CHAPTER 4

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4.14 Acceptance of Performance Standards

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(n) *AEMO* must establish and maintain a register of the *performance standards* applicable to *plant* as advised by *Registered Participants* in accordance with clause 5.3.7(g)(1), clause 5.3.9(h) or established in accordance with rule 4.14.

(n1) By 1 July each year, *AEMO* must provide to the *AER* an up-to-date copy of the register of *performance standards* required to be maintained under clause 4.14(n), including a copy of the corresponding *performance standards*.

(n2) The *AER* may, at any time, request *AEMO* to provide:

(1) an up-to-date copy of the register of *performance standards* (current as at the date of the *AER's* request) including a copy of the corresponding *performance standards*; or

(2) a copy of the *performance standards* relating to specified *plant*,

if, in the reasonable opinion of the *AER*, it is required for the performance or exercise of the *AER's* functions.

(n3) Following a request under subparagraph (n2), *AEMO* must provide the information requested within:

(1) 10 *business days* for a request under subparagraph (n1); and

(2) five *business days* for a request under subparagraph (n2),

unless the *AER* agrees otherwise.

(o) *AEMO* or, in respect of a matter concerning the quality of *supply* to *Network Users*, *AEMO* in consultation with the relevant *Network Service Provider*, must, when determining the applicable *performance standard* for a particular requirement based on any provision of schedules 5.1, 5.2, 5.3 and 5.3a, require a *Registered Participant* to meet or exceed the *minimum access*

standard but must not require the *Registered Participant* to exceed the relevant *automatic access standard* for that requirement.

(p) A *performance standard* may be amended at any time by agreement between *AEMO*, the relevant *Registered Participant* and the *Network Service Provider* if:

(1) where the *performance standard* was established under a transitional arrangement in rule 4.16 or 4.17, the amendment is consistent with the actual *plant* capability agreed between *AEMO*, the relevant *Registered Participant* and the *Network Service Provider*, even if it is less than the relevant *minimum access standard* that applied to applications to *connect* at the time of agreement; or

(2) the amendment satisfies all requirements for *negotiated access standards* under clause 5.3.4A(b); or

(3) the amendment satisfies all requirements to be an *automatic access standard*.

(q) *AEMO* must not withhold agreement under rule 4.14(p) on a matter that is not an *AEMO advisory matter* under clause 5.3.4A(a), unless the proposed amendment would adversely affect *power system security*.

(r) The *Network Service Provider* may as a condition of considering an amendment proposed under rule 4.14(p) require payment of a fee to meet the reasonable costs anticipated to be incurred by the *Network Service Provider*, other *Network Service Providers* and *AEMO*, in the assessment of the proposed amendment.

(s) The *Network Service Provider* must require payment of a fee under rule 4.14(r) if so requested by *AEMO*.

(t) On payment of the required fee referred to in rule 4.14(r), the *Network Service Provider* must pay the costs anticipated to be incurred by the other *Network Service Providers* and *AEMO*, as appropriate.

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CHAPTER 5

This indicative consolidated version of the National Electricity Rules (NER) includes a mark-up of amendments made to Chapter 5 of the NER as a result of the following rule changes:

- National Electricity Amendment (Transmission connection and planning arrangements) Rule 2017 No. 4
- National Electricity Amendment (Managing the rate of change of power system frequency) Rule No. 9
- National Electricity Amendment (Managing power system fault levels) Rule 2017 No. 10
- National Electricity Amendment (Generating system model guidelines) Rule 2017 No. 11

This indicative consolidation is based on version 99 of the NER.

This version of the NER is provided for information purposes only to indicate how Chapter 5 of the NER will appear as at 1 July 2018 after all schedules of the above rules have commenced.

The Australian Energy Market Commission does not guarantee the accuracy, reliability or completeness of this indicative consolidation. The relevant final Rules referred to above should be consulted for complete and accurate details of the amendments and relevant commencement dates.

5. Network Connection, Planning and Expansion

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5.1A.2 Principles

This Part B is based on the following principles relating to *connection* to the *national grid*:

(a) all *Registered Participants* should have the opportunity to form a *connection* to a *network* and have access to the *network services* provided by the *networks* forming part of the *national grid*;

(b) the terms and conditions on which *connection* to a *network* and provision of *network service* is to be granted are to be set out in commercial agreements on reasonable terms entered into between a *Network Service Provider* and other *Registered Participants*;

(c) the technical terms and conditions of *connection agreements* regarding standards of performance must be established at levels at or above the *minimum access standards* set out in schedules 5.1, 5.2, 5.3 and 5.3a, with the objective of ensuring that the *power system* operates securely and reliably and in accordance with the *system standards* set out in schedule 5.1a;

(d) [**Deleted**]

(e) the operation of the *Rules* should result in the achievement of:

(1) long term benefits to *Registered Participants* in terms of cost and *reliability* of the *national grid*; and

(2) open communication and information flows relating to *connections* between *Registered Participants* themselves, and between *Registered Participants* and *AEMO*, while ensuring the security of *confidential information* belonging to competitors in the *market*.

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5.2.6 Obligations of AEMO

AEMO must provide to *Network Service Providers* on request, a copy of any report provided to *AEMO* by a *Network Service Provider* under clause 5.2.3(d)(12). If a *Registered Participant* reasonably considers that it is or may be adversely affected by a development or change in another *region*, the *Registered Participant* may request the preparation of a report by the relevant *Network Service Provider* as to the technical impacts of the development or change. If so requested, the *Network Service Provider* must prepare such a report and provide a copy of it to *AEMO*, the *Registered Participant* requesting the report and, on request, any other *Registered Participant*.

5.2.6A AEMO review of technical requirements for connection

(a) *AEMO* must conduct a review of some or all of the technical requirements set out in Schedule 5.2, Schedule 5.3 and Schedule 5.3a at least once in every five year period (and may conduct a review more frequently if *AEMO* considers necessary) to assess whether those requirements should be amended, having regard to:

(1) the *national electricity objective*;

(2) the need to achieve and maintain *power system security*;

(3) changes in *power system* conditions; and

(4) changes in technology and capabilities of *facilities* and *plant*.

(b) When conducting a review under this clause 5.2.6A, *AEMO* must consult with, among other affected parties, the *Reliability Panel*.

(c) *AEMO* must commence a review under this clause 5.2.6A with the publication of an approach paper on its website, which must:

(1) set out the scope of the review, including the nature and extent of the issues to be reviewed;

(2) describe the technical requirements to be consulted on; and

(3) state the date by which a draft report will be published.

(d) *AEMO* must publish a draft report on its website that:

(1) sets out *AEMO*'s recommendations for any amendments to the technical requirements set out in Schedule 5.2, Schedule 5.3 and Schedule 5.3a and the reasons for those recommendations; and

(2) includes an invitation for written submissions to be made to *AEMO* within a period specified in the invitation (which must be at least 30 *business days*) on the technical requirements and recommendations in the draft report and must publish any submissions on its website, subject to obligations in respect of *confidential information*.

(e) *AEMO* must publish a final report on its website within 12 months of the approach paper's publication under paragraph (c), setting out *AEMO*'s recommendations for any amendments to the technical requirements set out in Schedule 5.2, Schedule 5.3 and Schedule 5.3a, having regard to the matters set out in subparagraphs (a)(1) to (4) and any submissions made in response to its invitation under subparagraph (d)(2).

(f) As soon as practicable following publication of a final report under paragraph (e), *AEMO* must provide written notification to the *AEMC* as to whether or not *AEMO* will be submitting a *Rule* change proposal that results from the review.

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5.3.4A Negotiated access standards

(a) *AEMO* must advise on *AEMO advisory matters*.

(b) A *negotiated access standard* must:

(1) subject to subparagraph (1A), be no less onerous than the corresponding *minimum access standard* provided by the *Network Service Provider* under clauses 5.3.3(b1)(4) or S5.4B(b)(2);

(1A) with respect to a submission by a *Generator* under clause 5.3.9(b)(3), be no less onerous than the *performance standard* that corresponds to the technical requirement that is affected by the alteration to the *generating system*;

(2) be set at a level that will not adversely affect *power system security*;

(3) be set at a level that will not adversely affect the quality of *supply* for other *Network Users*; and

(4) in respect of *generating plant*, meet the requirements applicable to a *negotiated access standard* in Schedule 5.2.

(b1) When submitting a proposal for a *negotiated access standard* under clause 5.3.4(e), clause 5.3A.9(f), clause 5.3.9(b)(3) or subparagraph (h)(3), and where there is a corresponding *automatic access standard* for the relevant technical requirement, a *Connection Applicant* must propose a standard that is as close as practicable to the corresponding *automatic access standard*, having regard to:

(1) the need to protect the *plant* from damage;

(2) *power system* conditions at the location of the proposed *connection*; and

(3) the commercial and technical feasibility of complying with the *automatic access standard* with respect to the relevant technical requirement.

(b2) When proposing a *negotiated access standard* under paragraph (b1), the *Connection Applicant* must provide reasons and evidence to the *Network Service Provider* and *AEMO* as to why, in the reasonable opinion of the *Connection Applicant*, the proposed *negotiated access standard* is appropriate, including:

(1) how the *Connection Applicant* has taken into account the matters outlined in subparagraphs (b1)(1) to (3); and

(2) how the proposed *negotiated access standard* meets the requirements of paragraph (b).

(c) Following the receipt of a proposed *negotiated access standard* under clause 5.3.4(e), clause 5.3A.9(f), clause 5.3.9(b)(3) or paragraph (h)(3), the *Network Service Provider* must consult with *AEMO* as soon as practicable in relation to *AEMO advisory matters* for that proposed standard.

Note

This clause is classified as a civil penalty provision under the National Electricity (South Australia) Regulations. (See clause 6(1) and Schedule 1 of the National Electricity (South Australia) Regulations.)

(d) Within 20 *business days* following the later of:

(1) receipt of a proposed *negotiated access standard* under clause 5.3.4(e), clause 5.3A.9(f), clause 5.3.9(b)(3) or paragraph (h)(3); and

(2) receipt of all information required to be provided by the *Connection Applicant* under clause S5.2.4, clause S5.5.6, clause S5.3.1(a1) or clause S5.3a.1(a1),

AEMO must advise the *Network Service Provider* in writing, in respect of *AEMO advisory matters*, whether the proposed *negotiated access standard* should be accepted or rejected.

(d1) When advising the *Network Service Provider* under paragraph (d) to reject a proposed *negotiated access standard*, and subject to obligations in respect of *confidential information*, *AEMO* must:

(1) provide detailed reasons for the rejection to the *Network Service Provider*, including:

(i) where the basis of *AEMO's* advice is lack of evidence from the *Connection Applicant*, details of the additional evidence of the type referred to in paragraph (b2) *AEMO* requires to continue assessing the proposed *negotiated access standard*; and

(ii) the extent to which each of the matters identified at subparagraphs (b)(1), (b)(1A), (b)(2) and (b)(4) contributed to *AEMO's* decision to reject the proposed *negotiated access standard*; and

(2) recommend a *negotiated access standard* that *AEMO* considers meets the requirements of subparagraphs (b)(1), (b)(1A), (b)(2) and (b)(4).

(e) Within 30 *business days* following the later of:

(1) receipt of a proposed *negotiated access standard* in accordance with clause 5.3.4(e), clause 5.3A.9(f), clause 5.3.9(b)(3), or paragraph (h)(3); and

(2) receipt of all information required to be provided by the *Connection Applicant* under clause S5.2.4, clause S5.5.6, clause S5.3.1(a1) or clause S5.3a.1(a1),

the *Network Service Provider* must accept or reject a proposed *negotiated access standard*.

Note

This clause is classified as a civil penalty provision under the National Electricity (South Australia) Regulations. (See clause 6(1) and Schedule 1 of the National Electricity (South Australia) Regulations.)

(f) The *Network Service Provider* must reject the proposed *negotiated access standard* where:

(1) in the *Network Service Provider's* reasonable opinion, one or more of the requirements at subparagraphs (b)(1), (b)(1A), (b)(3) and (b)(4) are not met; or

(2) *AEMO* has advised the *Network Service Provider* under paragraph (d) to reject the proposed *negotiated access standard*.

Note

This clause is classified as a civil penalty provision under the National Electricity (South Australia) Regulations. (See clause 6(1) and Schedule 1 of the National Electricity (South Australia) Regulations.)

(g) If a *Network Service Provider* rejects a proposed *negotiated access standard*, the *Network Service Provider* must:

(1) subject to obligations in respect of *confidential information*, provide to the *Connection Applicant*:

(i) where the basis for the *Network Service Provider's* rejection is lack of evidence from the *Connection Applicant*, details of the additional evidence of the type referred to in paragraph (b2) the *Network Service Provider* requires to continue assessing the proposed *negotiated access standard*;

(ii) detailed reasons for the rejection, including the extent to which each of the matters identified at subparagraphs (b)(1), (b)(1A), (b)(3) and (b)(4) contributed to the *Network Service Provider's* decision to reject the proposed *negotiated access standard*; and

(iii) the detailed reasons provided by *AEMO* to the *Network Service Provider* in respect of an *AEMO advisory matter* under paragraph (d1); and

(2) advise the *Connection Applicant* of a *negotiated access standard* that the *Network Service Provider* considers meets the requirements of subparagraphs (b)(1), (b)(1A), (b)(3) and (b)(4).

Note

This clause is classified as a civil penalty provision under the National Electricity (South Australia) Regulations. (See clause 6(1) and Schedule 1 of the National Electricity (South Australia) Regulations.)

(h) The *Connection Applicant* may in relation to a proposed *negotiated access standard* advised by a *Network Service Provider* in accordance with subparagraph (g)(2):

(1) accept the proposed *negotiated access standard*;

(2) reject the proposed *negotiated access standard*;

(3) propose an alternative *negotiated access standard* to be further evaluated in accordance with the criteria in paragraph (b); or

(4) elect to adopt the relevant *automatic access standard* or a corresponding *plant standard*.

(i) An *automatic access standard* or if the procedures in this clause 5.3.4A have been followed a *negotiated access standard*, that forms part of the terms and conditions of a *connection agreement*, is taken to be the *performance standard* applicable to the *connected plant* for the relevant technical requirement.

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5.3.9 Procedure to be followed by a Generator proposing to alter a generating system

(a) This clause 5.3.9 applies where a *Generator* proposes to alter a *connected generating system* or a *generating system* for which *performance standards* have been previously accepted by the *Network Service Provider* and *AEMO* (in relation to *AEMO advisory matters*) and that alteration:

(1) will affect the performance of the *generating system* relative to any of the technical requirements set out in clauses S5.2.5, S5.2.6, S5.2.7 and S5.2.8; or

(2) will, in *AEMO's* reasonable opinion, have an *adverse system strength impact*; or

(3) will, in *AEMO*'s reasonable opinion, adversely affect *network capability*, *power system security*, quality or reliability of *supply*, *inter-regional power transfer capability* or the use of a *network* by another *Network User*.

(b) A *Generator* to which this clause applies, must submit to the *Network Service Provider* with a copy to *AEMO*:

(1) a description of the nature of the alteration and the timetable for implementation;

(2) in respect of the proposed alteration to the *generating system*, details of the *generating unit* design data and *generating unit* setting data in accordance with the *Power System Model Guidelines*, *Power System Design Data Sheet* and *Power System Setting Data Sheet*;

(3) in relation to each relevant technical requirement for which the proposed alteration to the equipment will affect the performance of the *generating system*, the proposed amendments to the *plant's* existing corresponding *performance standard* for that technical requirement; and

(4) where relevant, the *Generator's* proposed *system strength remediation scheme*.

(c) Clause 5.3.4A applies to a submission by a *Generator* under subparagraph (b)(3).

(c1) Clause 5.3.4B applies to a submission by a *Generator* under subparagraph (b)(4). A *Generator* may request the *Network Service Provider* to undertake a preliminary assessment in accordance with the *system strength impact assessment guidelines* before making a submission under paragraph (b).

(d) Without limiting paragraph (a), a proposed alteration to the equipment specified in column 1 of the table set out below is deemed to affect the performance of the *generating system* relative to technical requirements

specified in column 2, thereby necessitating a submission under subparagraph (b)(3), unless *AEMO* and the *Network Service Provider* otherwise agree.

Column 1 **(altered equipment)**	**Column 2** **(clause)**
machine windings	S5.2.5.1, S5.2.5.2, S5.2.8
power converter	S5.2.5.1, S5.2.5.2, S5.2.5.5, S5.2.5.12, S5.2.5.13, S5.2.8
reactive compensation plant	S5.2.5.1, S5.2.5.2, S5.2.5.5, S5.2.5.12, S5.2.5.13
excitation control system	S5.2.5.5, S5.2.5.7, S5.2.5.12, S5.2.5.13
voltage control system	S5.2.5.5, S5.2.5.7, S5.2.5.12, S5.2.5.13
governor *control system*	S5.2.5.7, S5.2.5.11, S5.2.5.14
power *control system*	S5.2.5.11, S5.2.5.14
protection system	S5.2.5.3, S5.2.5.4, S5.2.5.5, S5.2.5.7, S5.2.5.8, S5.2.5.9, S5.2.5.10
auxiliary supplies	S5.2.5.1, S5.2.5.2, S5.2.7
remote control and monitoring system	S5.2.5.14, S5.2.6.1, S5.2.6.2

(e) The *Network Service Provider* may as a condition of considering a submission made under paragraph (b), require payment of a fee to meet the reasonable costs anticipated to be incurred by the provider, other *Network Service Providers* and *AEMO*, in the assessment of the submission.

(f) The *Network Service Provider* must require payment of a fee under paragraph (e) if so requested by *AEMO*.

(g) On payment of the required fee referred to in paragraph (e), the *Network Service Provider* must pay such amounts as are on account of the costs anticipated to be incurred by the other *Network Service Providers* and *AEMO*, as appropriate.

(h) If the application of this clause 5.3.9 leads to a variation to an existing *connection agreement* the *Network Service Provider* and the *Generator* must immediately jointly advise *AEMO*, including the details of any *performance standards* amended pursuant to this clause 5.3.9.

Note

This clause is classified as a civil penalty provision under the National Electricity (South Australia) Regulations. (See clause 6(1) and Schedule 1 of the National Electricity (South Australia) Regulations.)

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S5.1.9 Protection systems and fault clearance times

Network Users

(a) A *Network Service Provider* must determine the *automatic access standard* and *minimum access standard* that applies to the protection zone of each protection *system* in relation to the *connection point* and the *plant* to be *connected*, as follows:

(1) The *automatic access standard* for *fault clearance time* for any *fault type* is the lesser of the *system standard* set out in clause S5.1a.8 that applies to *the* highest *nominal voltage* within the *protection system's* protection zone and the corresponding *minimum access standard* determined under clause S5.1.9(a)(2) or clause S5.1.9(a)(3) as applicable.

(2) The *minimum access standard* for *fault clearance time* of a primary *protection system* is:

(i) for a *fault type* that constitutes a *credible contingency event* in the relevant protection zone, the longest time such that a *short circuit fault* of that *fault type* that is cleared in that time would not *cause* the *power system* to become unstable when operating at any level of *inter-regional* or *intra-regional power transfer* that would be permissible (taking into account all other limiting criteria) if the *fault clearance time* for such a fault at the *connection point* were the *system standard* set out in clause S5.1a.8 that applies to the *nominal voltage* at the *connection point*; and

(ii) for a *fault type* that does not constitute a *credible contingency event* in the relevant protection zone:

(A) if a two phase to ground fault in that protection zone constitutes a *credible contingency event*, the corresponding *fault clearance time* for a two phase to ground *short circuit fault* in that protection zone as determined under clause S5.1.9(a)(2)(i); and

(B) otherwise, the shortest of the *fault clearance times* for a two phase to ground *short circuit fault* in each adjoining protection zone (excluding *transformer* protection zones and dead zones) as determined under clause S5.1.9(a)(2)(i) or clause S5.1.9(e).

(3) The *minimum access standard* for *fault clearance time* of a *breaker fail protection system* or similar back-up *protection system* is the

longest time such that a *short circuit fault* of any *fault type* that is cleared in that time would not damage any part of the *power system* (other than the faulted element) while the fault current is flowing or being interrupted.

(b) [Deleted]

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Schedule 5.2 Conditions for Connection of Generators

S5.2.1 Outline of requirements

(a) This schedule sets out details of additional requirements and conditions that *Generators* must satisfy as a condition of *connection* of a *generating system* to the *power system*.

(b) This schedule does not apply to any *generating system* that is:

(1) subject to an exemption from registration under clause 2.2.1(c); or

(2) eligible for exemption under any guidelines issued under clause 2.2.1(c),

and which is *connected* or intended for use in a manner the *Network Service Provider* considers is unlikely to cause a material degradation in the quality of *supply* to other *Network Users*.

(c) This schedule also sets out the requirements and conditions which subject to clause 5.2.5 of the *Rules*, are obligations on *Generators*:

(1) to co-operate with the relevant *Network Service Provider* on technical matters when making a new *connection*; and

(2) to provide information to the *Network Service Provider* or *AEMO*.

(d) The equipment associated with each *generating system* must be designed to withstand without damage the range of operating conditions which may arise consistent with the *system standards*.

(e) *Generators* must comply with the *performance standards* and any attached terms or conditions of agreement agreed with the *Network Service Provider* or *AEMO* in accordance with a relevant provision of schedules 5.1a or 5.1.

(f) This schedule does not set out arrangements by which a *Generator* may enter into an agreement or contract with *AEMO* to:

(1) provide additional services that are necessary to maintain *power system security*; or

(2) provide additional services to facilitate management of the *market*.

(g) This schedule provides for *automatic access standards* and the determination of *negotiated access standards* which once determined, must be recorded together with the *automatic access standards* in a *connection agreement* and registered with *AEMO* as *performance standards*.

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S5.2.5 Technical requirements

S5.2.5.1 Reactive power capability

Automatic access standard

(a) The *automatic access standard* is a *generating system* operating at:

(1) any level of *active power* output; and

(2) any *voltage* at the *connection point* within the limits established under clause S5.1a.4 without a *contingency event*,

must be capable of supplying and absorbing continuously at its *connection point* an amount of *reactive power* of at least the amount equal to the product of the *rated active power* of the *generating system* and 0.395.

Minimum access standard

(b) The *minimum access standard* is a *generating system* operating at any *voltage* at the *connection point* within the limits established under clause S5.1a.4 without a *contingency event*, must be capable of supplying and absorbing continuously at its *connection point* an amount of *reactive power* of at least the amount equal to zero.

Negotiated access standard

(c) When negotiating a *negotiated access standard*, the *Generator*, the *Network Service Provider* and *AEMO*:

(1) must, subject to any agreement under subparagraph (d)(4), be consistent with maintaining *power system security* and ensure that the *reactive power capability* of the *generating system* is sufficient to ensure that all relevant *system standards* are met before and after *credible contingency events* under normal and planned *outage* operating conditions of the *power system*, taking into account at least existing projects and *considered projects*;

(2) may negotiate either a range of *reactive power* absorption and supply, or a range of *power factor*, at the *connection point*, within which the *plant* must be operated; and

(3) may negotiate a limit that describes how the *reactive power capability* varies as a function of *active power* output due to a design characteristic of the *plant*.

(d) If the *generating system* is not capable of the level of performance established under paragraph (c)(1) the *Generator*, depending on what is reasonable in the circumstances, must:

(1) pay compensation to the *Network Service Provider* for the provision of the deficit of *reactive power* (supply and absorption) from within the *network*;

(2) install additional equipment *connecting* at the *generating system's connection point* or another location, to provide the deficit of *reactive*

power (supply and absorption), and such equipment is deemed to be part of the *generating system*;

(3) reach a commercial arrangement with a *Registered Participant* to provide the deficit of *reactive power* (supply and absorption); or

(4) if the inability to meet the performance level only occurs for particular operating conditions, agree to and document as part of the proposed *negotiated access standard*, operational arrangements by which the *plant* can achieve an agreed level of performance for those operating conditions.

(e) The *Generator* may select one or more options referred to in paragraph (d).

General requirements

(f) An *access standard* must record the agreed value for *rated active power* and where relevant the method of determining the value.

(g) An *access standard* for consumption of *energy* by a *generating system* when not supplying or absorbing *reactive power* under an *ancillary services agreement* is to be established under clause S5.3.5 as if the *Generator* were a *Market Customer*.

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S5.2.5.3 Generating system response to frequency disturbances

(a) For the purposes of this clause S5.2.5.3:

normal operating frequency band, **operational frequency tolerance band**, or **extreme frequency excursion tolerance limits** are references to the widest range specified for those terms for any condition (including an "island" condition) in the *frequency operating standards* that apply to the *region* in which the *generating unit* is located.

stabilisation time and **recovery time** mean the longest times allowable for the *frequency* of the *power system* to remain outside the operational frequency tolerance band and the normal operating frequency band, respectively, for any condition (including an "island" condition) in the *frequency operating standards* that apply to the region in which the *generating unit* is located.

transient frequency limit and **transient frequency time** mean the values of 47.5 Hz and 9 seconds respectively, or such other values determined by the *Reliability Panel*.

Automatic access standard

(b) The *automatic access standard* is a *generating system* and each of its *generating units* must be capable of *continuous uninterrupted operation* for *frequencies* in the following ranges:

(1) the lower bound of the extreme frequency excursion tolerance limits to the lower bound of the operational frequency tolerance band for at least the stabilisation time;

(2) the lower bound of the operational frequency tolerance band to the lower bound of the normal operating frequency band, for at least the recovery time including any time spent in the range under subparagraph (1);

(3) the normal operating frequency band for an indefinite period;

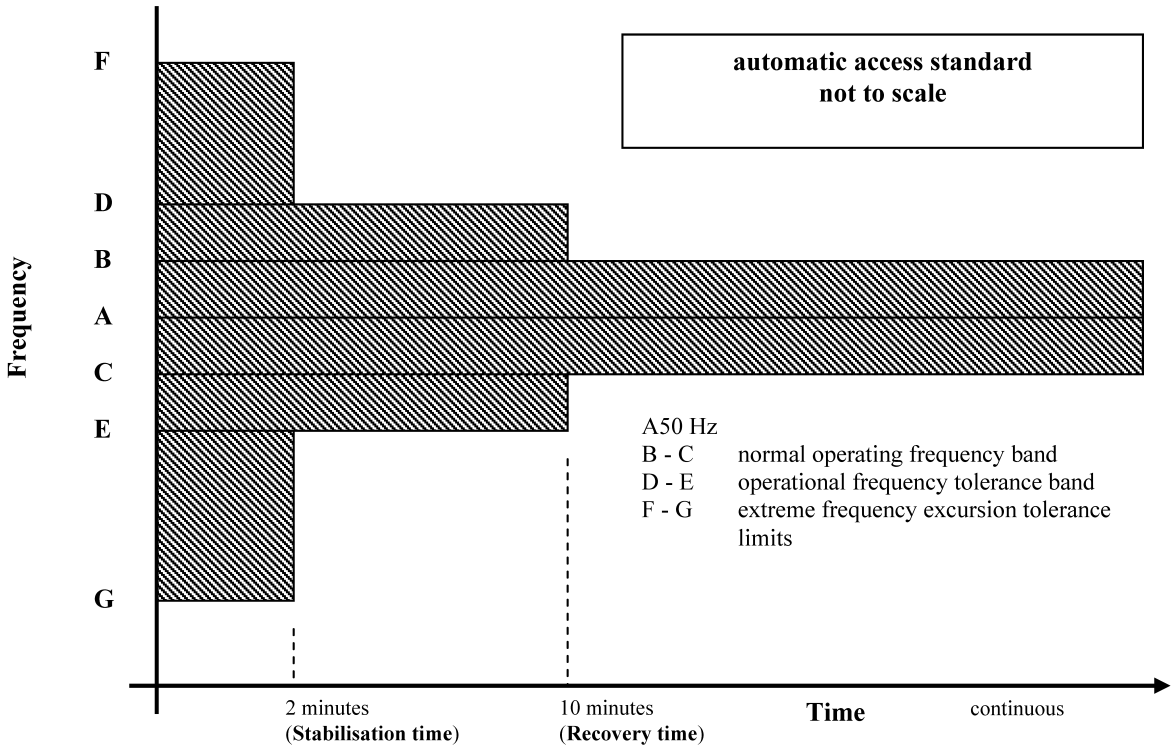
(4) the upper bound of the normal operating frequency band to the upper bound of the operational frequency tolerance band, for at least the recovery time including any time spent in the range under subparagraph (5); and

(5) the upper bound of the operational frequency tolerance band to the upper bound of the extreme frequency excursion tolerance limits for at least the stabilisation time,

unless the rate of change of *frequency* is outside the range of –4 Hz to 4 Hz per second for more than 0.25 seconds, -3 Hz to 3 Hz per second for more than one second, or such other range as determined by the *Reliability Panel* from time to time.

Note:

The automatic access standard is illustrated in the following diagram. To the extent of any inconsistency between the diagram and paragraph (b), paragraph (b) prevails.



Minimum access standard

(c) The *minimum access standard* is a *generating system* and each of its *generating units* must be capable of *continuous uninterrupted operation* for *frequencies* in the following ranges:

(1) the lower bound of the extreme frequency excursion tolerance limits to the transient frequency limit for at least the transient frequency time;

(2) the transient frequency limit to the lower bound of the operational frequency tolerance band for at least the stabilisation time;

(3) the lower bound of the operational frequency tolerance band to the lower bound of the normal operating frequency band for at least the recovery time including any time spent in the ranges under subparagraphs (1) and (2);

(4) the normal operating frequency band for an indefinite period;

(5) the upper bound of the normal operating frequency band to the upper bound of the operational frequency tolerance band for at least the recovery time including any time spent in the ranges under subparagraph (6) unless the *generating system* has a *protection system* to trip a *generating unit* if the *frequency* exceeds a level agreed with *AEMO*; and

(6) in respect of a *generating system*:

(i) of 30 MW or more; and

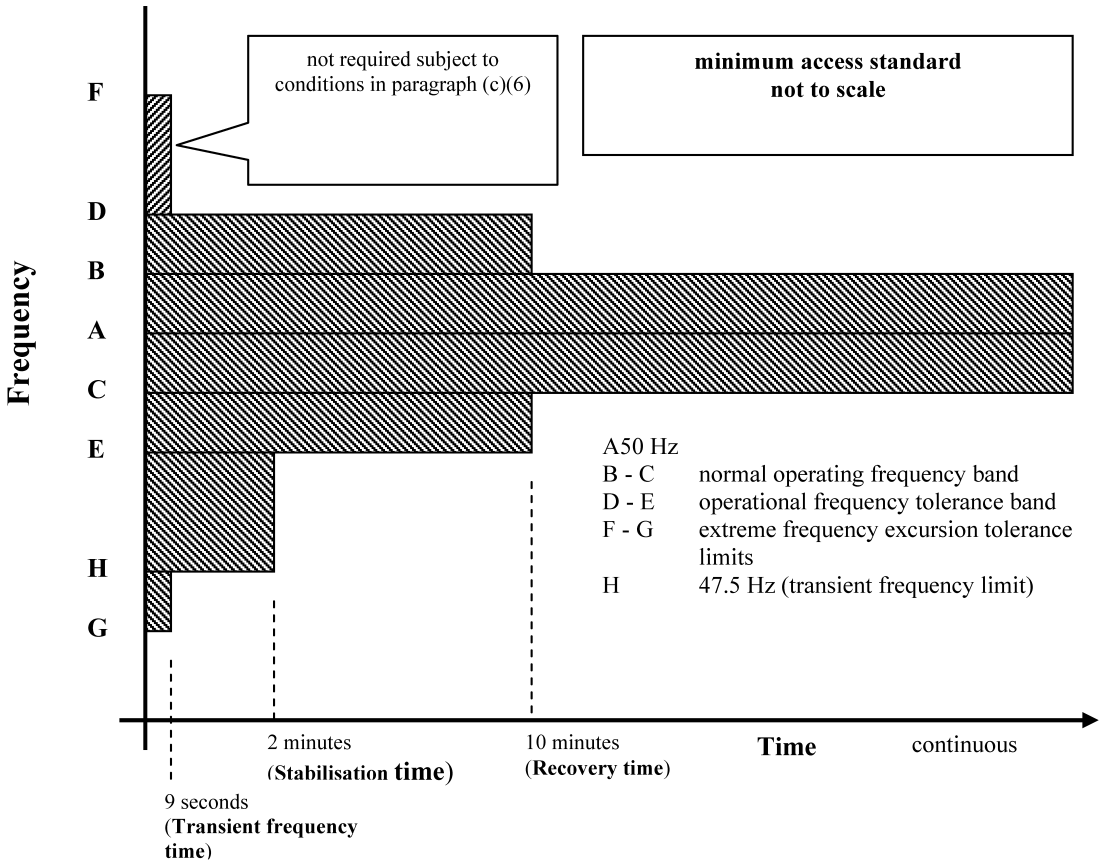
(ii) that does not have a *protection system* to trip the *generating unit* if the *frequency* exceeds a level agreed with *AEMO*,

the upper bound of the operational frequency tolerance band to the upper bound of the extreme frequency excursion tolerance limits (including an "island" condition) for at least the transient frequency time,

unless the rate of change of *frequency* is outside the range of -2 Hz to 2 Hz per second for more than 0.25 seconds, -1 Hz to 1 Hz per second for more than one second or such other range as determined by the *Reliability Panel* from time to time.

Note:

The minimum access standard is illustrated in the following diagram. To the extent of any inconsistency between the diagram and paragraph (c), paragraph (c) prevails.



Negotiated access standard

(d) A *negotiated access standard* must require that the *frequency* would be unlikely to fall below the lower bound of the operational frequency tolerance band as a result of over-frequency tripping of *generating units*.

S5.2.5.4 Generating system response to voltage disturbances

Automatic access standard

(a) The *automatic access standard* is a *generating system* and each of its *generating units* must be capable of *continuous uninterrupted operation* where a *power system* disturbance causes the *voltage* at the *connection point* to vary within the following ranges:

(1) over 130% of *normal voltage* for a period of at least 0.02 seconds after T(ov);

(2) 125% to 130% of *normal voltage* for a period of at least 0.2 seconds after T(ov);

(3) 120% to 125% of *normal voltage* for a period of at least 2.0 seconds after T(ov);

(4) 115% to 120% of *normal voltage* for a period of at least 20.0 seconds after T(ov);

(5) 110% to 115% of *normal voltage* for a period of at least 20 minutes after T(ov);

(6) 90% to 110% of *normal voltage* continuously;

(7) 80% to 90% of *normal voltage* for a period of at least 10 seconds after T(uv); and

(8) 70% to 80% of *normal voltage* for a period of at least 2 seconds after T(uv),

where T(ov) means the point in time when the *voltage* at the *connection point* first varied above 110% of *normal voltage* and T(uv) means the point in time when the *voltage* at the *connection point* first varied below 90% of *normal voltage*.

Minimum access standard

(b) The *minimum access standard* is a *generating system* including all operating *generating units* must be capable of *continuous uninterrupted operation* where a *power system* disturbance causes the *voltage* at the *connection point* to vary within the following ranges:

(1) 115% to 120% of *normal voltage* for a period of at least 0.1 seconds after T(ov);

(2) 110% to 115% of *normal voltage* for a period of at least 0.9 seconds after T(ov);

(3) 90% to 110% of *normal voltage* continuously, provided that the ratio of *voltage* to *frequency* (as measured at the *connection point* and expressed as a percentage of *normal voltage* and a percentage of 50 Hz) does not exceed:

(A) a value of 1.15 for more than two minutes; or

(B) a value of 1.10 for more than 10 minutes;

(4) 80% to 90% of *normal voltage* for a period of at least 5 seconds after T(uv); and

(5) 70% to 80% of *normal voltage* for a period of at least 2 seconds after T(uv),

where T(ov) means the point in time when the *voltage* at the *connection point* first varied above 110% of *normal voltage* and T(uv) means the point in time when the *voltage* at the *connection point* first varied below 90% of *normal voltage*.

Negotiated access standard

(c) In negotiating a *negotiated access standard*, a *generating system* and each of its operating *generating units* must be capable of *continuous uninterrupted operation* for the range of *voltages* specified in the *automatic access standard*, except where *AEMO* and the *Network Service Provider* agree that the total reduction of *generation* in the *power system* as a result of any *voltage* excursion within levels specified by the *automatic access standard* would not exceed 100 MW, or a greater limit based on what *AEMO* and the *Network Service Provider* both consider to be reasonable in the circumstances.

(d) In carrying out assessments of proposed *negotiated access standards* under this clause S5.2.5.4, *AEMO* and the *Network Service Provider* must at a minimum, in addition to the requirements of clauses 5.3.4A(d1) and 5.3.4A(g) respectively, take into account:

(1) the expected performance of existing *networks* and *considered projects*; and

(2) the expected performance of existing *generating plant* and other relevant projects.

(e) [**Deleted**]

General requirement

(f) The *access standard* must include any operational arrangements 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.

S5.2.5.5 Generating system response to disturbances following contingency events

(a) In this clause S5.2.5.5 a fault includes a fault of the relevant type having a metallic conducting path.

Automatic access standard

(b) The *automatic access standard* is:

(1) a *generating system* and each of its *generating units* must remain in *continuous uninterrupted operation* for a disturbance caused by:

(i) a *credible contingency event* other than a fault referred to in subparagraph (iv);

(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 a *transmission system* cleared in:

(A) the longest time expected to be taken for a relevant *breaker fail protection system* to clear the fault; or

(B) if a *protection system* referred to in subparagraph (A) is not installed, the greater of the time specified in column 4 of Table S5.1a.2 (or if none is specified, 430 milliseconds) and the longest time expected to be taken for all relevant primary *protection systems* to clear the fault; and

(iv) a three phase, two phase to ground, phase to phase or phase to ground fault in a *distribution network* cleared in:

(A) the longest time expected to be taken for the *breaker fail protection system* to clear the fault; or

(B) if a *protection system* referred to in subparagraph (A) is not installed, the greater of 430 milliseconds and the

longest time expected to be taken for all relevant primary *protection systems* to clear the fault,

provided that the event is not one that would *disconnect* the *generating unit* from the *power system* by removing *network elements* from service; and

(1A) a *generating system* and each of its *generating units* must remain in *continuous uninterrupted operation* for a series of up to 15 disturbances within any five minute period caused by any combination of the events described in subparagraph (b)(1) where:

(i) up to six of the disturbances cause the *voltage* at the *connection point* 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 *voltage* at the *connection point* 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 *voltage* at the *connection point* to vary within the ranges agreed by *AEMO* and the *Network Service Provider* under subparagraphs (a)(7) and (a)(8) of clause S5.2.5.4;

(v) the minimum clearance from the end of one disturbance and commencement of the next disturbance may be zero 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 *voltage* at the *connection point* is lower than 90% of *normal voltage* exceeding 1,800 milliseconds within any five minute period; or

(ix) the time integral, within any five minute period, of the difference between 90% of *normal voltage* and the *voltage* at the *connection point* when the *voltage* at the *connection point* is lower than 90% of *normal voltage* exceeding 1 pu second;

(2) subject to any changed *power system* conditions or energy source availability beyond the *Generator's* reasonable control, a *generating system* comprised solely of *synchronous generating units*, and each *synchronous generating unit* within a *generating system*, in respect of the types of fault described in subparagraphs (1)(ii) to (iv), must supply to or absorb from the *network*:

(i) to assist the maintenance of *power system voltages* during the application of the fault, capacitive reactive current of at least the greater of its pre-disturbance reactive current and 4% of the maximum continuous current of the *generating system* including all operating *synchronous generating units* (in the absence of a disturbance) for each 1% reduction (from the level existing just prior to the fault) of *connection point voltage* during the fault;

(ii) after clearance of the fault, *reactive power* sufficient to ensure that the *connection point voltage* is within the range for *continuous uninterrupted operation* under clause S5.2.5.4; and

(iii) from 100 milliseconds after clearance of the fault, *active power* of at least 95% of the level existing just prior to the fault;

(3) subject to any changed *power system* conditions or energy source availability beyond the *Generator's* reasonable control, a *generating system* comprised solely of a*synchronous generating units*, and each *asynchronous generating unit* within a *generating system*, in respect of the types of fault described in subparagraphs (1)(ii) to (iv), must have *facilities* capable of supplying to or absorbing from the *network*:

(i) to assist the maintenance of *power system voltages* during the application of the fault:

(A) capacitive reactive current in addition to its pre-disturbance level of 4% of the maximum continuous current of the *generating system* including all operating *asynchronous generating units* (in the absence of a disturbance) for each 1% reduction of *voltage* at the terminals of a *generating unit* below the relevant threshold identified in clause S5.2.5.5(i)(4), except where *voltage* at the terminals of a *generating unit* is 5% or lower of *nominal voltage*; and

(B) inductive reactive current in addition to its pre-disturbance reactive current and 6% of the maximum continuous current of the *generating system* including all operating *asynchronous generating units* (in the absence of a disturbance) for each 1% increase of *voltage* at the terminals of a *generating unit* above the relevant threshold identified in clause S5.2.5.5(i)(4),

during the disturbance and maintained until *connection point voltage* recovers to between 90% and 110% of *normal voltage*; and

(ii) from 100 milliseconds after clearance of the fault, *active power* of at least 95% of the level existing just prior to the fault,

provided that any active current consumption immediately upon the occurrence of a fault does not exceed 5% of the maximum continuous current of the *generating system* and is limited to 20 milliseconds.

(4) For the purpose of subparagraph (b)(3)(i), the reactive current response must have a *rise time* of no greater than 40 milliseconds and

a *settling time* of no greater than 70 milliseconds and must be *adequately damped*.

(5) For the purposes of subparagraphs (b)(2) and (b)(3), the *performance standards* must record the capacitive reactive current response and inductive reactive current response (where applicable) agreed with *AEMO* and the *Network Service Provider*.

Minimum access standard

(c) The *minimum access standard* is:

(1) a *generating system* and each of its *generating units* must remain in *continuous uninterrupted operation* for a disturbance caused by:

(i) a *credible contingency event*; or

(ii) a single phase to ground, phase to phase or two phase to ground fault in a *transmission system* or *distribution network* cleared in the longest time expected to be taken for all relevant primary *protection systems* to clear the fault unless:

(A) *AEMO* and the *Network Service Provider* agree that the total reduction of *generation* in the *power system* due to that fault would not exceed 100 MW, or a greater limit based on what *AEMO* and the *Network Service Provider* both consider to be reasonable in the circumstances; and

(B) the event is not one that would *disconnect* the *generating unit* from the *power system* by removing *network elements* from service;

(1A) a *generating system* and each of its *generating units* must remain in *continuous uninterrupted operation* for a series of up to six disturbances within any five minute period caused by any combination of the events described in subparagraph (1) where:

(i) up to three of the disturbances cause the *voltage* at the *connection point* to drop below 50% of *normal voltage*;

(ii) up to one disturbance is cleared by a *breaker fail protection system* or similar back-up *protection system*;

(iii) up to one disturbance causes the *voltage* at the *connection point* to vary within the ranges agreed by *AEMO* and the *Network Service Provider* under subparagraphs (a)(7), (a)(8), (b)(4) or (b)(5) (as appropriate) of clause S5.2.5.4;

(iv) the time difference between the clearance of one disturbance and commencement of the next disturbance exceeds 200 milliseconds; and

(v) all disturbances are caused by faults other than three phase faults,

provided that none of the events would result in:

(vi) the islanding of the *generation system* or cause a material reduction in *power transfer capability* by removing *network elements* from service;

(vii) the cumulative time that *voltage* at the *connection point* is lower than 90% of *normal voltage* exceeding 1,000 milliseconds within any five minute period; or

(viii) the time integral, within any five minute period, of the difference between 90% of *normal voltage* and the *voltage* at the *connection point* when the *voltage* at the *connection point* is lower than 90% of *normal voltage* exceeding 0.5 pu second,

and there is a minimum of 30 minutes where no disturbances occur following a five minute period of multiple disturbances;

(2) subject to any changed *power system* conditions or energy source availability beyond the *Generator's* reasonable control after clearance of the fault, a *generating system* comprised solely of *synchronous generating units*, and each *synchronous generating unit* within a *generating system*, in respect of the types of fault described in subparagraph (1)(ii), deliver *active power* to the *network*, and supply or absorb leading or lagging *reactive power*, sufficient to ensure that the *connection point voltage* is within the range for *continuous uninterrupted operation* agreed under clause S5.2.5.4;

(3) subject to any changed *power system* conditions or energy source availability beyond the *Generator's* reasonable control, a *generating system* comprised solely of a*synchronous generating units*, and each *asynchronous generating unit* within a *generating system*, must:

(i) in respect of the types of fault described in subparagraph (1)(ii), and to assist the maintenance of *power system voltages* during the application of the fault, have *facilities* capable of supplying to or absorbing from the *network*:

(A) capacitive reactive current in addition to its pre-disturbance level of 2% of the maximum continuous current of the *generating system* including all operating *asynchronous generating units* (in the absence of a disturbance) for each 1% reduction of *voltage* at the terminals of a *generating unit* below the relevant threshold identified in clause S5.2.5.5(i)(4), except where *voltage* at the terminals of a *generating unit* is 20% or lower of *nominal voltage*; and

(B) inductive reactive current in addition to its pre-disturbance reactive current and 2% of the maximum continuous current of the *generating system* including all operating *asynchronous generating units* (in the absence of a disturbance) for each 1% increase of *voltage* at the terminals of a *generating unit* above the relevant threshold identified in clause S5.2.5.5(i)(4),

during the disturbance and maintained until *connection point voltage* recovers to between 90% and 110% of *normal voltage*, except for *voltages* below the relevant threshold identified in clause S5.2.5.5(i)(4), the reactive current response may be limited to two seconds duration; and

(ii) return to at least 95% of the pre-fault *active power* output, after clearance of the fault, within a period of time agreed by the *Connection Applicant*, *AEMO* and the *Network Service Provider*,

provided that any active current consumption immediately upon the occurrence of a fault does not exceed 10% of the maximum continuous current of the *generating system* and is limited to 60 milliseconds;

(4) for the purpose of subparagraph (c)(3), the reactive current response must have a *rise time* of no greater than 40 milliseconds and a *settling time* of no greater than 70 milliseconds and must be *adequately damped*, except that where a duration of greater than two seconds is required, the reactive current *rise time* must be as soon as practicable, and in any event, no longer than 180 milliseconds; and

(5) for the purposes of subparagraphs (c)(3) and (c)(4), the *performance standards* must record the capacitive reactive current response and inductive reactive current response (where applicable) agreed with *AEMO* and the *Network Service Provider*.

Negotiated access standard

(d) In carrying out assessments of proposed *negotiated access standards* under this clause S5.2.5.5, the *Network Service Provider* and *AEMO* must take into account, without limitation:

(1) the expected performance of:

(i) existing *networks* and *considered projects*;

(ii) existing *generating plant* and other relevant projects; and

(iii) *control systems* and *protection systems*, including auxiliary systems and *automatic reclose equipment*; and

(2) the expected range of *power system* operating conditions.

(e) A proposed *negotiated access standard* may be accepted if the *connection* of the *plant* at the proposed access level would not 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.

(f) **[Deleted**]

General requirement

(g) The *access standard* must include any operational arrangements to ensure the *generating system* including all operating *generating units* will meet its agreed performance levels under abnormal *network* or *generating system* conditions.

(h) When assessing multiple disturbances, a failure by the *automatic reclose equipment* to clear the relevant fault shall be counted as a separate disturbance.

(i) For the purpose of subparagraphs (b)(3) and (c)(3):

(1) the reactive current contribution may be limited to the maximum continuous current of a *generating system*, including its operating *asynchronous generating units*;

(2) the reactive current contribution and *voltage* deviation described may be measured at the *connection point* where agreed with *AEMO* and the *Network Service Provider*;

(3) the reactive current contribution required may be calculated using phase to phase, phase to ground or sequence components of *voltages*. The ratio of the negative sequence to positive sequence components of the reactive current contribution must be agreed with *AEMO* and the *Network Service Provider* for the types of disturbances listed in this clause S5.2.5.5;

(4) for the purpose of subparagraphs (b)(3)(i) and (c)(3)(i), separate thresholds for activation of the reactive current contribution must be set within the ranges of 85% to 90% and 110% to 112% of the *nominal voltage* at the terminals of a *generating unit*, with the actual thresholds to be agreed between *AEMO* and the *Network Service Provider* and recorded as the *performance standards*;

(5) any reactive current consumption immediately upon the occurrence of a fault must not exceed 5% of the maximum continuous current of the *generating system* and is limited to the duration of *rise time*; and

(6) notwithstanding the amount of reactive current injected or absorbed during *voltage* disturbances, the maximum continuous current of the *generating system* including all operating *generating units* (in the absence of a disturbance) must be available at all times, except that *AEMO* and the *Network Service Provider* may agree limits on active current injection where required to maintain *power system security* and the quality of supply to other *Network Users*.

(j) For a *generating system* comprised solely of *synchronous generating units*, the reactive current contribution may be limited to 250% of the maximum continuous current of the *generating system*.

(k) For a *synchronous generating unit* within a *generating system* (other than a *generating system* described in paragraph (j)), the reactive current contribution may be limited to 250% of the maximum continuous current of that *synchronous generating unit*.

****

S5.2.5.7 Partial load rejection

(a) For the purposes of this clause S5.2.5.7 **minimum generation** means minimum *sent out generation* for continuous stable operation.

(b) [**Deleted**]

Automatic access standard

(c) The *automatic access standard* is a *generating system* must be 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 seconds, provided that the *loading level* remains above minimum generation.

Minimum access standard

(d) The *minimum access standard* is a *generating system* must be capable of *continuous uninterrupted operation* during and following a *power system load* reduction of 5% or equivalent impact from separation of part of the *power system* in less than 10 seconds provided that the *loading level* remains above minimum generation.

[Deleted]

(e) [**Deleted**]

(f) [**Deleted**]

General requirements

(g) The actual partial load rejection performance must be recorded in the *performance standards*.

S5.2.5.8 Protection of generating systems from power system disturbances

Minimum access standard

(a) The *minimum access standard* is:

(1) subject to subparagraph (2) and paragraph (e), for a *generating system* or any of its *generating units* that is required by a *Generator* or *Network Service Provider* 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* must 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 *Rules*; and

(2) a *generating system* with a *nameplate rating* of 30MW or more, or *generating system* comprised of *generating units* with a combined *nameplate rating* of 30 MW or more, *connected* to a *transmission system* must have *facilities* to automatically and rapidly reduce its *generation*:

(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:

(A) by reducing the output of the *generating system* within 3 seconds, and holding the output at the reduced level until the *frequency* returns to within the *normal operating frequency band*; or

(B) by disconnecting the *generating system* from the *power system* within 1 second; or

(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 seconds of the *frequency* reaching the upper limit of the *extreme frequency excursion tolerance limits*.

[Deleted]

(b) [**Deleted**]

General requirements

(c) *AEMO* or the *Network Service Provider* may require that an *access standard* include a requirement for the *generating system* to 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*, forming an island that *supplies* a *Customer*.

(d) The *access standard* must include specification of conditions for which the *generating unit* or *generating system* must trip and must not trip.

(e) Notwithstanding clauses S5.2.5.3, S5.2.5.4, S5.2.5.5, S5.2.5.6 and S5.2.5.7, a *generating system* may be automatically *disconnected* from the *power system* under any of the following conditions:

(1) in accordance with an *ancillary services agreement* between the *Generator* and *AEMO*;

(2) where a *load* that is not part of the *generating system* has the same *connection point* as the *generating system* and *AEMO* and the *Network Service Provider* agree that the *disconnection* would in effect be under-frequency *load shedding*;

(3) where the *generating system* is automatically *disconnected* under paragraph (a), clause S5.2.5.9 or by an *emergency frequency control scheme*;

(4) where the *generating system* is automatically *disconnected* under clause S5.2.5.10 due to a failure of the *generating plant*; or

(5) in accordance with an agreement between the *Generator* and a *Network Service Provider* (including an agreement in relation to an emergency control scheme under clause S5.1.8) to provide a service that *AEMO* agrees is necessary to maintain or restore *power system security* in the event of a specified *contingency event*.

(f) The *Network Service Provider* is not liable for any loss or damage incurred by the *Generator* or any other person as a consequence of a fault on either the *power system*, or within the *Generator's facility*.

S5.2.5.9 Protection systems that impact on power system security

Automatic access standard

(a) The *automatic access standard* is:

(1) subject to clauses S5.1.9(k) and S5.1.9(l), primary *protection systems* must be provided to *disconnect* from the *power system* any faulted element in a *generating system* and in protection zones that include the *connection point* within the applicable *fault clearance time* determined under clause S5.1.9(a)(1);

(2) each primary *protection system* must have 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* upon which that *protection system* depends) out of service; and

(3) *breaker fail protection systems* must be provided to clear faults that are not cleared by the circuit breakers controlled by the primary *protection system* within the applicable *fault clearance time* determined under clause S5.1.9(a)(1).

(b) In relation to an *automatic access standard* under this clause S5.2.5.9, the *Generator* must provide redundancy in the primary *protection systems* under paragraph (a)(2) and provide *breaker fail protection systems* under paragraph (a)(3) if *AEMO* or the *Network Service Provider* consider that a lack of these *facilities* could result in:

(1) a material adverse impact on *power system security* or quality of *supply* to other *Network Users*; or

(2) a reduction in *inter-regional* or *intra-regional power transfer capability*,

through any mechanism including:

(3) consequential tripping of, or damage to, other *network* equipment or *facilities* of other *Network Users*, that would have a *power system security* impact; or

(4) instability that would not be detected by other *protection systems* in the *network*.

Minimum access standard

(c) The *minimum access standard* is:

(1) subject to clauses S5.1.9(k) and S5.1.9(l), *protection systems* must be provided to *disconnect* from the *power system* any faulted element within a *generating system* and in protection zones that include the *connection point* within the applicable *fault clearance time* determined under clause S5.1.9(a)(2); and

(2) if a *fault clearance time* determined under clause S5.1.9(a)(2) for a protection zone is less than 10 seconds, a *breaker fail protection system* must be provided to clear from the *power system* any fault within that protection zone that is not cleared by the circuit breakers

controlled by the primary *protection system* within the applicable *fault clearance time* determined under clause S5.1.9(a)(3).

[Deleted]

(d) [**Deleted**]

General requirements

(e) The *Network Service Provider* and the *Generator* must cooperate in the design and implementation of *protection systems* to comply with this clause S5.2.5.9, including cooperation on:

(1) the use of *current transformer* and *voltage transformer* secondary circuits (or equivalent) of one party by the *protection system* of the other;

(2) tripping of one party's circuit breakers by a *protection system* of the other party; and

(3) co-ordination of *protection system* settings to ensure inter-operation.

(f) The *protection system* design referred to in paragraphs (a) and (c) must:

(1) be coordinated with other *protection systems*;

(2) avoid consequential *disconnection* of other *Network Users' facilities*; and

(3) take into account existing obligations of the *Network Service Provider* under *connection agreements* with other *Network Users*.

S5.2.5.10 Protection to trip plant for unstable operation

Automatic access standard

(a) The *automatic access standard* is a *generating system* must have:

(1) for its *synchronous generating units*, a *protection system* to *disconnect* it promptly when a condition that would lead to pole slipping is detected in order to prevent pole slipping or other conditions where a *generating unit* causes *active power*, *reactive power* or *voltage* at the *connection point* to become unstable as assessed in accordance with the *power system* stability guidelines established under clause 4.3.4(h); and

(2) for its *asynchronous generating units*, a *protection system* to *disconnect* it promptly for conditions where the *active power*, *reactive power* or *voltage* at the *connection point* becomes unstable as assessed in accordance with the guidelines for *power system* stability established under clause 4.3.4(h).

Minimum access standard

(b) The *minimum access standard* is a *generating system* must not cause a *voltage* disturbance at the *connection point* due to sustained unstable behaviour of more than the maximum level specified in Table 7 of *Australian Standard* AS/NZS 61000.3.7:2001.

Negotiated access standard

(c) If the *Network Service Provider* and the *Generator* agree, a *protection system* may also trip any other part of the *generating system* in order to cease the instability.

(d) Notwithstanding paragraph (c), a *protection system* must be provided in the *access standard* to trip the affected *generating unit* where:

(1) the *Network Service Provider* considers it necessary to prevent consequential tripping of, or damage to, other *generating units*, *network* equipment or other *Network Users' facilities*, or

(2) *AEMO* considers it necessary to prevent unstable operation having an adverse impact on *power system security*.

S5.2.5.11 Frequency control

(a) For the purpose of this clause S5.2.5.11:

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*.

maximum operating level means in relation to:

(1) a *non-scheduled generating unit*, the maximum *sent out generation* consistent with its *nameplate rating*;

(2) a *scheduled generating unit* or *semi-scheduled generating unit*, the maximum *generation* to which it may be *dispatched* and as provided to *AEMO* in the most recent *bid and offer validation data*;

(3) a *non-scheduled generating system*, the combined maximum *sent out generation* consistent with the *nameplate ratings* of its in-service *generating units*; and

(4) a *scheduled generating system* or *semi-scheduled generating system*, the combined maximum *generation* to which its in-service *generating units* may be *dispatched* and as provided to *AEMO* in the most recent *bid and offer validation data*.

minimum operating level means in relation to:

(1) a *non-scheduled generating unit*, its minimum *sent out generation* for continuous stable operation;

(2) a *scheduled generating unit* or *semi-scheduled generating unit*, its minimum *sent out generation* for continuous stable operation;

(3) a *non-scheduled generating system*, the combined *minimum operating level* of its in-service *generating units*; and

(4) a *scheduled generating system* or *semi-scheduled generating system*, the combined minimum *sent out generation* of its in-service *generating units*.

Automatic access standard

(b) The *automatic access standard* is:

(1) a *generating system's power transfer* to the *power system* must not:

(i) increase in response to a rise in the *frequency* of the *power system* as measured at the *connection point*; or

(ii) decrease in response to a fall in the *frequency* of the *power system* as measured at the *connection point*; and

(2) a *generating system* must be capable of operating in *frequency response mode* such that it automatically provides a proportional:

(i) decrease in *power transfer* to the *power system* in response to a rise in the *frequency* of the *power system* as measured at the *connection point*; and

(ii) increase in *power transfer* to the *power system* in response to a fall in the *frequency* of the *power system* as measured at the *connection point*,

sufficiently rapidly and sustained for a sufficient period for the *Generator* to be in a position to offer measurable amounts of all *market ancillary services* for the provision of *power system frequency* control.

Minimum access standard

(c) The *minimum access standard* is:

(1) for a *generating system* under relatively stable input energy, *power transfer* to the *power system* must not:

(i) increase in response to a rise in the *frequency* of the *power system* as measured at the *connection point*; and

(ii) decrease more than 2% per Hz in response to a fall in the *frequency* of the *power system* as measured at the *connection point*; and

(2) a *generating system* must be capable of operating in *frequency response mode* such that, subject to energy source availability, it automatically provides:

(i) a decrease in *power transfer* to the *power system* in response to a rise in the *frequency* of the *power system* as measured at the *connection point*; or

(ii) an increase in *power transfer* to the *power system* in response to a fall in the *frequency* of the *power system* as measured at the *connection point*,

where the change in *active power* is either proportional or otherwise as agreed with *AEMO* and the *Network Service Provider*.

[Deleted]

(d) [**Deleted**]

(e) [**Deleted**]

(f) [**Deleted**]

General requirements

(g) Each *control system* used to satisfy this clause S5.2.5.11 must be *adequately damped*.

(h) The amount of a relevant *market ancillary service* for which the *plant* may be registered must not exceed the amount that would be consistent with the *performance standard* registered in respect of this requirement.

(i) For the purposes of subparagraph (b)(2), and with respect to a *negotiated access standard* proposed for the technical requirements relevant to this clause S5.2.5.11:

(1) the change in *power transfer* to the *power system* must occur with no delay beyond that required for stable operation, or inherent in the *plant* controls, once the *frequency* of the *power system* as measured at the *connection point* leaves a deadband around 50 Hz;

(2) a *generating system* must be capable of setting the deadband and droop within the following ranges:

(i) the deadband referred to in subparagraph (1) must 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*; and

(ii) the droop must be set within the range of 2% to 10%;

(3) nothing in paragraph (b)(2) is taken to require a *generating system* to operate below its minimum operating level in response to a rise in the *frequency* of the *power system* as measured at the *connection point*, or above its maximum operating level in response to a fall in the *frequency* of the *power system* as measured at the *connection point*;

(4) a *generating system* is required to operate in *frequency response mode* only when it is enabled for the provision of a relevant *market ancillary service*; and

(5) the *performance standards* must record:

(i) the agreed values for maximum operating level and minimum operating level, and where relevant the method of determining the values, and the values for a *generating system* must take into account its in-service *generating units*; and

(ii) for the purpose of subparagraph (b)(2), the *market ancillary services*, including the performance parameters and requirements that apply to each such *market ancillary service*.

S5.2.5.12 Impact on network capability

Automatic access standard

(a) The *automatic access standard* is a *generating system* must have *plant* capabilities and *control systems* that are sufficient so that when *connected* 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*.

Minimum access standard

(b) The *minimum access standard* is a *generating system* must have *plant* capabilities, *control systems* and operational arrangements sufficient to ensure there is no reduction in:

(1) the ability to *supply Customer load* as a result of a reduction in *power transfer capability*; and

(2) *power transfer capabilities* into a region by more than the combined *sent out generation* of its *generating units*.

Negotiated access standard

(c) In carrying out assessments of proposed *negotiated access standards* under this clause S5.2.5.12, the *Network Service Provider* and *AEMO* must take into account:

(1) the expected performance of:

(i) existing *networks* and *considered projects*;

(ii) existing *generating plant* and other relevant projects; and

(iii) *control systems* and *protection systems*, including *automatic reclose equipment*; and

(2) the expected range of *power system* operating conditions.

(d) The *negotiated access standard* must include:

(1) *control systems* to minimise any reduction in *power transfer capabilities*; and

(2) operational arrangements, including curtailment of the *generating system's* output if necessary to ensure that the *generating plant* is operated in a way that meets at least the *minimum access standard* under abnormal *network* and *generating system* conditions, so that *power system security* can be maintained.

(e) A *negotiated access standard* under this clause S5.2.5.12 must detail the *plant* capabilities, *control systems* and operational arrangements that will be maintained by the *Generator*, notwithstanding that change to the *power system*, but not changes to the *generating system*, may reduce the efficacy of the *plant* capabilities, *control systems* and operational arrangements over time.

(f) [**Deleted**]

General requirement

(g) If a *Network Service Provider* considers that *power transfer capabilities* of its *network* would be increased through provision of additional *control system facilities* to a *generating system* (such as a *power system* stabiliser), the *Network Service Provider* and the *Generator* may negotiate for the

provision of such additional *control system facilities* as a commercial arrangement.

S5.2.5.13 Voltage and reactive power control

(a) For the purpose of this clause S5.2.5.13:

static excitation system means in relation to a *synchronous generating unit*, an *excitation control system* that does not use rotating machinery to produce the field current.

Automatic access standard

(b) The *automatic access standard* is:

(1) a *generating system* must have *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*, 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) a *control system* must 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;

(2A) a *generating system* must have *facilities* with a *control system* to regulate *voltage*, *reactive power* or *power factor*, with the ability to:

(i) operate in any control mode; and

(ii) switch between control modes,

in accordance with a procedure agreed with *AEMO* and the *Network Service Provider*. *Remote control equipment* to change the setpoint and control mode must be provided;

(2B) a *generating system* must have a *voltage control system* that:

(i) regulates *voltage* at the *connection point* or another agreed location in the *power system* (including within the *generating system*) to within 0.5% of the setpoint, where that setpoint may be droop-adjusted to incorporate any *voltage* droop agreed with *AEMO* and the *Network Service Provider;*

(ii) regulates *voltage* in a manner that helps to support *network voltages* during faults and does not prevent the *Network Service*

Provider from achieving the requirements of clauses S5.1a.3 and S5.1a.4;

(iii) allows the *voltage* setpoint to be continuously controllable in the range of at least 95% to 105% of *normal voltage* at the *connection point* or agreed location on the *power system*, without reliance on a *tap-changing transformer*;

(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; and

(v) has a *power system* stabiliser with sufficient flexibility to enable damping performance to be maximised, with characteristics as described in paragraph (c);

(3) a synchronous *generating system* must have an *excitation control system* that:

(i) [**Deleted**]

(ii) is able to operate the stator continuously at 105% of *nominal voltage* with *rated active power* output;

(iii) [**Deleted**]

(iv) [**Deleted**]

(v) [**Deleted**]

(vi) has an excitation ceiling *voltage* of at least:

(A) for a static excitation system, 2.3 times; or

(B) for other *excitation control systems*, 1.5 times,

the excitation required to achieve *generation* at the *nameplate rating* for rated *power factor*, rated speed and *nominal voltage*;

(vii) has settling *times* for a step change of *voltage* setpoint or *voltage* at the location agreed under subparagraph (2B)(i) of:

(A) generated *voltage* less than 2.5 seconds for a 5% *voltage* disturbance with the *generating unit* not *synchronised*;

(B) *active power*, *reactive power* and *voltage* less than 5.0 seconds for a 5% *voltage* disturbance with the *generating unit synchronised*, from an operating point where the *voltage* disturbance would not cause any limiting device to operate; and

(C) in respect of each limiting device, *active power*, *reactive power* and *voltage* less than 7.5 seconds for a 5% *voltage* disturbance with the *generating unit synchronised*, when operating into a limiting device from an operating point where a *voltage* disturbance of 2.5% would just cause the limiting device to operate; and

(viii) is able to increase field *voltage* from rated field *voltage* to the excitation ceiling *voltage* in less than:

(A) 0.05 second for a static excitation system; or

(B) 0.5 second for other *excitation control systems*; and

(4) a *generating system*, other than one comprised of *synchronous generating units*, must have a *voltage control system* that:

(i) [**Deleted**]

(ii) [**Deleted**]

(iii) [**Deleted**]

(iv) [**Deleted**]

(v) 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 the location agreed under clause subparagraph (2B)(i), of less than:

(A) 5.0 seconds 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 seconds 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; and

(vi) has *reactive power* rise time, for a 5% step change in the *voltage* setpoint, of less than 2 seconds.

(c) A *power system* stabiliser provided under paragraph (b) must have:

(1) 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;

(2) two washout filters for each input, with ability to bypass one of them if necessary;

(3) sufficient (and 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*;

(4) an output limiter, which for a *synchronous generating unit* is continually adjustable over the range of –10% to +10% of stator *voltage*;

(5) monitoring and recording *facilities* for key variables including inputs, output and the inputs to the lead-lag transfer function blocks; and

(6) *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.

(c1) A *reactive power* or *power factor control system* provided under paragraph (b)(2A) must:

(1) regulate *reactive power* or *power factor* (as applicable) at the *connection point*, an agreed location in the *power system* or within the *generating system*, to within 0.5% of its setpoint;

(2) allow the *reactive power* or *power factor* setpoint to be continuously controllable across the *reactive power* capability range established under clause S5.2.5.1;

(3) with the *generating system connected* to the *power system*, and for a step change in setpoint, or a 5% *voltage* disturbance at the location agreed under subparagraph (1):

(i) have *settling times* for *active power*, *reactive power* and *voltage* of less than 5.0 seconds from an operating point where the *voltage* disturbance would not cause any limiting device to operate;

(ii) have *settling times* for *active power*, *reactive power* and *voltage* of less than 7.5 seconds 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; and

(iii) has *reactive power rise time* of less than two seconds,

where the change in *reactive power* setpoint or *power factor* setpoint is sufficient to induce a 5% change in *voltage* at the location agreed under subparagraph (1).

Minimum access standard

(d) The *minimum access standard* is:

(1) a *generating system* must have *plant* capabilities and *control systems*, including, if appropriate, a *power system* stabiliser, sufficient to ensure that:

(i) *power system* oscillations, for the frequencies of oscillation of the *generating unit* against any other *generating unit*, are *adequately damped*;

(ii) operation of the *generating unit* does not degrade:

(A) any mode of oscillation that is within 0.3 nepers per second of being unstable, by more than 0.01 nepers per second; and

(B) any other mode of oscillation to within 0.29 nepers per second of being unstable; and

(iii) operation of the *generating unit* does not cause instability (including hunting of *tap-changing transformer control systems*) that would adversely impact other *Registered Participants*;

(2) a *generating system* comprised of *generating units* with a combined *nameplate rating* of 30 MW or more must have *facilities* for testing its

control systems sufficient to establish their dynamic operational characteristics;

(2A) a *generating system* must have *facilities* with a *control system* to regulate:

(i) *voltage*; or

(ii) either of *reactive power* or *power factor* with the agreement of *AEMO* and the *Network Service Provider*;

(2B) a *voltage control system* for a *generating system* must:

(i) regulate *voltage* at the *connection point*, an agreed location in the *power system* or within the *generating system*, to within 2% of the setpoint, where that setpoint may be droop-adjusted to incorporate any *voltage* droop agreed with *AEMO* and the *Network Service Provider*; and

(ii) allow the *voltage* setpoint to be controllable in the range of at least 98% to 102% of *normal voltage* at the *connection point* or the agreed location;

(3) a *generating system's reactive power* or *power factor control system* must:

(i) regulate *reactive power* or *power factor* (as applicable) at the *connection point*, an agreed location in the *power system* or within the *generating system*, to within 2% of its setpoint; and

(ii) allow the *reactive power* or *power factor* setpoint to be continuously controllable across the *reactive power* capability range established under clause S5.2.5.1;

(4) a *synchronous generating unit*, that is part of a *generating system* comprised of *generating units* with a combined *nameplate rating* of 30 MW or more, must have an *excitation control system* that:

(i) [**Deleted**]

(ii) has excitation ceiling *voltage* of at least 1.5 times the excitation required to achieve *generation* at the *nameplate rating* for rated *power factor*, rated speed and *nominal voltage*;

(iii) subject to co-ordination under paragraph (i), has a settling *time* of less than 7.5 seconds for a 5% *voltage* disturbance with the *generating unit* synchronised, from an operating point where such a *voltage* disturbance would not cause any limiting device to operate; and

(iv) has over and under excitation limiting devices sufficient to ensure that a *voltage* disturbance does not cause the *generating unit* to trip at the limits of its operating capability; and

(5) a *generating system* comprised solely of *asynchronous generating units* with a combined *nameplate rating* of 30 MW or more, must have a *control system* that:

(i) [**Deleted**]

(ii) subject to co-ordination under paragraph (i), has a *settling time* less than 7.5 seconds for a 5% *voltage* disturbance with the *generating unit* electrically connected to the *power system* from an operating point where such a *voltage* disturbance would not cause any limiting device to operate; and

(iii) has limiting devices to ensure that a *voltage* disturbance would not cause the *generating unit* to trip at the limits of its operating capability.

Negotiated access standard

(e) [**Deleted**]

(f) The *negotiated access standard* proposed by the *Generator* under clause 5.3.4A(b1) must be the highest level that the *generating system* can reasonably achieve, including by installation of additional dynamic *reactive power* equipment, and through optimising its *control systems*.

(g) [**Deleted**]

General requirements

(h) A limiting device provided under paragraphs (b) and (c) must:

(1) not detract from the performance of any *power system* stabiliser; and

(2) be co-ordinated with all *protection systems*.

(i) The *Network Service Provider* may require that the design and operation of the *control systems* of a *generating unit* or *generating system* be coordinated with the existing *voltage control systems* of the *Network Service Provider* and of other *Network Users*, in order to avoid or manage interactions that would adversely impact on the *Network Service Provider* and other *Network Users*.

(j) Any requirements imposed by the *Network Service Provider* under paragraph (i) must be recorded in the *access standard*.

(k) The assessment of impact of the *generating units* on *power system* stability and damping of *power system* oscillations shall be in accordance with the guidelines for *power system* stability established under clause 4.3.4(h).

(l) The performance characteristics of any *reactive power* control capability agreed with *AEMO* and the *Network Service Provider* under this clause S5.2.5.13 must be consistent with the *reactive power* capability agreed with *AEMO* and the *Network Service Provider* under clause S5.2.5.1.

S5.2.5.14 Active power control

(a) The *automatic access standard* is a *generating system* must have an *active power control system* capable of:

(1) for a *scheduled generating unit* or a *scheduled generating system*:

(i) maintaining and changing its *active power* output in accordance with its *dispatch instructions*;

(ii) ramping its *active power* output linearly from one level of *dispatch* 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 four seconds (or such other period specified by *AEMO* as required);

(2) subject to energy source availability, for a *non-scheduled generating unit* or *non-scheduled generating system*:

(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 *active power* output within 5 minutes by more than the raise and lower amounts specified in an instruction electronically issued by a *control centre*; and

(3) subject to energy source availability, for a *semi-scheduled generating unit* or a *semi-scheduled generating system*:

(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*;

(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 four seconds (or such other period specified by *AEMO* as required).

Minimum access standard

(b) The *minimum access standard* is a *generating system* must have an *active power control system* capable of:

(1) for a *scheduled generating unit* or a *scheduled generating system*:

(i) maintaining and changing its *active power* output in accordance with its *dispatch instructions*; and

(ii) receiving and automatically responding to signals delivered from the *automatic generation control system*, as updated at a

rate of once every four seconds (or such other period specified by *AEMO* as required);

(2) for a *non-scheduled generating system*:

(i) reducing its *active power* output, within 5 minutes, to or below the level required to manage *network* flows that is specified in a verbal instruction issued by the *control centre*;

(ii) limiting its *active power* output, to or below the level specified in subparagraph (i); and

(iii) subject to energy source availability, ensuring that the change of *active power* output in a 5 minute period does not exceed a value agreed with *AEMO* and the *Network Service Provider*; and

(3) subject to energy source availability, for a *semi-scheduled generating unit* or a *semi-scheduled generating system*:

(i) maintaining and changing its *active power* output in accordance with its *dispatch instructions*;

(ii) not changing its *active power* output within five minutes by more than the rise and lower amounts specified in an instruction electronically issued by a *control centre*; and

(iii) receiving and automatically responding to signals delivered from the *automatic generation control system*, as updated at a rate of once every four seconds (or such other period specified by *AEMO* as required).

Negotiated access standard

(c) A *negotiated access standard* may provide that if the number or frequency of verbal instructions becomes difficult for a *control centre* to manage, *AEMO* may require the *Generator* to upgrade its *facilities* to receive electronic instructions and fully implement them within 5 minutes.

(d) The *negotiated access standard* must document to *AEMO's* satisfaction any operational arrangements necessary to manage *network* flows that may include a requirement for the *generating system* to be operated in a manner that prevents its output changing within 5 minutes by more than an amount specified by a *control centre*.

(e) [**Deleted**]

General requirements

(f) Each *control system* used to satisfy the requirements of paragraphs (a) and (b) must be *adequately damped*.

S5.2.6 Monitoring and control requirements

S5.2.6.1 Remote Monitoring

Automatic access standard

(a) The *automatic access standard* is a:

(1) *scheduled generating unit*;

(2) *scheduled generating system*;

(3) *non-scheduled generating unit*;

(4) *non-scheduled generating system*;

(5) *semi-scheduled generating unit*; or

(6) *semi-scheduled generating system*,

must have *remote monitoring equipment* and *remote control equipment* to transmit to, and receive from, *AEMO's control centres* in real time in accordance with rule 4.11 the quantities that *AEMO* reasonably requires to discharge its *market* and *power system security* functions set out in Chapters 3 and 4.

(b) The quantities referred to under paragraph (a) that *AEMO* may request include:

(1) in respect of a *generating system* of a type referred to in subparagraphs (a)(1) to (6):

(i) the status of all switching devices that carry the *generation*;

(ii) *tap-changing transformer* tap position(s) and *voltages*;

(iii) *active power* and *reactive power* aggregated for groups of identical *generating units*;

(iv) either the number of identical *generating units* operating or the operating status of each non-identical *generating unit*;

(v) *active power* and *reactive power* for the *generating system*; and

(vi) *voltage control system* setpoint and mode (as applicable);

(2) in respect of a *generating unit* with a *nameplate rating* of 30 MW or more, current, *voltage*, *active power* and *reactive power* in respect of *generating unit* stators or power conversion systems (as applicable);

(3) in respect of an auxiliary supply system with a capacity of 30 MW or more associated with a *generating unit* or *generating system*, *active power* and *reactive power*;

(4) in respect of *reactive power* equipment that is part of a *generating system* but not part of a particular *generating unit*, its *reactive power*;

(5) in respect of a *semi-scheduled generating system*, all data specified as mandatory in the relevant *energy conversion model* applicable to that type of *semi-scheduled generating system*;

(6) in respect of a *scheduled generating system* or *semi-scheduled generating system*:

(i) maximum *active power* limit;

(ii) minimum *active power* limit;

(iii) maximum *active power* raise *ramp rate*; and

(iv) maximum *active power* lower *ramp rate*;

(7) in respect of a run-back scheme agreed with the *Network Service Provider*:

(i) run-back scheme status; and

(ii) *active power*, *reactive power* or other control limit, as applicable;

(8) the mode of operation of the *generating unit*, turbine 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*; and

(9) any other quantity that *AEMO* reasonably requires to discharge its *market* and *power system security* functions as set out in Chapters 3 and 4.

(b1) The remote control quantities referred to under paragraph (a) that *AEMO* may request include:

(1) in respect of a *generating system*:

(i) *voltage control* setpoint; and

(ii) *voltage control* mode (where applicable);

(2) in respect of a *scheduled generating system* or *semi-scheduled generating system*, the *automatic generation control system* signal; and

(3) in respect of a *non-scheduled generating system*, to the extent required to manage *network* flows:

(i) *active power* limit; and

(ii) *active power* ramp limit.

Minimum access standard

(c) The *minimum access standard* is a:

(1) *scheduled generating unit*;

(2) *scheduled generating system*;

(3) *non-scheduled generating system*;

(4) *semi-scheduled generating unit*; or

(5) *semi-scheduled generating system*,

must have *remote monitoring equipment* to transmit to *AEMO's control centres* in real time in accordance with rule 4.11 the quantities that *AEMO* reasonably requires to discharge its *market* and *power system security* functions set out in Chapters 3 and 4.

(d) The quantities referred to under paragraph (c) that *AEMO* may request include:

(1) the *active power* output of the *generating unit* or *generating system* (as applicable);

(2) if *connected* to a *transmission system*, the *reactive power* output of the *generating unit* or *generating system* (as applicable); and

(3) if a *semi-scheduled generating system*, all data specified as mandatory in the relevant *energy conversion model* applicable to that type of *semi-scheduled generating system*.

S5.2.6.2 Communications equipment

Automatic access standard

(a) The *automatic access standard* is a *Generator* must:

(1) provide and maintain 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) and *AEMO's control centre*; and

(2) provide 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 the relevant *generating unit*.

Minimum access standard

(b) The *minimum access standard* is a *Generator* must:

(1) provide and maintain a telephone facility for the purposes of operational communications between the *Generator's* responsible operator under clause 4.11.3(a) and *AEMO's control centre*; and

(2) provide 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 1 hour following total loss of *supply* at the *connection point* for the relevant *generating unit*.

Negotiated access standard

(c) A *negotiated access standard* must include, where the *Network Service Provider* or *AEMO* reasonably require, a back-up telephone facility be independent of commercial telephone service providers, and the *Network Service Provider* must provide and maintain the separate facility on a cost-recovery basis only through the charge for *connection*.

(d) A *negotiated access standard* must include that a *Generator* must provide communications paths (with appropriate redundancy) from the *remote monitoring equipment* or *remote control equipment* installed for each of its *generating systems* as appropriate, to a interface for communication purposes in a location reasonably acceptable to the *Network Service Provider* at the relevant *generation* facility.

(e) Communications systems between the interface for communication purposes under paragraph (d) and the *control centre* must be the responsibility of the *Network Service Provider* unless otherwise agreed by the *Generator* and the *Network Service Provider*.

(f) A *negotiated access standard* must include that the *Generator* provide accommodation and secure power supplies for communications *facilities* provided by the *Network Service Provider* under this clause S5.2.6.2.

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Schedule 5.3a Conditions for connection of Market Network Services

S5.3a.1a Introduction to the schedule

This schedule sets out obligations of *Market Network Service Providers* who *connect* to either a *transmission network* or a *distribution network.* It represents the requirements to be met for access to a *network*. Particular provisions may be varied by the *Network Service Provider* under the provisions of the *Rules* for the application of *minimum access standards* and *automatic access standards*.

This schedule includes specific provisions for the determination of *automatic access standards* and *negotiated access standards* which, once determined, must be recorded together with the *automatic access standards* in a *connection agreement* and registered with *AEMO* as *performance standards*.

In this schedule, the term ***Network Service Provider*** applies only to the *Network Service Provider* with whom the *Market Network Service Provider* has lodged, or is considering lodging, an *application to connect*.

(a) The schedule includes, in respect of each *market network service*, provisions regarding the capability to:

(1) automatically control the transfer of real power at the *connection point* for any given set of system conditions within the limits permitted under the *Rules*;

(2) respond to control requirements under expected normal and abnormal conditions;

(3) comply with general requirements to meet quality of *supply* obligations in accordance with clauses S5.3a.9, S5.3a.10 and S5.3a.11 and to maintain security of *supply* to other *Registered Participants*; and

(4) automatically *disconnect* itself when necessary to prevent any damage to the *market network service facilities* or threat to *power system security*.

(b) This schedule also sets out the requirements and conditions, which (subject to clause 5.2.3 of the *Rules*) are obligations of *Market Network Service Providers* to:

(1) co--operate with the relevant *Network Service Provider* on technical matters when making a new *connection*;

(2) provide information to the *Network Service Provider* or *AEMO*; and

(3) observe and apply the relevant provisions of the *system standards* contained in schedule 5.1a in relation to the planning, design and operation of its *market network service facilities*.

(c) This schedule does not set out arrangements by which a *Market Network Service Provider* may enter into an agreement or contract with *AEMO* to:

(1) provide additional services that are necessary to maintain *power system security*; or

(2) provide additional service to facilitate management of the *market*.

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S5.3a.4 Monitoring and control requirements

S5.3a.4.1 Remote Monitoring

(a) *Automatic access standard*:

(1) Each *market network service facility* must have *remote monitoring equipment* to transmit to *AEMO's control centres* in real time, the quantities that *AEMO* reasonably requires to discharge its *market* and *power system security* functions as set out in Chapters 3 and 4 of the *Rules* respectively.

(2) The quantities may include such data as current, *voltage*, *active power*, *reactive power*, operational limits and critical temperatures in respect of *connection points* and power conversion systems.

(b) *Minimum access standard*:

(1) Each *market network service facility* must have *remote monitoring equipment* to transmit to *AEMO's control centres* in real time:

(A) *connection point active power* flow, *reactive power* flow and *voltage*;

(B) *active power*, *reactive power* and *voltage* for AC power lines, *transformers* and *busbars*, and power and *voltage* (or alternatively current) for DC power lines; and

(C) the status of circuit breakers.

****

S5.3a.14 Protection of market network services from power system disturbances

(a) *Minimum access standard*: If a *Connection Applicant* requires that its *market network service facility* be automatically *disconnected* from the *power system* in response to abnormal conditions arising from the *power system*, the relevant *protection system* or *control system* must not *disconnect*

the *facility* for conditions under which it must continuously operate or must withstand under a provision of the *Rules*.

(b) There is no *automatic access standard* for this technical requirement.

(c) For the purposes of this clause S5.3a.14, the abnormal conditions include:

(1) *frequency* outside the *extreme frequency excursion tolerance limits*;

(2) sustained and uncontrollable DC current beyond a short term *current rating* for the period assigned to that rating;

(3) DC *voltage* above the *voltage* maximum rating or sustained below any lower limit for stable operation;

(4) *voltage* to *frequency* ratio beyond a *transformer* magnetic flux based *voltage* to *frequency* rating;

(5) sustained *voltage* fluctuations at the *connection point* beyond the level determined under clause S5.1.5(a);

(6) sustained harmonic *voltage* distortion at the *connection point* beyond the level determined under clause S5.1.6(a);

(7) sustained negative phase sequence *voltage* at the *connection point* beyond the level determined under clause S5.1.7(a); and

(8) any similar condition agreed between the *Market Network Service Provider* and *AEMO* after consultation with each relevant *Network Service Provider*.

(d) [**Deleted**]

(e) The *Network Service Provider* is not liable for any loss or damage incurred by the *Market Network Service Provider* or any other person as a consequence of a fault on either the *power system*, or within the *Market Network Service Provider's facility*.

CHAPTER 10

10. Glossary

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AEMO advisory matter

A matter that relates to *AEMO's* functions under the *National Electricity Law* and a matter in which *AEMO* has a role under clause 5.3.4B or in schedules 5.1a, 5.1, 5.2, 5.3 and 5.3a. Advice on the acceptability of *negotiated access standards* under the following clauses are deemed to be *AEMO advisory matters*: S5.1.9, S5.2.5.1, S5.2.5.3 to S5.2.5.5, S5.2.5.7 to S5.2.5.14, S5.2.6.1, S5.2.6.2, S5.3a.4.1 and S5.3a.14.

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continuous uninterrupted operation

In respect of a *generating system* or *generating unit* operating immediately prior to a *power system* disturbance:

(a) not *disconnecting* from the *power system* except under its *performance standards* established under clauses S5.2.5.8 and S5.2.5.9;

(b) during the disturbance contributing active and reactive current as required by its *performance standards* established under clause S5.2.5.5;

(c) after clearance of any electrical fault that caused the disturbance, only substantially varying its *active power* and *reactive power* as required or permitted by its *performance standards* established under clauses S5.2.5.5, S5.2.5.11, S5.2.5.13 and S5.2.5.14; and

(d) so as to not exacerbate or prolong the disturbance or cause a subsequent disturbance for other *connected plant*, except as required or permitted by its *performance standards*,

with all essential auxiliary and *reactive plant* remaining in service..

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rise time

In relation to a *control system*, the time taken for an output quantity to rise from 10% to 90% of the maximum change induced in that quantity by a step change of an input quantity.

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settling time

In relation to a *control system*, the time measured from initiation of a step change in an input quantity to the time when the magnitude of error between the output quantity and its final settling value remains less than 10% of:

(1) if the sustained change in the quantity is less than half of the maximum change in that output quantity, the maximum change induced in that output quantity; or

(2) the sustained change induced in that output quantity.

CHAPTER 11

11. Savings and Transitional Rules

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Part ZZZI Generator technical performance standards

11.107 Rules consequential on the making of the National Electricity Amendment (Generator technical performance standards) Rule 2018

11.107.1 Definitions

For the purposes of this rule 11.107:

agreed access standard means an *access standard* that has been agreed by the *Network Service Provider* and is capable of forming part of the terms and conditions of a *connection agreement* as the *performance standard* applicable to the *plant* for the relevant technical requirement.

Amending Rule means the National Electricity Amendment (Generator technical performance standards) rule 2018 No. X.

commencement date means the date of commencement of the Amending Rule.

conditional access standards has the meaning given in clause 11.107.3(e)(1)(B).

existing application to connect has the meaning given in clause 11.107.3.

existing connection enquiry has the meaning given in clause 11.107.2.

Existing Connection Agreement means a *connection agreement* entered into before the commencement date.

former Chapter 5 means Chapter 5 of the *Rules* as in force immediately prior to the commencement date.

new Chapter 5 means Chapter 5 of the *Rules* as it will be in force on and from the commencement date, as amended from time to time.

11.107.2 Application of the Amending Rule to existing *connection* enquiries

(a) This clause 11.107.2 applies where, before the commencement date, a *Connection Applicant* has, in respect of *plant* that the *Connection Applicant* proposes to *connect*:

(1) made a *connection* enquiry in accordance with clause 5.3.2 (**existing connection enquiry**); and

(2) not made an *application to connect* to a *Network Service Provider* under clause 5.3.4.

(b) On and from the commencement date:

(1) the new Chapter 5 applies for the purposes of determining the *access standards* that apply to the *plant* that the *Connection Applicant* proposes to *connect*;

(2) the existing connection enquiry will be taken to be a valid *connection* enquiry under the new Chapter 5 with respect to the proposed *plant*; and

(3) the *Network Service Provider* must:

(i) within 10 *business days* after the commencement date, use its reasonable endeavours to provide written notification to a *Connection Applicant* to which this clause 11.107.2 applies that the existing connection enquiry will be treated as a *connection* enquiry under the new Chapter 5; and

(ii) within 20 *business days* after providing the written notification in subparagraph (3)(i), in consultation with *AEMO* and where necessary, provide each *Connection Applicant* notified under subparagraph (3)(i) with:

(A) any further information required under clause 5.3.3 of the new Chapter 5 relevant to the proposed *plant*; and

(B) written notice of any further information or data to be provided by the *Connection Applicant* to the *Network Service Provider*,

to enable the *Connection Applicant* to submit an *application to connect* in accordance with the new Chapter 5 with respect to the proposed *plant*.

(c) Where the *Network Service Provider* has charged the *Connection Applicant* any fees or charges with respect to the existing connection enquiry, the *Network Service Provider* must not charge the *Connection Applicant* any additional fees or charges on or from the commencement date with respect to such existing connection enquiry, except to the extent necessary to cover the reasonable costs of work required to notify the *Connection Applicant* and provide any relevant information under subparagraph (3)(ii). For the avoidance of doubt, this clause 11.107.3(c) does not preclude a *Network Service Provider* recovering an application fee from the *Connection Applicant* under clause 5.3.4(b).

11.107.3 Application of the Amending Rule to existing *applications to connect*

(a) This clause 11.107.3 applies where, before the commencement date, a *Connection Applicant* has, in respect of *plant* that the *Connection Applicant* proposes to *connect*:

(1) made an *application to connect* to a *Network Service Provider* in accordance with clause 5.3.4 (**existing application to connect**); and

(2) not received an offer to *connect* from the relevant *Network Service Provider* in respect of the existing application to connect.

(b) Except in the circumstances set out in paragraph (f), on and from the commencement date:

(1) the new Chapter 5 applies for the purposes of determining the *access standards* that apply to the *plant* that the *Connection Applicant* proposes to *connect*;

(2) the existing application to connect will be taken to be a valid *application to connect* under the new Chapter 5 with respect to the proposed *plant*; and

(3) the *Network Service Provider* must:

(i) within 10 *business days* after the commencement date, use its reasonable endeavours to provide written notification to a *Connection Applicant* to which this clause 11.107.3 applies that the existing application to connect will be treated as an *application to connect* under the new Chapter 5; and

(ii) within 20 *business days* after providing the written notification in subparagraph (3)(i), in consultation with *AEMO* and where necessary, provide each *Connection Applicant* notified under subparagraph (3)(i) (with a copy to be provided to *AEMO*) with:

(A) any further information required under clause 5.3.3 of the new Chapter 5 relevant to the proposed *plant*, including for each technical requirement, written details of the *automatic access standards*, *minimum access standards* and *negotiated access standards* that are *AEMO advisory matters*; and

(B) written notice of any further information to be provided by the *Connection Applicant* (which may include information required to be provided under clauses 5.2.5(d) and (e) and Schedule 5.5),

necessary for the *Network Service Provider* to prepare an offer to *connect* in accordance with the new Chapter 5 with respect to the proposed *plant*.

(c) Where the *Network Service Provider* has charged the *Connection Applicant* any fees or charges with respect to the existing application to connect, the *Network Service Provider* must not charge the *Connection Applicant* any additional fees or charges on or from the commencement date with respect to such existing application to connect, except to the extent necessary to cover the reasonable costs of work required for the *Network Service Provider* to prepare an offer to *connect* in accordance with the new Chapter 5, including the requirements to notify the *Connection Applicant* and provide any relevant information under subparagraph (b)(3).

(d) A *Network Service Provider* to which this clause applies may extend the time period referred to in clause 5.3.6(a) to reasonably allow for any additional time taken in excess of the period allowed in the *preliminary program* that is necessary to take account of

the differences in *access standards* between the former Chapter 5 and the new Chapter 5.

(e) Subject to paragraph (f), where, in the reasonable opinion of the *Network Service Provider* and *AEMO*, as at the commencement date all *access standards* relevant to the *plant* were agreed *access standards*, then the *Network Service Provider* must:

(1) within 10 *business days* from receipt of a written request by the *Connection Applicant*, provide written confirmation to the *Connection Applicant*:

(A) that all *access standards* relevant to the *plant* are agreed *access standards* as at the commencement date; and

(B) identifying any *access standards* that are agreed subject to certain conditions being satisfied, including where relevant, the date for satisfaction of those conditions (**conditional access standards**); and

(2) otherwise, use its reasonable endeavours to provide, within 10 *business days* after the commencement date, the written confirmation at subparagraphs (e)(1)(A) and (e)(1)(B) to the relevant *Connection Applicant*.

(f) Where:

(1) the *Network Service Provider* has provided written confirmation under paragraph (e)(1) or (e)(2); and

(2) a condition under the conditional access standards was not satisfied,

then on and from the date on which such condition was not satisfied:

(3) the relevant conditional access standards will be taken to have not been agreed for the purposes of paragraph (e);

(4) the new Chapter 5 applies for the purposes of determining all *access standards* that apply to the *plant* that the *Connection Applicant* proposes to *connect*;

(5) the existing application to connect will be taken to be a valid *application to connect* under the new Chapter 5 with respect to the proposed *plant*;

(6) the *Network Service Provider* must, in consultation with *AEMO*, within a further 10 *business days* from the date on which the condition was not satisfied:

(i) notify the *Connection Applicant* that the relevant conditional access standards are no longer agreed *access standards* and that the existing application to connect will be treated as an *application to connect* under the new Chapter 5; and

(ii) provide the *Connection Applicant* notified under subparagraph (i) with the further information and notice specified in subparagraph (b)(3)(ii); and

(7) the *Network Service Provider* must comply with the requirements of paragraphs (c) and (d).

[AEMC drafting note: the application of conditional access standards are still being considered in the context of these transitional arrangements]

(g) Notwithstanding this clause 11.107.3, and subject to paragraph (f), if the *Network Service Provider* provides written confirmation to a *Connection Applicant* under subparagraphs (e)(1) or (e)(2), the former Chapter 5 applies for the purposes of determining the *access standards* that apply to the *plant* that the *Connection Applicant* proposes to *connect* under that *application to connect*.

11.107.4 Application of the Amending Rule to existing *offers to connect*

(a) This clause 11.107.4 applies where, before the commencement date, a *Connection Applicant*:

(1) has received a valid offer to *connect* from the relevant *Network Service Provider* in respect of an *application to connect*; and

(2) has not entered into a *connection agreement* with the relevant *Network Service Provider* in respect of that *application to connect.*

(b) On and from the commencement date, the former Chapter 5 applies for the purposes of determining the *access standards* that apply to the *plant* that the *Connection Applicant* proposes to *connect* under that offer to *connect*.

11.107.5 Application of the Amending Rule to Existing Connection Agreements

(a) The Amending Rule is neither intended to, nor to be read or construed as having, the effect of:

(1) altering the terms of an Existing Connection Agreement;

(2) altering the contractual rights or obligations of any of the parties under an Existing Connection Agreement; or

(3) relieving the parties under any such Existing Connection Agreement of their contractual obligations under such an agreement.

(b) Subject to paragraph (c), if, after the commencement of the Amending Rule, a *Generator* under an Existing Connection Agreement is required, in accordance with the *Rules*, to amend the *performance standards* set out in the Existing Connection Agreement, then the new Chapter 5 applies for the purposes of amending such *performance standards*.

(c) The former Chapter 5 applies to a *Generator* who, as at the commencement date, has proposed to alter its *generating system* and has advised *AEMO* in accordance with clause 5.3.9, unless:

(1) *AEMO*, the *Generator* and the relevant *Network Service Provider* agree otherwise; or

(2) in *AEMO*'s reasonable opinion (in respect of an *AEMO advisory matter*), there will be an adverse impact on *power system security* as a result of the application of former Chapter 5.

(d) The Amending Rule is neither intended to have, nor is it to be read or construed as having, the effect of changing the application of clause 11.6.11 (if applicable) in relation to *connection services* provided under an Existing Connection Agreement.