the longest time expected to be taken for a relevant breaker fail protection system to clear the fault;
(iv) a three-phase, two-phase-to-ground, phase-to-phase or phase-to-ground fault in a distribution network cleared in the longest time expected to be taken for a relevant breaker fail protection system to clear the fault.
</td></tr>
</table>

NER version	NER clause reference	Description	Required REZ Access Standard (Automatic – A, Minimum – M)	Detailed description of required performance standard
				Multiple disturbances (reflects clause S5.2.5.5(d), (s) and (t) of the NER): (2) When assessing multiple disturbances: a fault that is re-established following operation of *automatic reclose equipment* is counted as a separate disturbance. The *generating system* and each of its *generating units* will remain in *continuous uninterrupted operation* for a series of up to 15 disturbances within any 5-minute period caused by any combination of the events described above where: (i) up to 6 of the disturbances cause the Connection Point *voltage* to drop below 50% of Normal Voltage; (ii) in parts of the *network* where three-phase automatic reclosure is permitted up to two of the disturbances are three phase faults, and otherwise up to one three phase fault where the Connection Point *voltage* drops below 50% of Normal Voltage; (iii) up to one disturbance is cleared by a *breaker fail protection system* or similar back-up *protection system*; (iv) up to one disturbance causes the Connection Point *voltage* to vary within the ranges under clause S5.2.5.4(a)(7) and (8) of the NER; (v) the minimum clearance from the end of one disturbance, and commencement of the next disturbance, may be 0 milliseconds; and (vi) all remaining disturbances are caused by faults other than three-phase faults, provided that none of the events would result in: (vii) the islanding of the *generating system* or cause a material reduction in *power transfer capability* by removing *network elements* from service; (viii) the cumulative time that the Connection Point *voltage* is lower than 90% of Normal Voltage exceeding 1,800 milliseconds within any 5-minute period; or (ix) within any 5-minute period, the time integral of the difference between 90% of Normal Voltage and the Connection Point *voltage* when the Connection Point *voltage* is lower than 90% of Normal Voltage exceeding 1 pu second.

NER version	NER clause reference	Description	Required REZ Access Standard (Automatic – A, Minimum – M)	Detailed description of required performance standard
				(x) [delete if plant can tolerate cumulative 1,800 milliseconds faults within a 30 second period, or if no thermal limitations affecting ability to ride through faults] exceedance of a thermal limit on a *generating unit* or dynamic *reactive plant* within the *generating system* due to occurrence of [insert a number of faults not less than 4] or more faults, within any 30 second period. (xi) despite (v), a doubly-fed induction generator may trip where the timing between two or more faults is [detail fault timing that would lead to a mechanical resonance condition, if any. Delete clause if no such condition is identified] which can lead to a mechanical resonance condition or mechanical overload. The *generating system* will not, as a consequence of its *connection*, cause other generating *plant* or *loads* to trip as a result of an event, when they would otherwise not have tripped for the same event. [Insert any operational arrangements or conditions necessary to ensure the *generating system* and each of its *generating units* will meet its agreed performance levels under abnormal *network* or *generating system* conditions]. For *asynchronous generating systems* (reflects clause S5.2.5.5(f)-(i) and (u) of the NER): For the purposes of paragraphs (3)(i)(a) and (b), the maximum continuous current of the *generating system* at the assessment location is [insert A]. [For the reactive current contribution assessed at the Connection Point, the maximum continuous current of the *generating system* is to be determined based on the *rated active power* and the maximum *reactive power* capability proposed under clause S5.2.5.1 and the Nominal Voltage at the Connection Point]. (3) Subject to any changed *power system* conditions or energy source availability beyond the *Generator's* reasonable control, the *generating system,* including all operating a*synchronous generating units* (in the absence of a disturbance), in respect of fault types described in clause S5.2.5.5(c)(2) to (4) of the NER, will supply to, or absorb from, the *network*: (i) during the disturbance and maintained until the Connection Point *voltage* recovers to between 90% and 110% of Normal Voltage, to assist the maintenance of *power system voltages* during the fault: (a) capacitive reactive current in addition to its pre-disturbance level of at least 2% [this value is a design requirement; this value may be optimised during batch tuning of REZ generating systems] of its

NER version	NER clause reference	Description	Required REZ Access Standard (Automatic – A, Minimum – M)	Detailed description of required performance standard
				maximum continuous current for each 1% reduction of the Connection Point *voltage*, up to its maximum continuous current, commencing at a *voltage* greater than 80% of Connection Point Normal Voltage*;* (b) inductive reactive current in addition to its pre-disturbance level of at least 2% [this value is a design requirement] of its maximum continuous current for each 1% increase of the Connection Point *voltage,* up to [sufficient current, please specify if possible] to maintain its rated apparent power, commencing at a *voltage* less than 120% of Connection Point Normal Voltage; and, (c) the reactive current response measured at the *generating unit* terminal, or if the reactive current response is provided by an ancillary dynamic *reactive plant*, at the terminal of that *plant*, will: (A) commence within 20 milliseconds of the initiating condition; (B) have an initiating condition that is: [insert the initiating condition: *voltage* excursion commencement, exceeding the *voltage* change threshold or traversing *voltage* threshold level. Delete whichever is not applicable and retain the condition relevant to the technology]; and, (C) have a *settling time* as soon as practicable and be *adequately damped*. (d) the reactive current contribution is calculated using [delete whichever not applicable] [phase-to-phase], [phase-to-ground] or [sequence components, the ratio of positive to negative sequence components must be agreed with *AEMO* and the NSP for the types of disturbances listed in clause S5.2.5.5, and recorded]. (ii) From [insert ms] [*active power* recovery time of less than 300 ms to be specified, this value may be amended if batch tuning of REZ generating systems affects the recovery time] of the *voltage* recovering to within 90% to 110% of Normal Voltage on the Connection Point on all three phases after the clearance of the fault, *active power* of at least 95% of the level existing just prior to the fault.
	S5.2.5.6	Quality of Electricity Generated and Continuous	M	[Transgrid standard requirements and layout reflected in paragraphs (a), (b) and (c) for clause S5.2.5.6] [Requirements also apply to energy storage systems, considering bidirectional operation. Substitute 'energy storage system' for '*generating system*']

<table>
<tr><th>NER version</th><th>NER clause reference</th><th>Description</th><th>Required REZ Access Standard (Automatic – A, Minimum – M)</th><th>Detailed description of required performance standard</th></tr>
<tr><td></td><td></td><td>Uninterrupted Operation</td><td></td><td>
The generating system and each of its operating generating units and reactive plant, will not disconnect from the power system as a result of voltage fluctuation, harmonic voltage distortion and voltage unbalance conditions at the Connection Point up to the levels specified below:
(a) voltage fluctuations at the Connection Point up to the levels listed in Table 2.10: [Delete non-applicable column depending on Connection Point Nominal Voltage]
Table 2.10: Voltage Fluctuation Limits
<table>
<tr><td>Connection Point Nominal Voltage (kV)</td><td>[insert POC voltage] (for Vpoc >35kV)</td><td>[insert POC voltage] (for Vpoc ≤35kV)</td></tr>
<tr><td>Flicker index</td><td>Flicker level</td><td>Flicker level</td></tr>
<tr><td>P_{st}</td><td>1.5</td><td>1.35</td></tr>
<tr><td>P_{lt}</td><td>1.125</td><td>1.05</td></tr>
</table>
(where flicker levels are calculated by excluding voltage fluctuation caused due to uncontrolled events such as faults in the power system)
(b) harmonic voltage distortion levels at the Connection Point up to the levels listed in Table 2.11: [Delete non-applicable column depending on Connection Point Nominal Voltage]
Table 2.11: Harmonic Voltage Distortion Limits
<table>
<tr><td>Connection point Nominal Voltage (kV)</td><td>[insert POC voltage] (for Vpoc >35kV)</td><td>[insert POC voltage] (for Vpoc ≤35kV)</td></tr>
<tr><td>Harmonic order</td><td>Harmonic voltage (% of nominal Connection Point voltage)</td><td>Harmonic voltage (% of nominal Connection Point voltage)</td></tr>
<tr><td>2</td><td>2.25</td><td>2.40</td></tr>
<tr><td>3</td><td>3.00</td><td>6.00</td></tr>
</table>
</td></tr>
</table>

NER version	NER clause reference	Description	Required REZ Access Standard (Automatic – A, Minimum – M)	Detailed description of required performance standard			
					4	1.50	1.50
					5	3.00	7.50
					6	0.75	0.75
					7	3.00	6.00
					8	0.60	0.60
					9	1.50	1.80
					10	0.60	0.60
					11	2.25	4.50
					12	0.30	0.30
					13	2.25	3.75
					14	0.30	0.30
					15	0.45	0.45
					16	0.30	0.30
					17	1.50	2.40
					18	0.30	0.30
					19	1.50	1.80
					20	0.30	0.30
					21	0.30	0.30
					22	0.30	0.30
					23	1.05	1.80
					24	0.30	0.30
					25	1.05	1.80

NER version	NER clause reference	Description	Required REZ Access Standard (Automatic – A, Minimum – M)	Detailed description of required performance standard			
					26	0.30	0.30
					27	0.30	0.30
					28	0.30	0.30
					29	0.95	0.95
					30	0.30	0.30
					31	0.90	0.90
					32	0.30	0.30
					33	0.30	0.30
					34	0.30	0.30
					35	0.84	0.84
					36	0.30	0.30
					37	0.81	0.81
					38	0.30	0.30
					39	0.30	0.30
					40	0.30	0.30
					41	0.76	0.76
					42	0.30	0.30
					43	0.74	0.74
					44	0.30	0.30
					45	0.30	0.30
					46	0.30	0.30
					47	0.70	0.70

<table>
<tr><th>NER version</th><th>NER clause reference</th><th>Description</th><th>Required REZ Access Standard (Automatic – A, Minimum – M)</th><th>Detailed description of required performance standard</th></tr>
<tr><td></td><td></td><td></td><td></td><td>
<table>
<tr><td>48</td><td>0.30</td><td>0.30</td></tr>
<tr><td>49</td><td>0.68</td><td>0.68</td></tr>
<tr><td>50</td><td>0.30</td><td>0.30</td></tr>
<tr><td>Total Harmonic Distortion</td><td>4.50</td><td>9.75</td></tr>
</table>

(c) voltage unbalance levels at the Connection Point up to the levels listed in Table 2.12: [Delete non-applicable row depending on Connection Point Nominal Voltage]
Table 2.12: Voltage Unbalance Limits
<table>
<tr><th rowspan="2">Connection Point Nominal Voltage (kV)</th><th colspan="3">Negative sequence voltage (% of nominal Connection Point voltage)</th></tr>
<tr><th>30 minute average</th><th>10 minute average</th><th>1 minute average (Once per hour)</th></tr>
<tr><td>[insert POC voltage]
(for Vpoc >100kV)</td><td>1.4</td><td>2.0</td><td>4.0</td></tr>
<tr><td>[insert POC voltage]
(for Vpoc <100kV)</td><td>2.6</td><td>4.0</td><td>5.0</td></tr>
</table>
</td></tr>
<tr><td></td><td>S5.2.5.7</td><td>Partial Load Rejection</td><td>A</td><td>[Requirements also apply to energy storage systems, considering bidirectional operation. Substitute ‘energy storage system’ for ‘generating system’]

For the purposes of this performance standard:
Minimum generation means the minimum sent out generation for continuous stable operation, P_{MIN} = [insert] MW.</td></tr>
</table>

NER version	NER clause reference	Description	Required REZ Access Standard (Automatic – A, Minimum – M)	Detailed description of required performance standard
				The *generating system* is capable of *continuous uninterrupted operation* during and following a *power system load* reduction of 30% from its pre-disturbance level or equivalent impact from separation of part of the *power system* in less than 10 s, provided that the *loading level* remains above P_{MIN}.
	S5.2.5.8	Protection of Generating Systems from Power System Disturbances	M	[Requirements also apply to energy storage systems, considering bidirectional operation. Substitute 'energy storage system' for '*generating system*'] (a) Subject to paragraphs (b) [delete reference to (b) if *generating system* is <30MW or distribution connected] and (e) where the *generating system* or any of its *generating units* that are required by the NSP or *Generator* to be automatically *disconnected* from the *power system* in response to abnormal conditions arising from the *power system*, the relevant *protection system* or *control system* does not *disconnect* the *generating system* for: (i) conditions for which it must remain in *continuous uninterrupted operation*; or (ii) conditions it must withstand under the NER. (b) [Delete all of paragraph (b) if *generating system* is <30MW or distribution connected. Applies to energy storage systems only when generating] The *generating system* has *facilities* to automatically and rapidly reduce its *generation*: [Delete non-applicable paragraphs below (either (i) or (ii)), include any limitations e.g. minimum generation level] (i) by at least half, if the *frequency* at the Connection Point exceeds [a level nominated by *AEMO* (not less than the upper limit of the *operational frequency tolerance band*)] and the duration above this *frequency* exceeds a value nominated by *AEMO* where the reduction may be achieved by reducing the output of the *generating system* within 3s and holding the output at the reduced level until the *frequency* returns to within the *normal operating frequency band*. (ii) in proportion to the difference between the *frequency* at the Connection Point and a level nominated by *AEMO* (not less than the upper limit of the *operational frequency tolerance band*) such that the *generation* is reduced, by at least half, within 3 s of the *frequency* reaching the upper limit of the *extreme frequency excursion tolerance limits*. (c) [Delete paragraph (c) if *AEMO* or the NSP do not require it.] The *generating system* must be automatically *disconnected* by a local or remote control scheme whenever the part of the *network* to which it is *connected* has been *disconnected* from the *national grid* and has formed an island supplying a *Customer*.

NER version	NER clause reference	Description	Required REZ Access Standard (Automatic – A, Minimum – M)	Detailed description of required performance standard
				(d) The conditions for which the *generating unit* or *generating system* must trip are: [specify the conditions to facilitate AEMO and NSP maintaining power system security]. (e) The conditions for which the *generating unit* or *generating system* must not trip are: [specify the conditions to facilitate AEMO and NSP maintaining power system security]. (i) For a rate of change of *frequency* of 6 Hz/s for up to 0.25 seconds. (f) Notwithstanding the *performance standards* under clauses S5.2.5.3, S5.2.5.4, S5.2.5.5, S5.2.5.6 and S5.2.5.7 of the NER the *generating system* may be automatically *disconnected* from the *power system* under any of the following conditions [delete inapplicable sub-paragraphs]: (i) in accordance with the *ancillary services agreement* between the *Generator* and *AEMO* (ii) where a *load* that is not part of the *generating system* has the same Connection Point as the *generating system* and *AEMO* and the NSP agree that the *disconnection* would in effect be under-frequency *load shedding*; [delete if none exists] (iii) where the *generating system* is automatically *disconnected* under paragraphs (a), (b) [deleted reference to (b) if *generating system* is <30MW or distribution connected] or the *performance standard* under clause S5.2.5.9 of the NER; (iv) where the *generating system* is automatically *disconnected* under the *performance standard* under clause S5.2.5.10 of the NER; or (v) in accordance with an agreement between the *Generator* and the NSP (including an agreement in relation to an emergency control scheme under clause S5.1.8 of the NER) to provide a service that *AEMO* agrees is necessary to maintain or restore *power system security* in the event of a specified *contingency event*. [delete if none exists] (vi) Where the *generating system* is automatically *disconnected* from the *power system* via an *emergency frequency control scheme* (EFCS) in accordance with an *EFCS settings schedule* as maintained by AEMO and notified to the *Generator* from time to time.

<table>
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<tr><td></td><td>S5.2.5.9</td><td>Protection Systems that Impact on Power System Security</td><td>A</td><td>[Requirements also apply to energy storage systems, considering bidirectional operation. Substitute ‘energy storage system’ for ‘generating system’]
(a) The generating system has primary protection systems to disconnect from the power system any faulted element within the generating system and in the protection zones that include the Connection Point, within the fault clearance times specified in Table 2.13. [insert fault clearance times determined under clause S5.1.9(a)(1) of the NER, but subject to clauses S5.1.9(k) and (l) in the table below].
Table 2.13: Primary Protection System Fault Clearance Times
<table>
<tr><th></th><th>Local</th><th>Remote</th></tr>
<tr><td>[Insert HV level] kV Bus</td><td>[Insert time] ms</td><td>-</td></tr>
<tr><td>[Insert MV level] kV Bus</td><td>[Insert time] ms</td><td>-</td></tr>
<tr><td>[Insert MV level] kV feeder (other than Ph-G)</td><td>[Insert time] ms</td><td>[Insert time] ms</td></tr>
<tr><td>[Insert MV level] kV feeder (Ph-G)</td><td>[Insert time] ms</td><td>[Insert time] ms</td></tr>
<tr><td>[Insert LV level] V</td><td>[Insert time] ms</td><td>-</td></tr>
</table>
(b) Each primary protection system has sufficient redundancy to ensure that a faulted element within its protection zone is disconnected from the power system within the applicable fault clearance time with any single protection element (including any communications facility on which that protection system depends) out of service.
(c) Breaker fail protection systems are provided to clear faults that are not cleared by the circuit breakers controlled by the primary protection system, within the following fault clearance times in Table 2.14:
Table 2.14: Circuit Breaker Fail System Fault Clearance Times
<table>
<tr><th></th><th>Circuit breaker fail</th></tr>
<tr><td>[Insert HV level] kV Bus</td><td>[Insert time] ms</td></tr>
</table></td></tr>
</table>

<table>
<tr><th>NER version</th><th>NER clause reference</th><th>Description</th><th>Required REZ Access Standard (Automatic – A, Minimum – M)</th><th>Detailed description of required performance standard</th></tr>
<tr><td></td><td></td><td></td><td></td><td>
<table>
<tr><td>[Insert MV level] kV Bus</td><td>[Insert time] ms</td></tr>
<tr><td>[Insert MV level] kV feeder (other than Ph-G)</td><td>[Insert time] ms</td></tr>
<tr><td>[Insert MV level] kV feeder (other than Ph-G)</td><td>[Insert time] ms</td></tr>
<tr><td>[Insert MV level] kV feeder (Ph-G)</td><td>[Insert time] ms</td></tr>
<tr><td>[Insert LV level] V</td><td>[Insert time] ms</td></tr>
</table>

(d) The protection system design will be coordinated with other protection systems, avoid consequential disconnection of other Network Users' facilities and take into account the NSP's existing obligations under their connection agreements with other Network Users.</td></tr>
<tr><td></td><td>S5.2.5.10</td><td>Protection to Trip Plant for Unstable Operation</td><td>A</td><td>[Requirements also apply to energy storage systems, considering bidirectional operation. Substitute 'energy storage system' for 'generating system']

(1) The generating system due to sustained unstable behaviour of the generating units, will not cause active power, reactive power or voltage at the Connection Point to become unstable as defined in the guidelines for power system stability established under NER clause 4.3.4(h).

(2) The generating system has an instability detection system for voltage, active power or reactive power oscillations, which will promptly raise and send a SCADA alarm to the Network Service Provider and AEMO control centres [Detection scheme to be determined and agreed at detailed design].

(3) The generating system has a protection system that is capable of promptly disconnecting the generating system for sustained voltage oscillations based on the contribution of the generating system to the oscillation [Protection scheme to be determined and agreed at detailed design].</td></tr>
<tr><td></td><td>S5.2.5.11</td><td>Frequency Control</td><td>A</td><td>[Requirements also apply to energy storage systems, considering bidirectional operation. Substitute 'energy storage system' for 'generating system']</td></tr>
</table>

NER version	NER clause reference	Description	Required REZ Access Standard (Automatic – A, Minimum – M)	Detailed description of required performance standard
				For the purposes of this *performance standard*: 'Maximum operating level' = [Insert] MW. 'Minimum operating level' = [Insert] MW. 'droop' means, in relation to *frequency response mode*, the percentage change in *power system frequency* as measured at the Connection Point, divided by the percentage change in *power transfer* of the *generating system* expressed as a percentage of the maximum operating level of the *generating system*. Droop must be measured at *frequencies* that are outside the deadband and within the limits of *power transfer*. *Power system frequency* is measured at the Connection Point. (1) The *generating system's power* transfer to the *power system* will not: (i) increase in response to a rise in *power system frequency*; or (ii) decrease in response to a fall in *power system frequency*; and (2) The *generating system* is capable of operating in *frequency response mode* such that, subject to energy source availability [delete if not semi-scheduled], it automatically provides a proportional: (i) decrease in *power transfer* to the *power system* in response to a rise in *power system frequency*; and (ii) increase in *power transfer* to the *power system* in response to a fall in *power system frequency,* sufficiently rapidly and sustained for a sufficient period for the *Generator* to be in a position to offer measurable amounts all *market ancillary services* for the provision of *power system frequency* control. (3) Nothing in paragraph (2) requires the *generating system* to operate below its minimum operating level in response to a rise in *power system frequency*, or above its maximum operating level in response to a fall in *power system frequency*. (4) The change in *power transfer* to the *power system* will occur with no delay beyond that required for stable operation, or inherent in the *plant* controls, once *power system frequency* leaves a deadband around 50 Hz. (5) The *generating system's*: (i) deadband can be set within the range of 0 to ± 1.0 Hz [different deadband settings may be applied for a rise or fall in the *frequency* of the *power system* as measured at the Connection Point – delete if one deadband applies for rise and fall]; and

NER version	NER clause reference	Description	Required REZ Access Standard (Automatic – A, Minimum – M)	Detailed description of required performance standard
				(ii) droop can be set within the range of 2% to 10%. (6) Each *control system* used to satisfy this *performance standard* is *adequately damped*. The amount of relevant *market ancillary service* for which the *plant* is registered will not exceed the amount that would be consistent with this *performance standard*.
	S5.2.5.12	Impact on Network Capability	A	[Requirements also apply to energy storage systems, considering bidirectional operation. Substitute 'energy storage system' for '*generating system*'] The *generating system* has *plant* capabilities and *control systems* that are sufficient so that when *connected* to the *power system* it does not reduce any *inter-regional* or *intra-regional power transfer capability* below the level that would apply if the *generating system* were not *connected*.
	S5.2.5.13	Voltage and Reactive Power Control	A	(1) [Transgrid standard requirements incorporated for clause S5.2.5.13] [Requirements also apply to energy storage systems, considering bidirectional operation. Substitute 'energy storage system' for '*generating system*'] The *generating system* has *plant* capabilities and *control systems* sufficient to ensure that: (i) *power system* oscillations, for the frequencies of oscillation of the *generating unit* against any other *generating unit or system*, are *adequately damped*; (ii) operation of the *generating system* does not degrade the damping of any critical mode of oscillation of the *power system*; and (iii) operation of the *generating system* does not cause instability (including hunting of *tap-changing transformer control systems*) that would adversely impact other *Registered Participants*. (2) The *control systems* used with this *generating system* have: (i) for the purposes of disturbance monitoring and testing, permanently installed and operational, monitoring and recording *facilities* for key variables including each input and output; and (ii) *facilities* for testing the *control system* sufficient to establish its dynamic operational characteristics. (3) The *generating system* has *facilities* with a *control system* to regulate *voltage*, *reactive power* and *power factor*, with the ability to: (i) operate in any control mode; and

NER version	NER clause reference	Description	Required REZ Access Standard (Automatic – A, Minimum – M)	Detailed description of required performance standard
				(ii) switch between control modes. All control modes are to be implemented at the time of commissioning of the *generating system*. The normal operating mode of the *generating system* is *voltage* control with a re*active power* droop characteristics as described in paragraph (4) below. (4) The *generating system* has a *voltage control system* that: (i) regulates *voltage* [Insert: at the Connection Point or an agreed location in the power system (including within the *generating system*)] to within 0.5% of the target determined by the control system in accordance with a *voltage-reactive power* droop, based on [Insert bus name] [Insert bus *voltage*] kV bus *voltage* and *reactive power* flow at the Connection Point, of 12.7% on a base of *rated active power* at the Connection Point [expressed in MVA]. The *rated active power* is proportional to the number of *generating units* in-service [this value may be varied as a result of batch tuning of REZ generating systems]. (ii) regulates *voltage* in a manner that helps to support *network voltages* during faults and does not prevent the NSP from achieving the requirements under clause S5.1a.3 and S5.1a.4 of the NER; (iii) allows the *voltage* setpoint to be continuously controllable in the range of at least 95% to 105% of the target *voltage* at [the Connection Point (as recorded in the *connection agreement*) or the agreed location in the *power system*] [adjust to align with sub-paragraph (i)], without reliance on a *tap-changing transformer* and subject to the *reactive power* capability referred to in the *performance standard* under clause S5.2.5.1; (iv) has limiting devices to ensure that a *voltage* disturbance does not cause the *generating unit* to trip at the limits of its operating capability. The limiting devices: (A) do not detract from the performance of any power system stabiliser or power oscillation damping capability; and (B) are co-ordinated with all *protection systems*. (5) The *generating system* has a *voltage control system* that: (i) with the *generating system connected* to the *power system*, has *settling times* for *active power*, *reactive power* and *voltage* due to a step change of *voltage* setpoint or *voltage* at [insert the location agreed under subparagraph (4)(i)], of less than:

NER version	NER clause reference	Description	Required REZ Access Standard (Automatic – A, Minimum – M)	Detailed description of required performance standard
				(A) 5.0 s for a 5% *voltage* disturbance with the *generating system connected* to the *power system*, from an operating point where the *voltage* disturbance would not cause any limiting device to operate; and (B) 7.5 s for a 5% *voltage* disturbance with the *generating system connected* to the *power system*, when operating into any limiting device from an operating point where a *voltage* disturbance of 2.5% would just cause the limiting device to operate; (ii) for a 5% step change in the *voltage* setpoint, has *reactive power* rise time, of less than [insert] [*reactive power* rise time of less than 4 s to be specified]. [this value may be varied as a result of batch tuning of REZ generating systems] (iii) has power oscillation damping capability with sufficient flexibility to enable damping performance to be maximised with characteristics as described in paragraph (6); (iv) for the purpose of paragraph (5) the *active power* settling time is deemed to be compliant with the settling time requirements in (A) and (B) if the *active power* disturbance resulting from a *voltage* disturbance is less than 5 MW. (6) The *power system* stabiliser or power oscillation damping device has functionality agreed with AEMO and the relevant *Network Service Provider* or: (i) [For a *synchronous generating unit*] measurements of rotor speed and *active power* output of the *generating unit* as inputs, and otherwise, measurements of *power system frequency* and *active power* output of the *generating unit* as inputs [delete for *asynchronous generating unit*]; (ii) two washout filters for each input, with ability to bypass one of them if necessary; (iii) [Insert number not less than two] lead-lag transfer function blocks (or equivalent number of complex poles and zeros) with adjustable gain and time-constants, to compensate fully for the phase lags due to the *generating plant*; (iv) an output limiter, which for a *synchronous generating unit* is continually adjustable over the range of ±10% of stator *voltage* [delete for *asynchronous generating unit*]; (v) monitoring and recording *facilities* for key variables including inputs, output and the inputs to the lead-lag transfer function blocks; and (vi) *facilities* to permit testing of the *power system* stabiliser in isolation from the *power system* by injection of test signals, sufficient to establish the transfer function of the *power system* stabiliser.

NER version	NER clause reference	Description	Required REZ Access Standard (Automatic – A, Minimum – M)	Detailed description of required performance standard
				(7) A *reactive power* or *power factor control system* provided under paragraph (3) will: (i) *regulate reactive power* or *power factor* at [the Connection Point or [specify agreed location in the *power system* (including within the *generating system*)]], to within: (A) for a *generating system* operating in *reactive power* mode, 2% of the *generating system's* rating (expressed in MVAr); or (B) for a *generating system* operating in *power factor* mode, a *power factor* equivalent to 2% of the *generating system's* rating (expressed in MVAr); (ii) allow the *reactive power* or *power factor* setpoint to be continuously controllable across the *reactive power* capability range established under the *performance standard* under clause S5.2.5.1; and (iii) with the *generating system connected* to the *power system*, and for a 5% *voltage* disturbance at the location agreed under subparagraph (i): (A) have *settling times* for *active power*, *reactive power* and *voltage* of less than 5.0 s from an operating point where the *voltage* disturbance would not cause any limiting device to operate; and (B) have *settling times* for *active power*, *reactive power* and *voltage* of less than 7.5 s when operating into any limiting device from an operating point where a *voltage* disturbance of 2.5% would just cause the limiting device to operate. (iv) for the purpose of paragraph (7) the *active power settling time* is deemed to be compliant with the *settling time* requirements in (A) and (B) if the *active power* disturbance resulting from a *voltage* disturbance is less than 5 MW. (8) The design and operation of the *generating units* and *generating system's* control systems under paragraphs (4), (5), (6) and (7) are coordinated with the existing *voltage* control systems of the Network Service Provider and of other Network Users, in order to avoid or manager interactions that would adversely impact on the Network Service Provider and other Network Users. (9) The assessment of impact of the *generating units* and *generating system* on *power system* stability and damping of *power system* oscillations shall be in accordance with the guidelines of *power system* stability established under the NER clause 4.3.4(h).

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				[Include any requirements for the design and operation of the *control systems* of the *generating unit* or *generating system* to be coordinated with the existing NSP *voltage control systems* of and those of other *Network Users* and any requirements relating to inclusion in AEMO's Var Dispatch Schedule system]
	S5.2.5.14	Active Power Control	A	[Requirements also apply to energy storage systems, considering bidirectional operation. Substitute 'energy storage system' for '*generating system*'] [Delete paragraph (1), (2) or (3), as applicable – (1) applies to *scheduled generating units/systems*, (2) applies to *non-scheduled generating units/systems* and (3) applies to *semi-scheduled generating units/systems*.] (1) The *generating unit* or *generating system* [delete whichever not applicable] has an *active power control system* that is *adequately damped* and capable of: (i) maintaining and changing its *active power* output in accordance with its *dispatch instructions*; (ii) ramping its *active power* output linearly from one *dispatch* level to another; and (iii) receiving and automatically responding to signals delivered from the *automatic generation control system*, as updated at a rate of once every 4 s [or insert other period specified by *AEMO*]. (2) Subject to the energy source availability, the *generating unit* or *generating system* [delete whichever not applicable] has an *active power control system* that is *adequately damped* and capable of: (i) automatically reducing or increasing its *active power* output within 5 minutes at a constant rate, to or below the level specified in an instruction electronically issued by a *control centre*, subject to subparagraph (iii), (ii) automatically limiting its *active power* output, to below the level specified in subparagraph (i); and (iii) not changing its a*ctive power* output within 5 minutes by more than the raise and lower amounts specified in an instruction electronically issued by a *control centre*. (3) Subject to energy source availability, the *generating unit* or *generating system* [delete whichever not applicable] has an *active power control system* that is *adequately damped* and capable of: (i) automatically reducing or increasing its *active power* output within 5 minutes at a constant rate, to or below the level specified in an instruction electronically issued by a *control centre*;

NER version	NER clause reference	Description	Required REZ Access Standard (Automatic – A, Minimum – M)	Detailed description of required performance standard
				(ii) automatically limiting its *active power* output to or below the level specified in subparagraph (i); (iii) not changing its *active power* output within 5 minutes by more than the raise and lower amounts specified in an instruction electronically issued by a *control centre;* (iv) ramping its *active power* output linearly from one level of *dispatch* to another; and (v) receiving and automatically responding to signals delivered from the *automatic generation control system*, as updated at a rate of once every 4 s [or insert other period specified by *AEMO*].
	S5.2.5.15	Short circuit ratio	A	For the purpose of this clause, the *short circuit ratio* is determined based on the *generating system's rated active power* [3]. (1) The *generating system* has *plant* capability sufficient to operate stably and remain *connected* at a short circuit ratio of 2.2 at the Connection Point, assessed in accordance with the system strength impact assessment guidelines established under NER clause 4.6.6. (2) If the *generating system* is not capable of meeting short circuit ratio of 2.2, the *Generator* may, if agreed by AEMO and the *Network Service Provider*, achieve compliance by demonstrating it has [insert any arrangements agreed with AEMO and *Network Service Provider*, including legally binding commitments to make additional investment in its *plant* or for the supply to it of services to remedy, at its cost, the shortfall in capability, either on *connection* or in agreed circumstances (such as the occurrence of an event that results in a change to the *three phase fault level* at the Connection Point)]. [For the purpose of paragraph (2) the Generator may: (i) reach agreement with the *Network Service Provider* for the *Generator* to undertake investment in its *plant* to achieve *plant* capability sufficient to operate stably and remain *connected* at a short circuit ratio of 2.2; or (ii) procure from the *Network Service Provider*, a system strength service provider or another *Registered Participant*, services to enable the *generating system* to operate stably and remain *connected* at a short circuit ratio of 2.2 but calculated using a *three phase fault level* at the Connection Point that excludes any contribution from the facilities providing the service.]
	S5.2.5.16	Voltage phase angle shift	A	The *generating system* and each of its *asynchronous generating units* must:

[3] The *generating system's rated active power* is expected to be defined in Table 1 of the GPS or within clause S5.2.5.1.

<table>
<tr><th>NER version</th><th>NER clause reference</th><th>Description</th><th>Required REZ Access Standard (Automatic – A, Minimum – M)</th><th>Detailed description of required performance standard</th></tr>
<tr><td></td><td></td><td></td><td></td><td>(1) Not include any vector shift or similar relay or protective function that acts upon voltage phase angle which might operate for phase angle changes less than 30 degrees at the Connection Point.
(2) Have sufficient plant capability to remain connected and operate stably for voltage phase angle changes of up to 30 degrees at the Connection Point.</td></tr>
<tr><td></td><td>S5.2.6.1 and 4.11.1</td><td>Remote Monitoring</td><td>A</td><td>The generating system or generating unit (as applicable) has remote monitoring equipment and remote control equipment to transmit to, and receive from, AEMO's and the Network Service Provider's control centres the quantities specified in Table 2.15 in real-time in accordance with clause 4.11 of the NER:
Table 2.15: Remote Monitoring Equipment and Remote Control Equipment Quantities required by AEMO
<table>
<tr><th>Type of Plant
[delete rows where not applicable]</th><th>Remote Monitoring Quantities</th><th>Remote Control Quantities</th></tr>
<tr><td>Generating systems</td><td>(1) the status of all switching devices that carry the generation;
(2) tap-changing transformer tap position(s) and voltages;
(3) active power and reactive power aggregated for groups of identical generating units;
(4) either the number of identical generating units generating or the generating status of each non-identical generating unit;
(5) either the number of identical generating units available or the available status of each non-identical generating unit;
(6) active power and reactive power for the generating system; and</td><td>(1) voltage control setpoint;
(2) power factor setpoint;
(3) reactive power setpoint; and
(4) voltage, power factor and reactive power control mode selection.</td></tr>
</table></td></tr>
</table>

NER version	NER clause reference	Description	Required REZ Access Standard (Automatic – A, Minimum – M)	Detailed description of required performance standard		
					(7) *voltage, reactive power* and power factor *control system* setpoint and mode (as applicable); (8) the mode of operation of each *generating unit*, inverter control limits, or other information required to reasonably predict the *active power* response of the *generating system* to a change in *power system frequency* at the Connection Point; (9) any quantities reasonable required by AEMO for the Var Dispatch Scheduling (VDS) system. (10) any quantities reasonably required by AEMO to discharge its *market* and *power system security* functions as set out in Chapters 3 and 4 of the NER. (11) *voltage* fluctuation (flicker 10-second calculation window) measurements at the Connection Point; (12) *generating system's* stability status alarm (as per clause S5.2.5.10 of this *Generator Performance Standards);* (13) *generating system's* communication failure shutdown activation alarm for: (i) communication failure between Power Plant Controller and any of the *generating units;*	

NER version	NER clause reference	Description	Required REZ Access Standard (Automatic – A, Minimum – M)	Detailed description of required performance standard		
					(ii) communication failure between Power Plant Controller and any of its measurement units.	
				***Generating units* with *nameplate rating* of 30 MW or more, in respect of *generating unit* stators or power conversion systems (as applicable)**	(1) Current; (2) *Voltage*; and (3) *Active power* and *reactive power*	
				Automated generation control system (AGC) – scheduled generating systems and semi-scheduled generating systems	(1) *AGC* control mode (remote or local); (2) *AGC* availability status; (3) maximum *active power* limit; (4) minimum *active power* limit; (5) maximum *active power* raise ramp rate; and (6) maximum *active power* lower ramp rate;	(1) *AGC active power* setpoint
				Reactive power* equipment that is part of the *generating system* but not part of a *generating unit	(1) Status of all switching devices and *reactive power* for each *reactive power* equipment. (2) Status of all switching devices that connect each harmonic filter.	
				Semi-scheduled generating system	All data specified as mandatory in the relevant *energy conversion model* applicable to that type of *semi-scheduled generating system,* especially the standing and metered data requirements (see the Semi-Scheduled Energy Conversion Model Guidelines for wind and solar *generating systems*)	

NER version	NER clause reference	Description	Required REZ Access Standard (Automatic – A, Minimum – M)	Detailed description of required performance standard		
				Special protection* and *control schemes* agreed with the *Network Service Provider	(1) Run-back scheme status (enabled, disabled, activated); (2) Transfer Trip scheme status (enabled, disabled, activated); and (3) *active power, reactive power* or other control limit, as applicable.	
				Energy Storage System (ESS)	(1) Energy remaining in the ESS (Energy Remaining) (MWh); (2) Estimated maximum energy capacity (Full Pack Energy) (MWh); (3) State of energy available in ESS (Available Maximum Capacity) (%);	
	S5.2.6.2 and 4.11.3	Communications Equipment	A	The *Generator* has provided and will maintain: (1) two separate telephone *facilities* using independent telecommunications service providers, for the purposes of operational communications between the *Generator's* responsible operator under clause 4.11.3(a) of the NER and *AEMO's control centre*; and (2) electricity supplies for *remote monitoring equipment* and *remote control equipment* installed in relation to its *generating system* capable of keeping such equipment available for at least 3 hours following total loss of *supply* at the Connection Point for a relevant *generating unit*.		
	S5.2.7	Power Station Auxiliary Supplies	Not applicable	[Only required if the *generating system* takes its auxiliary supplies via a Connection Point through which its *generation* is not transferred to the *network,* in which case, specify *performance standard* under clause S5.3.5 of the NER as if the *Generator* were a *Market Customer*] The *generating system* takes its auxiliary supplies via [insert Connection Point and Nominal Voltage]. The *power factor* of the *generating system* auxiliary loads will be between 0.9 leading to 0.9 lagging [or insert power factor requirement as agreed with NSP].		

NER version	NER clause reference	Description	Required REZ Access Standard (Automatic – A, Minimum – M)	Detailed description of required performance standard
				[Delete as appropriate]
	S5.2.8	Fault Current	A	(1) The *generating system* limits its contribution to the fault current at the Connection Point to: (i) three-phase fault current, [insert value] kA; (ii) single-phase-to-ground fault current, [insert value] kA; (iii) phase-to-phase-to-ground fault current, [insert value] kA. [Specify calculation basis as necessary] (2) The *generating system's connected plant* are capable of withstanding fault current through the Connection Point up to [insert] kA for a duration of 1 second. (3) The circuit breaker provided to isolate the *generating system* from the *network* is capable of breaking, without damage or restrike, the maximum fault current of [insert value] kA expected to flow through the circuit breaker for any fault in the *network* or in the *generating system*, as specified in the *connection agreement*.