Power System Security and Reliability (PSSR) Standards Review: Exposure Draft

Proposed Electricity System and Market (ESM) Amending Rules

Explanatory Note for Exposure Draft of the Proposed ESM Amending Rules

This Exposure Draft is presented in two parts and contains proposed Electricity System and Market (ESM) Amending Rules considered as part of the Power System Security and Reliability (PSSR) Standards Review (the Review).

Part 1: Clarifies grid-following (GFL) and grid-forming (GFM) inverter Technical Requirements and refined performance standards to better recognise the capabilities and operational characteristics of modern inverter-based resources (IBRs); and

Part 2: Establishes a system strength framework for the South West Interconnected System (SWIS), which prescribes the relevant roles and responsibilities, including:

- Establishing a Forecast and Planning Coordination Group under the ESM Rules chaired by the Coordinator of Energy and comprising representatives from the Australian Market Operator (AEMO) and Western Power to align forecasting and planning approaches and methodologies.
- Clear roles and responsibilities, with the AEMO responsible for forecasting system strength shortfalls, and Western Power responsible for procuring network and non-network solutions to address residual shortfalls.

The proposed amendments implement the review outcomes in the accompanying Information Paper, which has been finalised following consideration of stakeholder feedback and further analysis by the Department of Energy and Economic Diversification (DEED), Western Power and the Australian Energy Market Operator (AEMO).

Further information on the relevant proposed amendments is set out under each Part.

Following industry consultation, ESM Amending Rules, taking into account stakeholder feedback on this Exposure Draft, will be prepared and submitted to the Minister for Energy for making, with the Amending Rules to commence at a time specified by the Minister in a notice published in the Gazette.

DEED is seeking feedback from stakeholders on this Exposure Draft **by 5:00 PM (WST) on 21 September 2026**. Feedback can be sent to energymarkets@deed.wa.gov.au.

Mark-up Colour guide:

The Amending Rules are based on the Electricity System and Market Rules – 1 July 2026.

Text in black	Rules assumed to be in force at the time the Amending Rules in the relevant schedule are proposed to commence (based on confirmed commencement dates for Amending Rules made by the Minister and the Amending Rules in prior schedules of this exposure draft)
Text in red - underlined and ~~strikethrough~~	Amendments proposed under the PSSR Standards Review

Part 1: Amending Rules to clarify Technical Requirements for connecting inverter-based technologies

Explanatory Note

The relevant proposed amendments for GFL and GFM inverter Technical Requirements include:

- updated terminology introducing the concepts of Automatic Access Standard, Minimum Access Standard, Negotiated Access Standard and Proposed Negotiated Access Standard, while retaining 'Generator Performance Standard' as the umbrella term for approved and registered performance standards;
- amendments to section 3A.5 of the ESM Rules to clarify how Proposed Generator Performance Standards (GPS) are to be assessed if amendments to the Technical Requirements are made;
- a revised behaviour-based definition of GFM Capability, replacing 'controllable impedance' with 'effective impedance' to provide greater clarity regarding when a facility should be assessed as meeting GFM-specific Technical Requirements;
- adoption of a unified Minimum Access Standard of Withstand Short Circuit Ratio (SCR) ≤3 for both GFL and GFM IBRs;
- retention of the default requirement that settings used to demonstrate compliance are the same settings used during normal operation;
- clarification of voltage phase-angle jump response requirements, including applicable thresholds and response expectations;
- clarification of active and reactive current behaviour during and following contingencies, including definitions relating to Commencement Time, Rise Time, Adequately Controlled behaviour, operation at current limitation and the use of Total Current;
- requirements for disturbance ride-through across multiple disturbances in quick succession, including conditions for continuous uninterrupted operation and for providing a sufficient response following the End of the Disturbance;
- a Commencement Time requirement of ≤30 ms for reactive current injection by GFM IBRs;
- requirements relating to damping of power system oscillations for GFM IBRs, including a Minimum Access Standard requiring that a Generating System must not degrade damping of power system oscillations and must be Adequately Controlled;
- amendments relating to partial load rejection and the revised definition of Continuous Uninterrupted Operation; and
- introduction of an instability detection mechanism, aligned with the National Electricity Rules (NER), to support the detection and management of inverter-based instability through agreed performance standards.

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1.40. Requirements for Existing Transmission Connected Generating Systems

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Explanatory Note

The defined term 'Minimum Generator Performance Standard' is replaced with 'Minimum Access Standard' in section 1.40 to align with the revised terminology introduced in Appendix 12.

1.40.7. Where clause 1.40.6 applies, the Market Participant responsible for the Existing Transmission Connected Generating System must also submit reasons and supporting evidence as to how the Proposed Alternative Standard meets the applicable criteria listed in clause 1.40.8 and is otherwise appropriate in the circumstances. Where the Proposed Alternative Standard is less onerous than the ~~Minimum Generator Performance Standard~~ Minimum Access Standard or the Reference Standard (as applicable) for that Technical Requirement, the Market Participant must also submit:

(a) technical evidence as to why the Existing Transmission Connected Generating System cannot comply with the ~~Minimum Generator Performance Standard~~ Minimum Access Standard or the Reference Standard (as applicable); and

(b) information on the costs the Market Participant is likely to incur in order to meet the ~~Minimum Generator Performance Standard~~ Minimum Access Standard or Reference Standard (as applicable).

1.40.8. A Proposed Alternative Standard submitted under clause 1.40.6 must be as consistent as practicable to the ~~Minimum Generator Performance Standard~~ Minimum Access Standard or Reference Standard for the relevant Technical Requirement (as applicable), having regard to:

(a) the need to protect the Existing Transmission Connected Generating System from damage;

(b) power system conditions at the location of the connection;

(c) the commercial and technical feasibility of complying with the ~~Minimum Generator Performance Standard~~ Minimum Access Standard or Reference Standard (as applicable);

(d) the costs associated with complying with the ~~Minimum Generator Performance Standard~~ Minimum Access Standard or Reference Standard (as applicable) over the remaining life of the Existing Transmission Connected Generating System; and

(e) the capability of the Existing Transmission Connected Generating System in respect of the Technical Requirement.

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1.40.10. If:

(a) a Proposed Alternative Standard is at or above the ~~Minimum Generator Performance Standard~~ Minimum Access Standard or Reference Standard (as applicable); or

(b) the Network Operator reasonably considers it will approve a Proposed Alternative Standard having regard to the matters in clause 1.40.8 and following the receipt of the information and evidence referred to in clause 1.40.7 and any further information requested under clause 1.40.9,

the Network Operator must:

(c) provide any information received from the Market Participant responsible for the Existing Transmission Connected Generating System under clause 1.40.7 and clause 1.40.9 to AEMO; and

(d) use best endeavours to consult with AEMO within a reasonable timeframe, in accordance with the process agreed under clause 3A.1.3, in relation to each submitted Proposed Alternative Standard.

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1.40.14. Subject to clause 1.40.15, AEMO must recommend that the Network Operator accept a Proposed Alternative Standard if:

(a) AEMO reasonably considers the Proposed Alternative Standard satisfies clause 1.40.8; or

(b) the Proposed Alternative Standard:

i. relates to a standard or technical level of performance for a Technical Requirement for which there is no Agreed Generator Performance Standard that is deemed to apply in accordance with clause 1.40.4 or clause 1.40.5; and

ii. is at or above the ~~Minimum Generator Performance Standard~~ Minimum Access Standard for the relevant Technical Requirement.

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1.40.16. Where AEMO recommends that the Network Operator reject a Proposed Alternative Standard in respect of a Technical Requirement, AEMO must:

(a) provide written reasons to the Network Operator; and

(b) recommend that either:

i. an amended Proposed Alternative Standard is adopted that AEMO considers satisfies clause 1.40.8 which may include a Generator Condition; or

ii. otherwise:

1. where a Reference Standard exists, the Reference Standard is adopted; or

2. where no Reference Standard exists, the ~~Minimum Generator Performance Standard~~ Minimum Access Standard is adopted.

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3A.5. Generator Performance Standards for Transmission Connected Generating Systems

Explanatory Note

New clause 3A.5.1A is inserted to clarify how Proposed Generator Performance Standards (GPS) are to be assessed if amendments to the Technical Requirements are made.

An exception has been applied if an Arrangement for Access has been executed before the amended Technical Requirements commence.

In those circumstances:

- the Proposed GPS will continue to be assessed against the version of the Technical Requirements that applied before the amendments commenced, or
- if the Market Participant and the Network Operator agree that the amended Technical Requirements should apply, the Network Operator must assess the Proposed GPS under clause 3A.5 using the Technical Requirements that are in force at the time of the assessment.

New clause 3A.5.1B is inserted to clarify that where a Market Participant is required to submit a Proposed GPS for a Relevant Generator Modification, the Proposed GPS will be assessed against the Technical Requirements that applied when the Network Operator declared the modification to be a Relevant Generator Modification.

Consequential terminology amendments are also made to section 3A.5, to align with the revised terminology introduced in Appendix 12:

- ‘Ideal Generator Performance Standard’ is replaced with ‘Automatic Access Standard’.
- ‘Minimum Generator Performance Standard’ is replaced with ‘Minimum Access Standard’.
- ‘Negotiated Generator Performance Standard’ is replaced with ‘Negotiated Access Standard’.
- ‘Proposed Negotiated Generator Performance Standard’ is replaced with ‘Proposed Negotiated Access Standard’.

3A.5.1. Where a Market Participant responsible for generating works intends to connect those generating works to a transmission system, the Market Participant must submit to the relevant Network Operator, Proposed Generator Performance Standards for the generating works as if the generating works were a Transmission Connected Generating System addressing each Technical Requirement.

3A.5.1A. If the Technical Requirements are amended after the date on which a Market Participant submits Proposed Generator Performance Standards under clause 3A.5.1, the Network Operator must assess the Proposed Generator Performance

Standard under this clause 3A.5 using the Technical Requirements that are in force at the time of the assessment, unless:

(a) an Arrangement for Access that relates to the relevant Transmission Connected Generating System has been executed by all relevant parties before the date on which the Technical Requirements are amended and the Market Participant has included a copy of the executed Arrangement for Access, in which case:

i. the Network Operator must assess the Proposed Generator Performance Standard against the Technical Requirements that were in force at the date of execution of the Arrangement for Access; or

ii. if the Market Participant and the Network Operator agree that the amended Technical Requirements should apply, the Network Operator must assess the Proposed Generator Performance Standard under this clause 3A.5 using the Technical Requirements that are in force at the time of the assessment.

3A.5.1B If a Market Participant responsible for a Transmission Connected Generating System submits a Proposed Generator Performance Standard under clause 3A.14.1(a), the Network Operator must assess the Proposed Generator Performance Standard under this clause 3A.5 using the Technical Requirements that were in force at the time the Network Operator notified the Market Participant that a Potential Relevant Generator Modification has been declared by the Network Operator to be a Relevant Generator Modification in accordance with clause 3A.13.7.

3A.5.2. Each Proposed Generator Performance Standard submitted under clause 3A.5.1 or clause 3A.14.1(a) must meet the Common Requirements and:

(a) be equal to or better than the ~~Ideal Generator Performance Standard~~ Automatic Access Standard; or

(b) if a ~~Proposed Negotiated Generator Performance Standard~~ Proposed Negotiated Access Standard is submitted:

i. be no less onerous than the ~~Minimum Performance Standard~~ Minimum Access Standard;

ii. demonstrate any applicable Negotiation Criteria have been met;

iii. meet the requirements of clause 3A.5.5; and

iv. if applicable, meet the requirements of clause 3A.5.6.

3A.5.3. The Network Operator must not approve a Proposed Generator Performance Standard that does not meet or demonstrate the applicable criteria listed in clause 3A.5.2.

3A.5.4. The Network Operator is not required to consult AEMO and must approve a Proposed Generator Performance Standard that is equal to or better than the ~~Ideal Generator Performance Standard~~ Automatic Access Standard for a Technical Requirement.

3A.5.5. A ~~Proposed Negotiated Generator Performance Standard~~ Proposed Negotiated Access Standard must be as consistent as practicable with the corresponding ~~Ideal Generator Performance Standard~~ Automatic Access Standard for that Technical Requirement, having regard to:

(a) the need to protect the Transmission Connected Generating System from damage;

(b) power system conditions at the location of the connection or proposed connection;

(c) the commercial and technical feasibility of complying with the ~~Ideal Generator Performance Standard~~ Automatic Access Standard; and

(d) electrical losses between a Measurement Point and Connection Point that may cause a ~~Proposed Negotiated Generator Performance Standard~~ Proposed Negotiated Access Standard to adversely impact on Power System Security or Power System Reliability.

3A.5.6. A ~~Proposed Negotiated Generator Performance Standard~~ Proposed Negotiated Access Standard may include a Trigger Event which must address:

(a) the conditions for determining whether the Trigger Event has occurred;

(b) the party responsible for determining whether the Trigger Event has occurred;

(c) the actions required to be taken and any revised standard or technical level of performance in respect of a Technical Requirement which must be achieved if the Trigger Event occurs;

(d) the maximum timeframe for compliance with any action required to be taken and each revised standard or technical level of performance in respect of a Technical Requirement following the Trigger Event;

(e) any requirements to provide information and supporting evidence required by the Network Operator or AEMO to demonstrate that, if the Trigger Event occurs, the actions required will occur and will deliver the agreed outcome and level of performance required by any revised standard or technical level of performance in respect of a Technical Requirement;

(f) any testing requirements to verify compliance with each revised standard or technical level of performance in respect of a Technical Requirement; and

(g) any requirements necessary to verify that the actions required to be taken have occurred if the Trigger Event occurs.

3A.5.7. If a Registered Generator Performance Standard includes a Trigger Event and the Trigger Event subsequently occurs, the Market Participant responsible for the Transmission Connected Generating System must comply with the requirements of the Trigger Event.

3A.5.8. A Trigger Event contained in a Registered Generator Performance Standard may be modified by written agreement between the Market Participant responsible for the Transmission Connected Generating System, AEMO and the relevant Network Operator. For the avoidance of doubt, the process that applies to a ~~Proposed Negotiated Generator Performance Standard~~ Proposed Negotiated Access Standard in this section 3A.5 does not apply to the modification of a Trigger Event contained in a Registered Generator Performance Standard under this clause 3A.5.8.

3A.5.9. If a Market Participant responsible for a Transmission Connected Generating System submits to the Network Operator a ~~Proposed Negotiated Generator Performance Standard~~ Proposed Negotiated Access Standard under clause 3A.5.1 or clause 3A.14.1(a), the Market Participant responsible for the Transmission Connected Generating System must provide to the relevant Network Operator:

(a) the reasons and supporting evidence why the Market Participant responsible for the Transmission Connected Generating System cannot meet the ~~Ideal Generator Performance Standard~~ Automatic Access Standard; and

(b) any information and supporting evidence required by the Network Operator setting out the reasons why the ~~Proposed Negotiated Generator Performance Standard~~ Proposed Negotiated Access Standard is appropriate, including:

i. how the ~~Proposed Negotiated Generator Performance Standard~~ Proposed Negotiated Access Standard meets the applicable criteria listed in clause 3A.5.2; and

ii. how the Market Participant responsible for the Transmission Connected Generating System has taken into account each of the matters listed in clause 3A.5.5.

3A.5.10. If, following the receipt of a ~~Proposed Negotiated Generator Performance Standard~~ Proposed Negotiated Access Standard and the information and evidence referred to in clause 3A.5.9, the Network Operator reasonably considers it will approve the Proposed Negotiated Generator Performance Standard, the Network Operator, in accordance with the process agreed under clause 3A.1.3, must:

(a) provide the information received from the Market Participant responsible for the Transmission Connected Generating System under clause 3A.5.9 to AEMO; and

(b) use best endeavours to consult with AEMO within a reasonable timeframe in relation to each ~~Proposed Negotiated Generator Performance Standard~~ Proposed Negotiated Access Standard.

3A.5.11. AEMO must use best endeavours to respond in a reasonable timeframe after being consulted in accordance with clause 3A.5.10 and provide a recommendation to the Network Operator whether a ~~Proposed Negotiated Generator Performance Standard~~ Proposed Negotiated Access Standard should be approved or rejected by the Network Operator, or whether AEMO requires further information to make the recommendation in accordance with the process agreed under clause 3A.1.3.

3A.5.12. Where AEMO requires further information that it considers necessary to make the recommendation in clause 3A.5.11, the Network Operator, in accordance with the process agreed under clause 3A.1.3, must:

(a) provide the further information that is in its possession, power or control; or

(b) use reasonable endeavours to obtain that information from the Market Participant responsible for the Transmission Connected Generating System and provide that information to AEMO.

3A.5.13. In making a recommendation whether a ~~Proposed Negotiated Generator Performance Standard~~ Proposed Negotiated Access Standard should be approved or rejected in accordance with clause 3A.5.11, AEMO is not limited to considering information provided by the Network Operator and may use any other relevant information available to it.

3A.5.14. AEMO must recommend that the Network Operator reject a ~~Proposed Negotiated Generator Performance Standard~~ Proposed Negotiated Access Standard in accordance with clause 3A.5.11 if it reasonably considers that the ~~Proposed Negotiated Generator Performance Standard~~ Proposed Negotiated Access Standard may adversely affect Power System Security or Power System Reliability.

3A.5.15. Where AEMO recommends that the Network Operator reject a ~~Proposed Negotiated Generator Performance Standard~~ Proposed Negotiated Access Standard in accordance with clause 3A.5.11, AEMO must:

(a) provide written reasons to the Network Operator; and

(b) in respect of the relevant Technical Requirement, recommend that either:

i. if applicable, an alternative ~~Proposed Negotiated Generator Performance Standard~~ Proposed Negotiated Access Standard that AEMO considers meets the requirements of clause 3A.5.2(b), which may include a Trigger Event, is adopted; or

ii. otherwise, the ~~Ideal Generator Performance Standard~~ Automatic Access Standard is adopted.

3A.5.16. Subject to clause 3A.5.17, after a Network Operator has received the recommendation from AEMO under clause 3A.5.11, the Network Operator must determine whether to approve or reject each ~~Proposed Negotiated Generator Performance Standard~~ Proposed Negotiated Access Standard proposed by the Market Participant responsible for the Transmission Connected Generating System.

3A.5.17. A Network Operator must reject a ~~Proposed Negotiated Generator Performance Standard~~ Proposed Negotiated Access Standard in accordance with clause 3A.5.16 where:

(a) in the Network Operator's reasonable opinion:

i. one or more of the requirements in clause 3A.5.2(b); or

ii. in the case of a Relevant Generator Modification, one or more of the requirements in clause 3A.14.1,

are not met;

(b) AEMO has recommended in accordance with clause 3A.5.11 that the Network Operator reject the ~~Proposed Negotiated Generator Performance Standard~~ Proposed Negotiated Access Standard; or

(c) in the Network Operator's reasonable opinion, the ~~Proposed Negotiated Generator Performance Standard~~ Proposed Negotiated Access Standard will adversely affect:

i. Power System Security;

ii. Power System Reliability;

iii. Power Transfer Capability; or

iv. the quality of supply of electricity for other users of the Network.

3A.5.18. If a Network Operator rejects a ~~Proposed Negotiated Generator Performance Standard~~ Proposed Negotiated Access Standard in accordance with clause 3A.5.16, the Network Operator must provide to the Market Participant responsible for the Transmission Connected Generating System:

(a) written reasons for the rejection; and

(b) if applicable, an alternative ~~Proposed Negotiated Generator Performance Standard~~ Proposed Negotiated Access Standard that the Network Operator and AEMO consider meets the requirements of clause 3A.5.2(b), which may include a Trigger Event.

3A.5.19. The Market Participant responsible for the Transmission Connected Generating System may, in relation to an alternative ~~Proposed Negotiated Generator Performance Standard~~ Proposed Negotiated Access Standard provided by the Network Operator in accordance with clause 3A.5.18(b), either:

(a) accept the alternative ~~Proposed Negotiated Generator Performance Standard~~ Proposed Negotiated Access Standard; or

(b) reject the alternative ~~Proposed Negotiated Generator Performance Standard~~ Proposed Negotiated Access Standard; and

i. propose a different alternative ~~Proposed Negotiated Generator Performance Standard~~ Proposed Negotiated Access Standard consistent with the requirements of clause 3A.5.2(b), which may include a Trigger Event, in which case the process for consideration and approval of Proposed Generator Performance Standards in this section 3A.5 applies; or

ii. elect to adopt the ~~Ideal Generator Performance Standard~~ Automatic Access Standard for the relevant Technical Requirement.

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3A.13. Potential Relevant Generator Modifications

Explanatory Note

Clause 3A.13.1(b) is amended to replace the term 'Ideal Generator Performance Standard' with 'Automatic Access Standard' to align with revised terminology introduced in Appendix 12.

Clause 3A.13.1(b) is also amended to correct a typographical error.

3A.13.1. Potential Relevant Generator Modification means for the purposes of Chapter 3A, a modification to a generating unit or generating works that are part of a Transmission Connected Generating System or Exempt Transmission Connected Generating System that:

(a) has the potential to materially impact or change any of the characteristics, performance or capacity of the generating unit or generating works in respect of a Technical Requirement;

(b) has the potential to alter the capacity of the Transmission Connected Generating System or Exempt Transmission Connected Generating System in respect of any Technical Requirement for which ~~the Ideal Generator Performance Standard~~ Automatic Access Standard has been amended since the applicable Registered Generator Performance Standard was approved;

(c) is reasonably considered to require an amendment to the Arrangement for Access for the Transmission Connected Generating System or Exempt Transmission Connected Generating System; or

(d) requires submission of a connection application in accordance with a Network Operator's policy for access to its Network.

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11. Glossary

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Explanatory Note

The Glossary is amended to align with the revised terminology introduced in Appendix 12.

The following new terms are inserted:

- 'Automatic Access Standard', for the Technical Requirements specified in Appendix 12.
- 'Minimum Access Standard', for the Technical Requirements specified in Appendix 12.

The following definitions are retained because other instruments (such as WEM Procedures or Guidelines) may continue to refer to them until they are updated. The retained definitions are amended to refer to the corresponding new terminology:

- 'Ideal Generator Performance Standard', to refer to the 'Automatic Access Standard'.
- 'Minimum Generator Performance Standard', to refer to the 'Minimum Access Standard'.
- 'Negotiated Generator Performance Standard', to refer to the 'Negotiated Access Standard'.
- 'Proposed Negotiated Generator Performance Standard', to refer to the 'Proposed Negotiated Access Standard'.

Automatic Access Standard: Means the automatic access standard in respect of a Technical Requirement as specified in Appendix 12.

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Common Requirements: In respect of each Technical Requirement, means each requirement as specified in Appendix 12 that is common to both the ~~Ideal Generator Performance Standard~~ Automatic Access Standard and ~~Minimum Generator Performance Standard~~ Minimum Access Standard.

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Ideal Generator Performance Standard: ~~Means the ideal generator performance standard in respect of a Technical Requirement as specified in Appendix 12.~~ The Automatic Access Standard.

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Minimum Access Standard: Means the minimum access standard in respect of a Technical Requirement as specified in Appendix 12.

Minimum Generator Performance Standard: ~~Means the minimum generator performance standard in respect of a Technical Requirement as specified in Appendix 12.~~ The Minimum Access Standard.

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Negotiated Access Standard: Means s standard or technical level of performance in respect of a Technical Requirement that represents a variation from the Automatic Access Standard but is no less than the Minimum Access Standard that has been approved and registered in accordance with the process in Chapter 3A.

Negotiated Generator Performance Standard: ~~Means a standard or technical level of performance in respect of a Technical Requirement that represents a variation from the Ideal Generator Performance Standard but is no less than the Minimum Generator Performance Standard that has been approved and registered in accordance with the process in Chapter 3A.~~ A Negotiated Access Standard.

Negotiation Criteria: Means the criteria that must be met in respect of each Technical Requirement as specified in Appendix 12 if a Market Participant submits a ~~Proposed Negotiated Generator Performance Standard~~ Proposed Negotiated Access Standard.

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Proposed Negotiated Access Standard: Means a Proposed Generator Performance Standard that is not an Automatic Access Standard but is no less than the Minimum Access Standard.

Proposed Negotiated Generator Performance Standard: ~~Means a Proposed Generator Performance Standard that is not an Ideal Generator Performance Standard but is no less than the Minimum Generator Performance Standard.~~ Means a Proposed Negotiated Access Standard.

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Registered Generator Performance Standard: Means:

(a) in respect of a Transmission Connected Generating System other than an Existing Transmission Connected Generating System, an ~~Ideal Generator Performance Standard~~ Automatic Access Standard or a ~~Negotiated Generator Performance Standard~~ Negotiated Access Standard that has been approved and registered in accordance with the process in Chapter 3A; and

(b) in respect of an Existing Transmission Connected Generating System, the standard or technical level of performance in respect of a Technical Requirement that is an Agreed Generator Performance Standard under section 1.40 and deemed to be a Registered Generator Performance Standard under clause 1.40.31.

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Appendix 12: Transmission Connected Generating System Generator Performance Standards

Explanatory Note

Throughout Appendix 12, references to Generator Performance Standards are replaced with the corresponding Access Standard terminology. In particular, "Ideal Generator Performance Standard" is replaced with "Automatic Access Standard", together with the associated amendments replacing Minimum, Negotiated and Proposed Negotiated Generator Performance Standards with the corresponding Access Standards.

New Parts A12.9A (Voltage Phase Angle Jump Withstand) and A12.9B (Short Circuit Ratio), are inserted to implement review outcomes 2 and 3 identified in the Information Paper. Further details of these amendments are provided in the explanatory notes accompanying each new Part.

This Appendix lists each of the Technical Requirements for Transmission Connected Generating Systems and sets out the ~~Ideal Generator Performance Standard~~ Automatic Access Standard, ~~Minimum Generator Performance Standard~~ Minimum Access Standard and any applicable Common Requirements for each Technical Requirement.

Each Technical Requirement may specify Negotiation Criteria which must be met if a Market Participant responsible for a Transmission Connected Generating System submits a ~~Proposed Negotiated Generator Performance~~ Proposed Negotiated Access Standard.

If a Technical Requirement specifies Common Requirements, these apply whether an ~~Ideal Generator Performance Standard~~ Automatic Access Standard or ~~Negotiated Generator Performance Standard~~ Negotiated Access Standard is intended to apply to a Transmission Connected Generating System in respect of a Technical Requirement.

Use of defined terms in this Appendix 12

Terms defined in Part A12.1 of this Appendix 12 are defined for the purposes of this Appendix alone and must not be used to infer the meaning of those words, or other words, in these ESM Rules. Terms which are defined in these ESM Rules will apply to this Appendix unless defined in this Appendix or the context otherwise requires.

Where the terms Scheduled Generator and Non-Scheduled Generator are used in this Appendix, in relation to generating works that are proposed to be connected to a transmission system and is yet to be registered under these ESM Rules as a Facility or a Facility that is undergoing an upgrade that may impact its Facility Class, these terms are to be used as they will ultimately apply to the relevant Facility.

The measurement location for each of the following terms, where they are used in this Appendix, is as specified in the relevant clause or, where applicable, by the relevant Network Operator in consultation with AEMO and recorded in the relevant Generator Performance Standard:

(a) Rated Maximum Active Power;

(b) Rated Maximum Apparent Power;

(c) Maximum Continuous Current;

(d) Rated Minimum Active Power;

(e) Temperature Dependency Data; and

(f) Generator Performance Chart.

When producing electric power, Electricity Storage which is part of a Generating System will be considered as Generation and must meet the Technical Requirements of Appendix 12.

Where the term 'Technical Rules' is used in this Appendix then the reference to the Technical Rules is to the Technical Rules of Western Power for the SWIS.

Where terms defined in Technical Rules are used in this Appendix, then any references to 'power system' in those definitions should be read as the SWIS.

For ease of reference, a list of the Technical Requirements that apply to Transmission Connected Generating Systems contained in this Appendix is set out below.

Appendix 12 Part	Technical Requirement
A12.2.	Active Power Capability
A12.3.	Reactive Power Capability
A12.4.	Voltage and Reactive Power Control
A12.5.	Active Power Control
A12.6.	Inertia and Frequency Control
A12.7.	Disturbance Ride Through for a Frequency Disturbance
A12.8.	Disturbance Ride Through for a Voltage Disturbance
A12.9.	Disturbance Ride Through for Multiple Disturbances
A12.9A.	Withstand Short Circuit Ratio
A12.9B.	Voltage Phase Angle Jump
A12.10.	Disturbance Ride Through for Partial Load Rejection
A12.11.	Disturbance Ride Through for Quality of Supply
A12.12.	Quality of Electricity Generated
A12.13.	Generation Protection Systems
A12.14.	Remote Monitoring Requirements
A12.15.	Remote Control Requirements
A12.16.	Communications Equipment Requirements

A12.17.	Generation System Model

A12.1. Definitions

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Explanatory Note

A new definition of 'Adequately Controlled' is inserted, and the definition of 'Adequately Damped' is amended to distinguish between the acceptable responses of IBRs and synchronous generating systems.

The definition of 'Adequately Controlled' applies to IBRs, while the amended definition of 'Adequately Damped' is clarified to apply only to Synchronous Generating Systems, Synchronous Generating Units or the power system as applicable.

The guidelines published by the Network Operator under clause 3A.4.4 are intended to provide information on the testing requirements for demonstrating that an IBR is Adequately Controlled.

Adequately Controlled: The response of an Asynchronous Generating Unit or Asynchronous Generating System, as applicable, to temporary over-voltage or temporary under-voltage achieves the agreed level of reactive current injection or absorption within the duration of the relevant Disturbance, considering:

(a) expected positive and negative sequence reactive current response;

(b) expected active current response; and

(c) stable control when operating at and transitioning into and out of limits,

and does not cause or exacerbate:

(d) over-voltages, exceeding levels and durations agreed under Part A12.8;

(e) under-voltages, below levels and durations agreed under Part A12.8; and

(f) voltage transients or oscillations that could adversely affect the ability of other Equipment to remain in operation during the Disturbance.

Adequately Damped: ~~As described in the Technical Rules.~~ The response of a Generating Unit, Generating System or the power system, as applicable, following an oscillation triggered by any Disturbance must conform to the following criteria:

(a) the damping ratio of the oscillation must be at least 0.1;

(b) the halving time of any oscillation is not to exceed 5 seconds; and

(c) allow other Generating Systems or Generating Units, as applicable to maintain Continuous Uninterrupted Operation.

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Explanatory Note

A new definition of 'Commencement Time' is inserted to implement review outcome 4 of the Information Paper. The definition provides a clear and measurable point at which the reactive current response is taken to have commenced for the purposes of the Technical Requirements.

Commencement Time: In relation to a voltage Disturbance, the time measured from the commencement of the voltage deviation until the first clearly identifiable point at which the reactive current response begins to act in a direction that opposes the voltage deviation, based on the relevant fundamental-frequency reactive current component.

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Explanatory Note

The definition of 'Continuous Uninterrupted Operation' is amended to implement review outcome 7 of the Information Paper (Partial Load Rejection). The amendments clarify how continuous uninterrupted operation is assessed following a rapid reduction in system load while a Facility remains connected and in operation. The definition is also amended to replace references to "disturbance" with updated defined terminology.

Continuous Uninterrupted Operation: In respect of a Generating System or operating Generating Unit within a Transmission Connected Generating System that is operating immediately prior to a ~~power system disturbance~~ Disturbance, means:

(a) not disconnecting from the SWIS except ~~in accordance with~~ as required or permitted under its Registered Generator Performance Standard;

(b) during the ~~disturbance~~ Disturbance, contributing active and reactive current or Active Power and Reactive Power as required or permitted by its Registered Generator Performance Standard;

(c) after clearance of any electrical fault that caused the ~~disturbance~~ Disturbance, only ~~substantially~~ varying its Active Power and Reactive Power as required or permitted by its Registered Generator Performance Standard; and

(d) not exacerbating or prolonging the ~~disturbance~~ Disturbance or causing a subsequent ~~disturbance~~ Disturbance for other connected Equipment, except as required or permitted by its Registered Generator Performance Standard,

with all essential auxiliary and reactive Equipment remaining in service~~.~~ and accounting for, where applicable:

(e) inherent or programmed responses, in accordance with good electricity industry practice, opposing RoCoF or opposing voltage phase angle jumps; and

(f) responses consistent with the operation of the Generating Unit or Generating System, as applicable, in accordance with Part A12.6.

…

Explanatory Note

A new definition of 'Control System Bandwidth' is inserted to support the operation of clause A12.4.3.10, which sets out the Minimum Access Standard for voltage and reactive control under Part A12.4.

Control System Bandwidth: For a relevant Control System, the upper frequency limit, expressed as an absolute frequency in Hz, up to which the closed-loop Control System can provide its intended response for the applicable Technical Requirement at the relevant operating point. This limit is assessed by considering the response of the Control System to time-varying changes, in a relevant command or input signal, or a measured quantity used by the Control System, or a Disturbance. For the avoidance of doubt, Control System Bandwidth is not the power system fundamental frequency, switching frequency components of semiconducting devices, sampling frequency, communication update rate, measurement filter cut-off frequency, or harmonic frequency.

…

Explanatory Note

New definitions of 'Disturbance' and 'End of Disturbance' are inserted. The definition of Disturbance clarifies the meaning of that term for the purposes of Appendix 12 and supports the operation of the definition of 'Continuous Uninterrupted Operation' and other Technical Requirements that refer to a Disturbance.

The definition of 'End of Disturbance' establishes a consistent reference point for assessing active power recovery following a contingency event. It provides that recovery obligations commence once the voltage at the Connection Point has recovered to the specified range following the Disturbance.

Disturbance: Any large disturbance or small disturbance as described in the Technical Rules.

…

End of the Disturbance: Following a Disturbance, the time at which the root mean square magnitude of the voltage at the Connection Point recovers to within 90% and 110% of the nominal voltage, and remains within this range for at least 20 milliseconds.

…

Explanatory Note

The definition of 'Frequency Dead Band' is amended to correct typographical errors.

Frequency Dead Band: The range through which power system frequency can vary without the frequency ~~control system~~ Control System initiating an ~~active power~~ Active Power response.

…

Explanatory Note

The definition of 'Generator Performance Standard' is amended to apply the new defined terms of 'Automatic Access Standard' and 'Negotiated Access Standard'.

Generator Performance Standard: Means either the ~~Ideal Generator Performance Standard~~ Automatic Access Standard or ~~Negotiated Generator Performance Standard~~ Negotiated Access Standard in respect of a Technical Requirement.

Explanatory Note

New definitions of 'Grid-Following Capability' and 'Grid-Forming Capability' are inserted to identify whether a Generating Unit or Generating System (as relevant) may be assessed against Grid-Forming specific Technical Requirements.

Grid-Following Capability: The capability of a Generating Unit or Generating System, as applicable, that does not have Grid-Forming Capability.

Grid-Forming Capability: The capability of a Generating Unit or Generating System, as applicable, to:

(a) behave as a controlled voltage source behind an effective impedance; and

(b) autonomously deliver a stable sub-cycle response to rapid changes in voltage magnitude, frequency, and phase angle, within its current and energy limits,

such that the relevant Generating Unit or Generating System does not primarily rely on an externally measured voltage phase angle or frequency reference to determine its response.

Explanatory Note

New definitions of 'Maximum Active Power' and 'Maximum Apparent Power' are inserted to support the application of Parts A12.3, A12.9 and A12.10. The definitions distinguish between 'Maximum Apparent Power' representing the derated apparent power capability of the Generating System.

Maximum Active Power: The maximum Active Power level that a Generating Unit or Generating System, as applicable, can inject or withdraw, as specified in the Temperature Dependency Data provided under Part A12.2.

Maximum Apparent Power: The maximum Apparent Power level that a Generating Unit or Generating System, as applicable, can inject or withdraw, including as calculated from the Generator Performance Chart provided under Part A12.3.

Explanatory Note

The definition of 'Maximum Continuous Current is amended to apply the new defined term 'Disturbance'.

Maximum Continuous Current: Means the maximum current capable of being injected continuously in accordance with the relevant Australian Standard or ISO Standard for Synchronous Generating Units and Asynchronous Generating Units at the Measurement Location by the Generating System or Generating Units, as applicable, in order to support maintaining voltage on the SWIS during a ~~disturbance~~ Disturbance, without causing damage to, or maloperation of, Equipment in the Transmission Connected Generating System. The

details regarding which relevant Australian Standard or ISO Standard applies is documented in the guidelines published by the Network Operator under clause 3A.4.4.

…

Explanatory Note

The definition of 'Measurement Location' is amended to clarify the mechanism for determining an alternative Measurement Location by referencing the guidelines published under clause 3A.4.4.

Measurement Location: The Connection Point, or another measurement location agreed by AEMO and the Network Operator, as specified for the relevant Technical Requirement. The process for agreeing an alternate measurement location is documented in the guidelines published by the Network Operator under clause 3A.4.4.

…

Explanatory Note

The definition of 'Rise Time' is amended to apply the new defined term of 'Disturbance' and to amend a typographical error.

Rise Time: In relation to a control system, means the time taken for an output quantity to rise from its initial value to 90% of the final value induced by a step change of an input quantity, including in response to a ~~disturbance~~ Disturbance as required under ~~section~~ Part A12.9.

…

Explanatory Note

A new definition of 'Short Circuit Ratio' is inserted to implement review outcome 2 (Withstand SCR). The definition establishes the basis for the Withstand SCR Technical Requirements by defining the method for calculating Short Circuit Ratio.

Short Circuit Ratio (SCR): The ratio of the three-phase fault level (MVA) at the Connection Point, calculated excluding the contribution of all Asynchronous Generating Systems, to the Maximum Apparent Power (MVA) of the relevant Asynchronous Generating System.

…

Explanatory Note

A new definition of 'Total Current' is inserted to implement review outcome 4 of the Information Paper (Active and reactive current response during and after contingencies). The definition specifies Total Current as the reference quantity for the relevant Technical Requirements during contingencies and the current components that are included and excluded when determining Total Current.

Total Current: The root mean square magnitude of the fundamental-frequency current injected or absorbed by a Generating System or Generating Unit, as applicable, at the Measurement Location, determined as the root-sum-square of the active and reactive

current components of both positive-sequence and negative-sequence current, including any overload capability (if available). Total Current excludes zero-sequence current, harmonic, inter-harmonic, direct current offset and switching-frequency components of semiconducting devices, unless expressly stated otherwise in the relevant clause.

…

Explanatory Note

A new definition of 'Withstand Short Circuit Ratio' is inserted to support the operation of new Part A12.9A, which implements review outcome 2 of the Information Paper (Withstand SCR), The definition establishes the meaning of 'Withstand Short Circuit Ratio' for the purposes of the Technical Requirements in Part A12.9A.

The definition applies only for the purposes of the 'Withstand Short Circuit Ratio assessment under Part A12.9A and is not intended to apply more generally to System Strength reporting or assessment.

Withstand Short Circuit Ratio: The lowest Short Circuit Ratio at the Measurement Location at which an Asynchronous Generating Unit or Generating System, as applicable, is demonstrated to be Adequately Controlled, while remaining in Continuous Uninterrupted Operation, for the purposes of the withstand SCR assessment under Part A12.9A.

A12.2. Technical Requirement: Active Power Capability

Explanatory Note

Clause A12.2.1.1 is amended to correct a typographical error.

Part A12.2.2 is amended, and the headings of Parts A12.2.3 and A12.3.2 are amended, to apply the new defined term 'Automatic Access Standard' and 'Minimum Access Standard'.

A12.2.1.1. In relation to the application of this Technical Requirement, the requirements apply at the Connection Point unless otherwise specified in the relevant clause, or the Network Operator or AEMO determines that the Technical Requirement must be measured at a different location for the particular Generating Unit or Generating System, in which case the ~~measurement location~~ Measurement Location must be recorded as part of the relevant Generator Performance Standard.

A12.2.2. ~~Ideal Generator Performance Standard~~ Automatic Access Standard

A12.2.2.1. The ~~Ideal Generator Performance Standard~~ Automatic Access Standard is the same as the ~~Minimum Generator Performance Standard~~ Minimum Access Standard for Active Power capability.

A12.2.3. ~~Minimum Generator Performance Standard~~ Minimum Access Standard

…

A12.3.2. ~~Ideal Generator Performance Standard~~ Automatic Access Standard

…

A12.3. Technical Requirement: Reactive Power Capability

Explanatory Note

Clauses A12.3.2.1 and A12.3.3.1 are amended to improve the accuracy of the provision and avoid potential misinterpretation that could require a Market Participant to provide maximum active power capability at all temperatures regardless of any applicable derating.

Clause A12.3.2.1 is also amended to apply the newly defined term 'Maximum Active Power'.

The titles of Figures A12.3.2.1 and A12.3.3.1 are amended to apply the newly defined terms 'Automatic Access Standard' and 'Minimum Access Standard' respectively.

The x-axis of Figure A12.3.3.2 is amended to replace 'lead' and 'lag' with 'Absorb' and 'Supply', aligning the terminology with clause A12.3.3.2 and making it applicable to ESRs.

A12.3.2. ~~Ideal Generator Performance Standard~~ Automatic Access Standard

A12.3.2.1. For all operating conditions including temperatures up to and including the Maximum Temperature, each Generating Unit within the Generating System must be capable of supplying or absorbing Reactive Power continuously of at least the amount equal to the product of ~~the Rated Maximum Active Power output of the Generating Unit at nominal voltage~~ the applicable Active Power output level achievable at any temperature, as specified in the Temperature Dependency Data under Part A12.2 and 0.484 while operating at any level of Active Power output between its ~~maximum Active Power output level as specified in the Temperature Dependency Data under Part A12.2~~ Maximum Active Power, and its Rated Minimum Active Power output level.

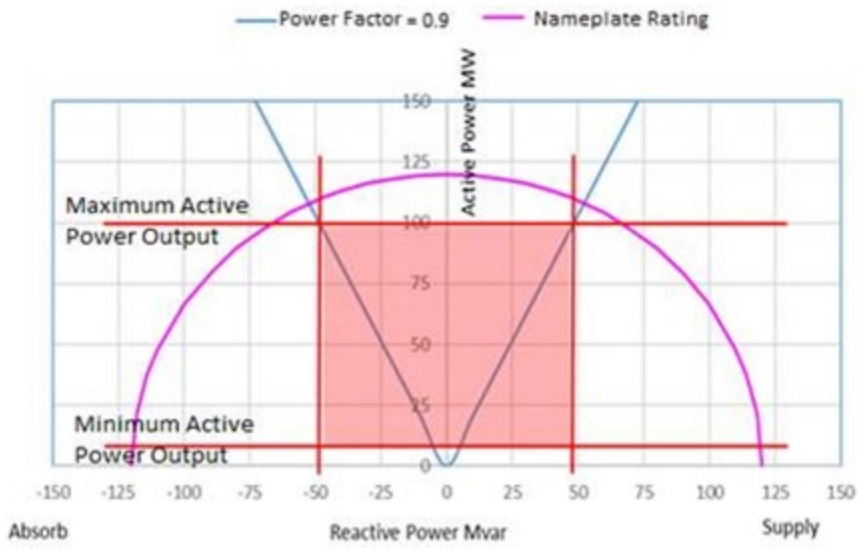


Figure A12.3.2.1: Example Reactive Power Capability required to meet ~~Ideal Generator Performance Standard~~ Automatic Access Standard

…

A12.3.3. ~~Minimum Generator Performance~~ Minimum Access Standard

A12.3.3.1. Subject to clause A12.3.3.3, for all operating conditions including temperatures up to and including the Maximum Temperature, the Generating System must be capable of supplying or absorbing Reactive Power continuously of at least the amount equal to the product of the ~~Rated Maximum Active Power output of the Generating System~~ the applicable Active Power output level achievable at any temperature, as specified in the Temperature Dependency Data under Part A12.2 and 0.329 while operating at any level of Active Power output level between its ~~maximum Active Power output level as specified in the Temperature Dependency Data under Part A12.2,~~ Maximum Active Power and Rated Minimum Active Power output level.

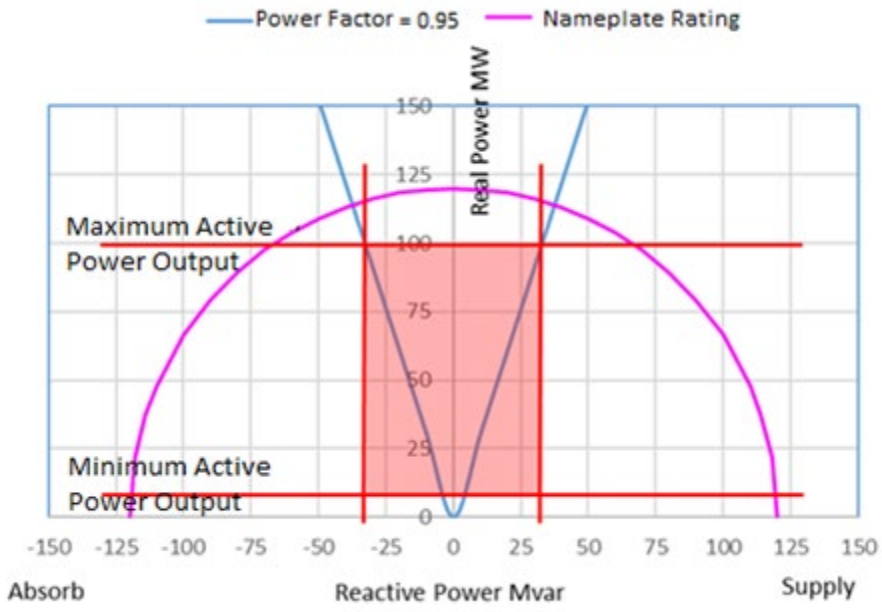


Figure A12.3.3.1: Example Reactive Power Capability required to meet the ~~Minimum Generator Performance Standard~~ Minimum Access Standard

A12.3.3.2. The Reactive Power Capability may be varied as shown in Figure A12.3.3.2 when the voltage at the Connection Point varies between 0.9 per unit and 1.1 per unit, where the Generating System must be capable of absorbing or supplying Reactive Power continuously when operating anywhere inside the curve specified in Figure A12.3.3.2.

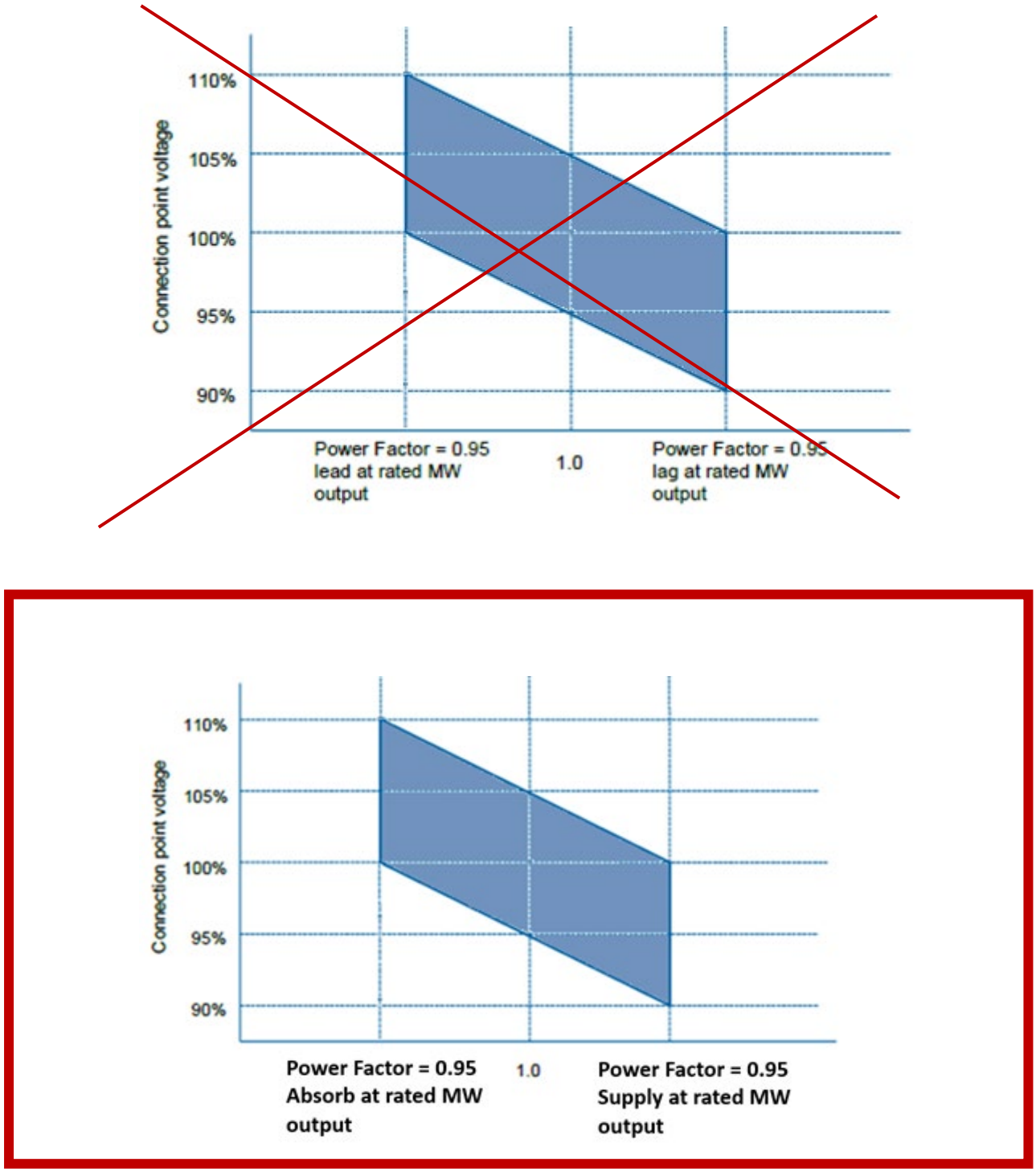


Figure A12.3.3.2: Relaxation of Reactive Power requirement with Connection Point voltage

…

A12.4. Technical Requirement: Voltage And Reactive Power Control

…

Explanatory Note

Amendments to Part A12.4 implement review outcome 6 of the Information Paper (Damping of power system oscillations), together with consequential amendments arising from the revised Access Standard Framework.

Automatic Access Standard

- The heading of Part A12.4.2, clause A12.4.2.1, the title of Table A12.4.2.1, clause A12.4.2.9 and associated cross-references are amended to apply the revised Access Standard terminology and updated clause numbering.
- Clauses A12.4.2.2 and A12.4.2.13 are amended to remove requirements that are no longer applicable or have become redundant.
- Clause A12.4.2.5(b) is amended to clarify that the voltage Control System is required to support voltage following clearance of a fault.
- Clause A12.4.2.5(c) is amended to clarify that the voltage control requirement applies to a configurable voltage setpoint.
- Clause A12.4.2.5(d) is amended to apply the new defined term 'Disturbance'.
- New clauses A12.4.2.13A and A12.4.2.13B establish Automatic Access Standards for Asynchronous Generating Systems with Grid-Following Capability and Grid-Forming Capability, respectively.

Minimum Access Standard

- The heading of Part A12.4.3, clause A12.4.3.1, the title of Table A12.4.3.1 and associated cross-references are amended to apply the revised Access Standard terminology and updated clause numbering.
- Clause A12.4.3.2 is amended to remove redundant requirements that pertain to *All Generating Systems*.
- Clauses A12.4.3.5(c), A12.4.3.6(b) and A12.4.3.7 are amended to apply the new defined term 'Disturbance'.
- New clause A12.4.3.6A introduces a Minimum Access Standard requiring Synchronous Generating Systems to have equipment capabilities and control systems sufficient to ensure the Generating System is 'Adequately Damped' consistent with the amended definition.
- New clauses A12.4.3.8, A12.4.3.9 and A12.4.3.10 introduce Minimum Access Standards for requiring the Generating System to be Adequately Controlled. Different requirements apply depending on whether the Generating System has Grid-Following Capability or Grid-Forming Capability.
- For Asynchronous Generating Systems with Grid-Forming Capability, evidence of the Control System Bandwidth must be provided and recorded as part of the Registered Generator Performance Standard. Where no bandwidth is specified, a default frequency limit of 100 Hz applies.

Negotiation Criteria

- Clause A12.4.4.1 is amended to apply revised Access Standard terminology.

A12.4.2. ~~Ideal Generator Performance Standard~~ Automatic Access Standard

A12.4.2.1. The ~~Ideal Generator Performance Standard~~ Automatic Access Standard, as it applies to different Generating Systems, is specified in Table A12.4.2.1

Type of Generating System	Relevant requirement
Generating System comprised solely of Synchronous Generating Units.	Clause A12.4.2.2 to clause ~~A12.4.2.9~~ A12.4.2.8 and clause A12.4.2.10 to clause A12.4.2.12.
Generating System comprised solely of Asynchronous Generating Units.	Clause A12.4.2.2 to clause ~~A12.4.2.9~~ A12.4.2.8 and clause A12.4.2.13 to clause A12.4.2.16.
Generating System comprised of Synchronous Generating Units and Asynchronous Generating Units.	Clause A12.4.2.2 to clause ~~A12.4.2.9~~ A12.4.2.8 and: (a) for that part of the Generating System comprised of Synchronous Generating Units, clause A12.4.2.10 to clause A12.4.2.12; (b) for that part of the Generating System comprised of Asynchronous Generating Units, clause A12.4.2.13 to clause A12.4.2.16.

Table A12.4.2.1: Voltage and Reactive Power Control ~~Ideal Generator Performance Standard~~ Automatic Access Standard

All Generating Systems

A12.4.2.2. The Generating System must have Equipment capabilities and Control Systems~~, including, if necessary, a power system stabiliser,~~ sufficient to ensure that~~:~~ the operation of the Generating System does not cause instability (including hunting of Tap-Changing Transformer Control Systems) that would adversely impact other Equipment connected to the SWIS.

~~(a) power system oscillations, for the frequencies of oscillation of the Generating System against any other Generating System or device, are Adequately Damped;~~

~~(b) operation of the Generating System does not degrade the damping of any critical mode of oscillation of the power system; and~~

~~(c) operation of the Generating System does not cause instability (including hunting of Tap-Changing Transformer Control Systems) that would adversely impact other Equipment connected to the SWIS.~~

…

A12.4.2.5. A Generating System must have a voltage Control System that:

(a) after clearance of any electrical fault, regulates voltage to within 0.5% of the Target Setpoint, where that setpoint may be adjusted to incorporate any voltage droop or reactive current compensation agreed with AEMO and the Network Operator;

(b) after clearance of any electrical fault, regulates voltage in a manner that helps ~~to~~ support ~~network voltages during faults~~ the SWIS towards a

Stable operating state, and does not prevent the requirements for voltage performance and stability in the Technical Rules from being achieved;

(c) allows the voltage setpoint to be continuously controllable in the range of at least 95% to 105% of the target voltage (as determined by the Network Operator), without reliance on a Tap-Changing Transformer and subject to the Generator Performance Standards for Reactive Power Capability with the voltage control location agreed with AEMO and the Network Operator; and

(d) has limiting devices to ensure that a voltage ~~disturbance~~ Disturbance does not cause a Generating Unit to trip at the limits of its operating capability. The Generating System must be capable of continuous stable operation while under the control of any limiter. Limiters must not detract from the performance of any stabilising circuits and must have settings applied which are coordinated with all Protection Systems.

…

A12.4.2.9. ~~Each Control System must be Adequately Damped.~~ The Automatic Access Standard in clause A12.4.2.9 is the same as the Minimum Access Standard in clause A12.4.3.10.

A12.4.2.9A. The Automatic Access Standard in clause A12.4.2.9A is the same as the Minimum Access Standard in clause A12.4.3.10.

…

Asynchronous Generating Systems

A12.4.2.13. ~~A Generating System, comprised of Asynchronous Generating Units, must have a voltage and Reactive Power Control System that has a power oscillation damping capability with sufficient flexibility to enable damping performance to be maximised, with the stabilising circuit responsive and adjustable over a frequency range from 0.1 Hz to 2.5 Hz. Any power system stabiliser must have measurements of power system frequency and Active Power output of the Generating Unit as inputs.~~ [Blank]

A12.4.2.13A. The Automatic Access Standard in clause A12.4.2.13A is the same as the Minimum Access Standard in clause A12.4.3.8.

A12.4.2.13B. The Automatic Access Standard in clause A12.4.2.13B is the same as the Minimum Access Standard in clauses A12.4.3.9 and A12.4.3.10.

…

A12.4.3. ~~Minimum Generator Performance Standard~~ Minimum Access Standard

A12.4.3.1. The ~~Minimum Generator Performance Standard~~ Minimum Access Standard for Voltage and Reactive Power Control as it applies to different Generating Systems, is specified in Table A12.4.3.1:

Type of Generating System	Relevant requirement
Generating System comprised solely of Synchronous Generating Units.	Clause A12.4.3.2 to clause ~~A12.4.3.6~~ A12.4.3.6A.
Generating System comprised solely of Asynchronous Generating Units.	Clause A12.4.3.2 to clause A12.4.3.5 and clause ~~A12.4.3.7~~ A12.4.3.10.
Generating System comprised of Synchronous Generating Units and Asynchronous Generating Units.	Clause A12.4.3.2 to clause A12.4.3.5 and: (a) for that part of the Generating System comprised of Synchronous Generating Units, clause ~~A12.4.3.6~~ A12.4.3.6A; (b) for that part of the Generating System comprised of Asynchronous Generating Units, clause ~~A12.4.3.7~~ A12.4.3.10.

Table A12.4.3.1: Voltage and Reactive Power Control ~~Minimum Generator Performance Standard~~ Minimum Access Standard

All Generating Systems

A12.4.3.2. A Generating System must have Equipment capabilities and Control Systems, ~~including, if necessary, a power system stabiliser,~~ sufficient to ensure that~~:~~ Control Systems can be sufficiently tested to establish their dynamic operational characteristics.

~~(a) power system oscillations, for the frequencies of oscillation of the Generating System against any other Generating System or device, are Adequately Damped;~~

~~(b) operation of the Generating System is Adequately Damped; and~~

~~(c) Control Systems can be sufficiently tested to establish their dynamic operational characteristics.~~

…

A12.4.3.5. A Generating System's Reactive Power or Power Factor Control System must:

(a) regulate Reactive Power or Power Factor (as applicable) to within:

i. for a Generating System operating in Reactive Power mode, 5% of the Rated Maximum Apparent Power of the Generating System from the Target Setpoint; or

ii. for a Generating System operating in Power Factor mode, a Power Factor equivalent to 5% of the Rated Maximum Apparent Power of the Generating System from the Target Setpoint;

(b) allow the Reactive Power or Power Factor Target Setpoint to be continuously controllable across the Reactive Power Capability defined in the relevant Generator Performance Standard; and

(c) have limiting devices to ensure that a voltage ~~disturbance~~ Disturbance does not cause a Generating Unit to trip at the limits of its operating capability. The Generating System must be capable of stable operation for indefinite periods while under the control of any limiter. Limiters must not detract from the performance of any stabilising circuits and must have settings applied, which are coordinated with all Protection Systems, and must be included as part of the Generator Performance Standard.

Synchronous Generating Systems

A12.4.3.6. Each Synchronous Generating Unit within the Generating System, with an Excitation Control System required to regulate voltage must:

(a) have excitation ceiling voltage of at least 1.5 times the excitation required to achieve generation at the rated output, rated speed and nominal voltage in accordance with the relevant Australian Standard or ISO Standard for Synchronous Generating Units. The details regarding which relevant Australian Standard or ISO Standard applies is documented in the guidelines published by the Network Operator under clause 3A.4.4; and

(b) subject to the ceiling voltage requirement, have a Settling Time of less than 7.5 seconds for a 5% voltage ~~disturbance~~ Disturbance with the Generating Unit synchronised, subject to the Generating Unit operating at a point where such a voltage ~~disturbance~~ Disturbance would not cause any limiting device to operate.

A12.4.3.6A. The Generating System must have Equipment capabilities and Control Systems sufficient to ensure that:

(a) for the frequencies of oscillation of the Generating System against any other Generating System or device, are Adequately Damped; and

(b) operation of the Generating System does not degrade the power system damping and is Adequately Damped.

Asynchronous Generating Systems

A12.4.3.7. A Generating System, comprised of Asynchronous Generating Units, with a voltage Control System must have a Settling Time of less than 7.5 seconds for a 5% voltage ~~disturbance~~ Disturbance subject to the Generating Unit being

electrically connected to the SWIS and operating at a point where such a voltage ~~disturbance~~ Disturbance would not cause any limiting device to operate.

A12.4.3.8. An Asynchronous Generating System with Grid-Following Capability must have Equipment capabilities and Control Systems sufficient to ensure that operation of the Generating System is Adequately Controlled.

A12.4.3.9. An Asynchronous Generating System with Grid-Forming Capability must have Equipment capabilities and Control Systems sufficient to ensure that;

(a) operation of the Generating System does not degrade the damping of power system oscillations; and

(b) operation of the Generating System must be Adequately Controlled.

A12.4.3.10. An Asynchronous Generating System with Grid-Forming Capability must have its relevant Control System Bandwidth documented as part of the Registered Generator Performance Standard, based on evidence provided by the Market Participant. AEMO and the Network Operator may rely on an upper frequency limit of 100 Hz for assessment purposes unless sufficient evidence of the actual converter control bandwidth is provided.

A12.4.4. Negotiation Criteria

A12.4.4.1. A ~~Proposed Negotiated Generator Performance Standard~~ Proposed Negotiated Access Standard 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.

…

A12.5. Technical Requirement: Active Power Control

Explanatory Note

Amendments to Part A12.5 are made to implement review outcome 6 of the Information Paper (Damping of power system oscillations).

Common Requirements

- The Common Requirements in Part A12.5.1 are amended to distinguish Control System requirements that apply to Synchronous Generating Systems and Asynchronous Generating Systems.
- Clause A12.5.1.3 is amended to require Synchronous Generating Systems and Synchronous Generating Units to be Adequately Damped.
- New clause A12.5.1.3A is inserted to require Asynchronous Generating Systems and Asynchronous Generating Units to be Adequately Controlled.
- New clause A12.5.1.8 is inserted to clarify that an Active Power excursion resulting from an inherent pre-programmed response, in the circumstances specified, will not constitute a breach of Active Power Control requirements in Part A12.5.

Automatic Access Standard and Minimum Access Standard

- The headings of Parts A12.5.2 and A12.5.3 are amended to apply the revised Access Standard terminology.
- Clauses A12.5.2.1, A12.5.2.2 and A12.5.3.1 are amended to apply the new defined term 'Maximum Active Power'.

A12.5.1. Common Requirements

…

A12.5.1.3. Each Control System for a Synchronous Generating Unit or Synchronous Generating System, as applicable, must be Adequately Damped.

A12.5.1.3A. Each Control System for an Asynchronous Generating Unit or Asynchronous Generating System, as applicable, must be Adequately Controlled.

…

A12.5.1.8. Active Power excursions arising from an inherent pre-programmed response, provided in accordance with good electricity industry practice, that opposes RoCoF or opposes voltage phase angle jumps will not be taken to be a breach of the requirements of this Part A12.5.

A12.5.2. ~~Ideal Generator Performance Standard~~ Automatic Access Standard

A12.5.2.1. A Non-Intermittent Generating System within a Transmission Connected Generating System must have an Active Power Control System capable of:

(a) maintaining and changing its Active Power output in accordance with Target Setpoints;

(b) ramping its Active Power output linearly from one Target Setpoint to another; and

(c) in a thermally stable state, changing Active Power output in response to a change in Target Setpoint at a rate not less than 5% of its ~~Rated~~ Maximum Active Power per minute.

A12.5.2.2. Subject to energy source availability, an Intermittent Generating System within a Transmission Connected Generating System must be able to change its Active Power output in accordance with Target Setpoints, and must not change its Active Power output at a rate greater than 10 MW per minute or 15% of the ~~Rated~~ Maximum Active Power per minute, whichever is the lower or as agreed with the Network Operator and AEMO.

…

A12.5.3. ~~Minimum Generator Performance Standard~~ Minimum Access Standard

A12.5.3.1. A Non-Intermittent Generating System within a Transmission Connected Generating System must have an Active Power Control System capable of maintaining and changing its Active Power output in accordance with a Target Setpoint, and must be capable of changing Active Power generation at a rate not less than 5% of its ~~Rated~~ Maximum Active Power per minute.

…

A12.6. Technical Requirement: Inertia and Frequency Control

Explanatory Note

Amendments to this Part A12.6 implement review outcome 7 of the Information Paper (Partial load rejection).

Common Requirements

- The Common Requirements in Part A12.6.1 are amended to distinguish the Control Systems requirements that apply to Synchronous Generating Systems from those that apply to Asynchronous Generating Systems.
- Clause A12.6.1.1 is amended to require Synchronous Generating Systems and Synchronous Generating Units to be Adequately Damped.
- New clause A12.1.1.A is inserted to require Asynchronous Generating Systems and Asynchronous Generating Units to be Adequately Controlled.
- Clause A12.6.1.10 is amended to apply the new defined term 'Maximum Active Power'.

Automatic Access Standard

- The heading of Part A12.6.2 and clause A12.6.2.1 are amended to apply the revised Access Standard terminology.
- Clauses A12.6.2.1(a), A12.6.2.1(b) and A12.6.2.1(c) are amended to apply the new defined terms 'Disturbance' and 'Maximum Active Power'.
- Clauses A12.6.2.1(d) and (e) are amended so that the Automatic Access Standards for sustained frequency response are aligned with the corresponding Minimum Access Standard requirements in clauses A12.6.3.2(e) and (f).

Minimum Access Standard

- The heading of Part A12.6.3 is amended to apply the revised Access Standard terminology.
- Clause A12.6.3.2 is amended to apply the new defined terms 'Disturbance' and 'Maximum Active Power'.

Negotiation Criteria

- Clause A12.6.4 is amended to apply the revised Access Standard terminology.

A12.6.1. Common Requirements

A12.6.1.1. All Control Systems for a Synchronous Generating Unit or Synchronous Generating System, as applicable, must be Adequately Damped.

A12.6.1.1A. All Control Systems for an Asynchronous Generating Unit or Asynchronous Generating System, as applicable, must be Adequately Controlled.

…

A12.6.1.10. Unless otherwise stated in this Part A12.6, the overall required frequency response of each Generating Unit, or Generating System, as applicable, must be settable and be capable of:

(a) automatically achieving an increase in Active Power output proportional to a change in power system frequency of not less than 5% of the ~~maximum Active Power specified in the Temperature Dependency Data provided under Part A12.2~~ Generating System's Maximum Active Power for each 0.1 Hz reduction in power system frequency from the lower level of Frequency Dead Band, provided the output is above the Rated Minimum Active Power; and

(b) automatically achieving a reduction in Active Power output proportional to a change in power system frequency of not less than 5% of the ~~maximum Active Power specified in the Temperature Dependency Data provided under Part A12.2~~ Generating System's Maximum Active Power for each 0.1 Hz increase in power system frequency from the upper level of Frequency Dead Band, provided this does not require operation below the Rated Minimum Active Power.

…

A12.6.2. ~~Ideal Generator Performance Standard~~ Automatic Access Standard

A12.6.2.1. The ~~Ideal Generator Performance Standard~~ Automatic Access Standard requires that control ranges, response times and sustain times, are achieved for Generating Units, or the Generating System, as applicable, such that, subject to energy source availability:

(a) the required frequency response in clause A12.6.1.10(a) can be complied with for any initial output up to the ~~maximum Active Power specified in the Temperature Dependency Data provided under Part A12.2 for the relevant temperature~~ Generating System's Maximum Active Power;

(b) for Synchronous Generating Systems, for any frequency ~~disturbance~~ Disturbance where the change in power system frequency is sufficient to change the Active Power of the Generating System by at least 5% of its ~~Rated~~ Maximum Active Power, the Generating Unit or Generating System achieves at least 90% of the required frequency response specified in clause A12.6.1.10 within 6 seconds;

(c) for Asynchronous Generating Systems, for any frequency ~~disturbance~~ Disturbance where the change in power system frequency is sufficient to change the Active Power of the Generating System by at least 5% of its

~~Rated~~ Maximum Active Power, the Generating Unit or Generating System achieves at least 90% of the required frequency response specified in clause A12.6.1.10 within 2 seconds;

(d) ~~the required frequency response specified in clause A12.6.1.10 is sustained for not less than a further 10 seconds beyond the timeframes specified in clause A12.6.2.1(b) and clause A12.6.2.1(c), as applicable, subject to a restoration of power system frequency in which case the Active Power output must be changed in proportion to the power system frequency in accordance with the required frequency response specified in clause A12.6.1.10~~ the Automatic Access Standard for clause A12.6.2.1(d) is the same as the Minimum Access Standard for clause A12.6.3.2(e); and

(e) ~~each Generating Unit's or Generating System's, as applicable, capability to sustain response beyond the timeframe specified in clause A12.6.2.1(d) must be included as part of the relevant Generator Performance Standard~~ the Automatic Access Standard for clause A12.6.2.1(e) is the same as the Minimum Access Standard for clause A12.6.3.2(f).

A12.6.3. ~~Minimum Generator Performance Standard~~ Minimum Access Standard

A12.6.3.1. [Blank]

A12.6.3.2. Subject to energy source availability, a Generating System is required to have control ranges and response times for each Generating Unit, or Generating Systems as applicable, such that:

(a) it is able to comply with the required frequency response specified in clause A12.6.1.10(a), up to 85% of ~~Rated~~ Maximum Active Power output;

(b) for initial outputs above 85% of ~~Rated~~ Maximum Active Power output, each Generating Unit's or Generating System's, as applicable, response capability must be agreed with the relevant Network Operator and AEMO, and included as part of the relevant Generator Performance Standard;

(c) for Synchronous Generating Systems, for any frequency ~~disturbance~~ Disturbance where the change in frequency is sufficient to change the Active Power of the Generating System by at least 5% of its ~~Rated~~ Maximum Active Power output, the Generating Unit or Generating System achieves at least 60% of the required frequency response specified in clause A12.6.1.10 within 6 seconds, and 90% of the required frequency response specified in clause A12.6.1.10 within 15 seconds;

(d) for Asynchronous Generating Systems, for any frequency ~~disturbance~~ Disturbance where the change in frequency is sufficient to change the Active Power of the Generating System by at least 5% of its ~~Rated~~ Maximum Active Power output, the Generating Unit or Generating System achieves at least 60% of the required frequency response specified in clause A12.6.1.10 within 6 seconds, and at least 90% of the required frequency response specified in clause A12.6.1.10 within 15 seconds;

(e) the required frequency response specified in clause A12.6.1.10 is sustained for not less than a further 10 seconds beyond the latest timeframe specified in ~~clause~~ clauses A12.6.2.1(b) and A12.6.2.1(c) or clauses A12.6.3.2(c) and ~~clause~~ A12.6.3.2(d), as applicable, subject to a restoration of power system frequency in which case the Active Power output must be changed in proportion to the power system frequency in accordance with the required frequency response specified in clause A12.6.1.10; and

(f) each Generating Unit's or Generating System's, as applicable, capability to sustain response beyond the timeframe specified in clause A12.6.3.2(e) must be included as part of the relevant Generator Performance Standard.

A12.6.4. Negotiation Criteria

A12.6.4.1. A ~~Negotiated Generator Performance Standard~~ Negotiated Access Standard must require that there is no requirement for a Generating System to operate with an Active Power output:

(a) below its Rated Minimum Active Power in response to a rise in the frequency of the SWIS as measured at the Connection Point;

(b) above the relevant maximum Active Power output specified in the Temperature Dependency Data provided under Part A12.2 for the relevant temperature, in response to a fall in the frequency of the SWIS as measured at the Connection Point; or

(c) to deliver a rate of change in output exceeding the specified maximum ramp rate.

...

A12.7. Technical Requirement: Disturbance Ride Through for a Frequency Disturbance

Explanatory Note **Automatic Access Standard**

- The heading of Part A12.7.2, the title of Table A12.7.2.1 and clauses A12.7.2.1 and A12.7.2.2 are amended to apply the revised Access Standard terminology and the new defined term 'Disturbance'.
- Clause A12.7.2.1 is also amended to replace "up to" with "at least" to clarify the application of the timeframes specified in subclauses (a) to (e). This amendment aligns the drafting with the Generator Performance Standards Guideline and the National Electricity Rules and does not change the substantive operation of the clause.

Minimum Access Standard

- The heading of Part A12.7.3, the title of Table A12.7.3.1 and clauses are amended to apply the revised Access Standard terminology and the new defined term 'Disturbance'. .
- Clause A12.7.3.1 is also amended to replace "up to" with "at least" to clarify the application of the timeframe specified in subclause (a) and to align the drafting with the remaining subclauses.

Negotiation Criteria

- Clause A12.7.4.1 is amended to apply the new defined terms 'Proposed Negotiated Access Standard' and 'Disturbance'.

A12.7.2. ~~Ideal Generator Performance Standard~~ Automatic Access Standars

A12.7.2.1. A Generating System must maintain Continuous Uninterrupted Operation where a power system ~~disturbance~~ Disturbance causes the frequency to:

(a) reach 52.5 Hz for a period of ~~up to~~ at least 6 seconds;

(b) reach 52 Hz for a period of ~~up to~~ at least 2 minutes;

(c) reach 51.5 Hz for a period of ~~up to~~ at least 5 minutes;

(d) operate between 49.0 Hz to 51.0 Hz continuously;

(e) reach 47.5 Hz for a period of ~~up to~~ at least 15 minutes; or

(f) reach 47.0 Hz for a period of ~~up to~~ at least 2 minutes,

as shown in Figure A12.7.2.1.

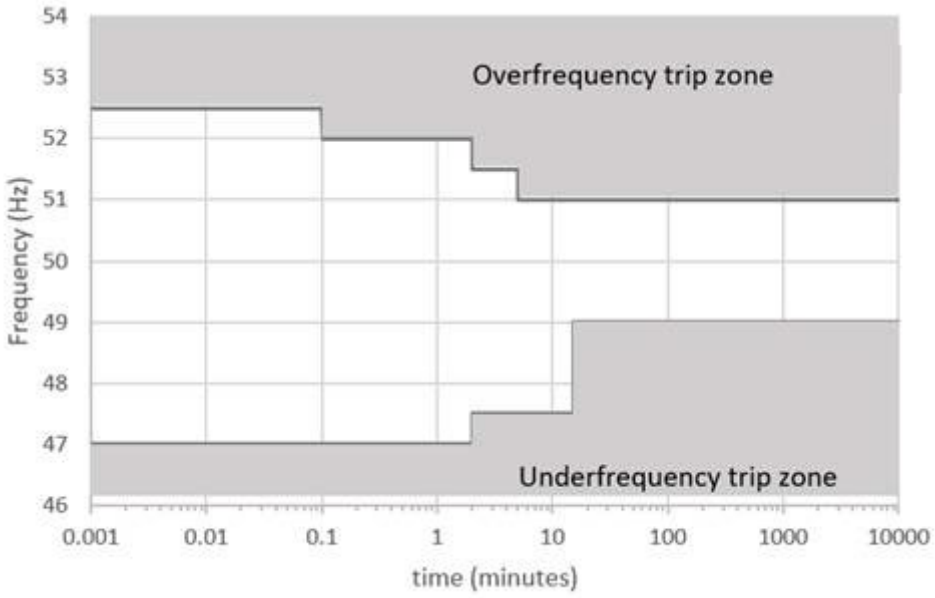


Figure A12.7.2.1 Frequency variations that a Generating System must ride through to meet the ~~Ideal Generator Performance Standard~~ Automatic Access Standard

A12.7.2.2. A Generating System must maintain Continuous Uninterrupted Operation where a power system ~~disturbance~~ Disturbance causes the RoCoF to:

(a) reach 4 Hz/s over 250 milliseconds during the ~~disturbance~~ Disturbance; or

(b) reach 3 Hz/s over 1 second during the ~~disturbance~~ Disturbance.

A12.7.3. ~~Minimum Generator Performance Standard~~ Minimum Access Standard

A12.7.3.1. A Generating System must maintain Continuous Uninterrupted Operation where a power system ~~disturbance~~ Disturbance causes the frequency to:

(a) reach 52.0 Hz for a period of ~~up to~~ at least 2 minutes;

(b) operate between 49.0 Hz to 51.0 Hz continuously;

(c) reach 48.0 Hz for a period of at least 15 minutes;

(d) reach 47.5 Hz for a period of at least 5 minutes; or

(e) reach 47.0 Hz for a period of at least 10 seconds,

as shown in Figure A12.7.3.1.

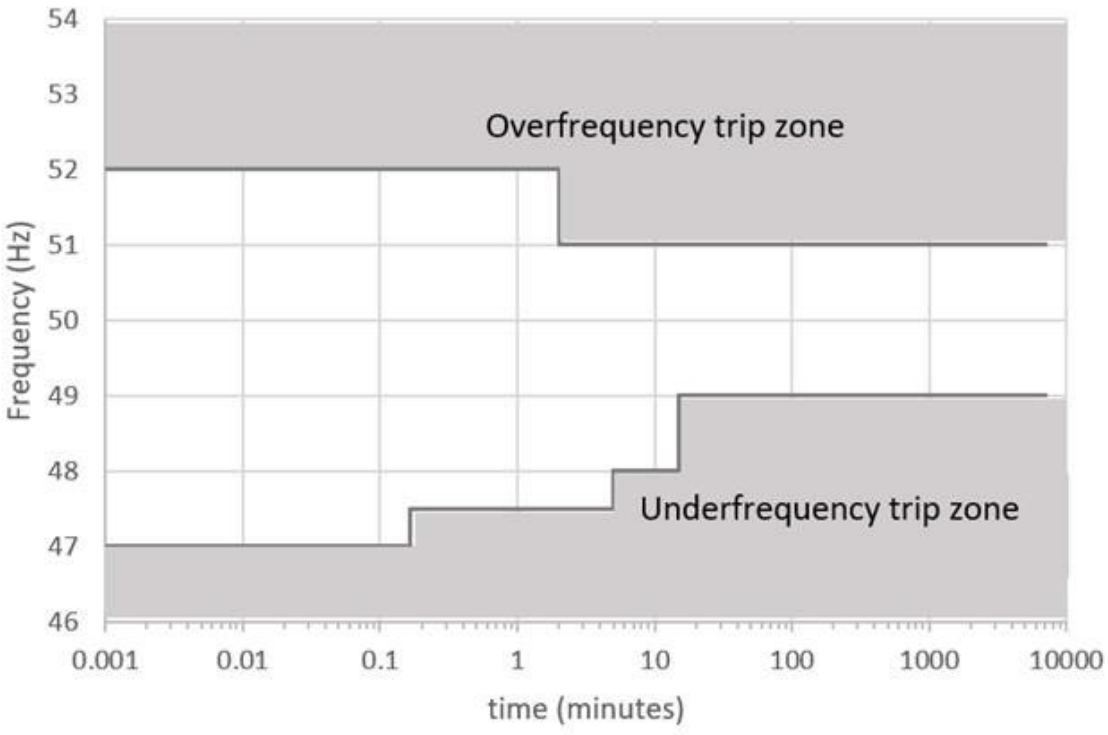


Figure A12.7.3.1: Frequency variations that a Generating System must ride through to meet the ~~Minimum Generator Performance Standard~~ Minimum Access Standard

A12.7.3.2. A Generating System must maintain Continuous Uninterrupted Operation where a power system ~~disturbance~~ Disturbance causes the RoCoF to:

(a) reach 2 Hz/s over 250 milliseconds during the ~~disturbance~~ Disturbance; or

(b) reach 1 Hz/s over 1 second during the ~~disturbance~~ Disturbance.

A12.7.4. Negotiation Criteria

A12.7.4.1. A ~~Proposed Negotiated Generator Performance~~ Proposed Negotiated Access Standard for ~~disturbance~~ Disturbance ride through for a frequency ~~disturbance~~ Disturbance may be accepted provided the Network Operator and AEMO agree that the frequency would be unlikely to fall below the lower bound of the single contingency event band specified in the Frequency Operating Standard.

A12.8. Technical Requirement: Disturbance Ride Through for a Voltage Disturbance

…

Explanatory Note

Automatic Access Standard

- The heading of Part A12.8.2, the title to Figure A12.8.2.1 and clause A12.8.2.1 are amended to apply the new revised Access Standard terminology and the new defined term 'Disturbance'.
- Clause A12.8.2.1 is also amended to clarify the applications of timeframes specified in sub-clauses (a) to (h). The amendments align the drafting with the Generator Performance Standards Guideline and the National Electricity Rules and does not change the substantive operation of the clause
- New clause A12.8.2.2 is inserted to align the Automatic Access Standards with the corresponding Minimum Access Standard requirements.

Minimum Access Standard

- The heading of Part A12.8.3, the title to Figure A12.8.3.1 and clause A12.8.3.1 are amended to apply the revised Access Standard terminology and the new defined term 'Disturbance'.
- Clause A12.8.3.1 is also amended to clarify the application of the timeframes specified in subclauses (a) to (h). The amendment aligns the drafting with the Generator Performance Standards Guideline and the National Electricity Rules and does not change the substantive operation of the clause.
- The figure for clause A12.8.3.3 is replaced to correct a typographical error in the spelling of 'Voltage'.
- New clause A12.8.3.4 implements review outcome 3.2 of the Information Paper by introducing a Minimum Access Standard for GFM IBRs requiring initiation of a response to oppose the positive-sequence phase angle jump within 20 milliseconds. This establishes a

maximum Access Standard for the fast voltage angle support capability characteristic of GFM operation.

A12.8.2. ~~Ideal Generator Performance Standard~~ Automatic Access Standard

A12.8.2.1. A Generating System must maintain Continuous Uninterrupted Operation where a power system ~~disturbance~~ Disturbance causes the voltage to vary within the following ranges:

(a) voltage exceeds 130% of nominal voltage for ~~not more than~~ a period of at least 0.02 seconds after T(ov);

(b) voltage ~~does not exceed~~ exceeds 120% up to and including 130% of nominal voltage for ~~more than~~ a period of at least 2.0 seconds after T(ov);

(c) voltage ~~does not exceed~~ exceeds 115% up to and including 120% of nominal voltage for ~~more than~~ a period of at least 20.0 seconds after T(ov);

(d) voltage ~~does not exceed~~ exceeds 110% up to and including 115% of nominal voltage for ~~more than~~ a period of at least 20.0 minutes after T(ov);

(e) ~~voltage remains at 0% of nominal voltage for no more than 450 milliseconds after T(uv);~~[Blank]

(f) voltage ~~does not stay~~ stays below 70% down to and including 0% of nominal voltage for ~~more than~~ a period of at least 450 milliseconds after T(uv);

(g) voltage ~~does not stay~~ stays below 80% down to and including 70% of nominal voltage for ~~more than~~ a period of at least 2.0 seconds after T(uv); and

(h) voltage ~~does not stay~~ stays below 90% down to and including 80% of nominal voltage for ~~more than~~ a period of at least 10.0 seconds after T(uv).

Where:

T(ov) means a point in time when the voltage first varied above 110% of nominal voltage before returning to between 90% and 110% of nominal voltage; and

T(uv) means a point in time when the voltage first varied below 90% of nominal voltage before returning to between 90% and 110% of nominal voltage.

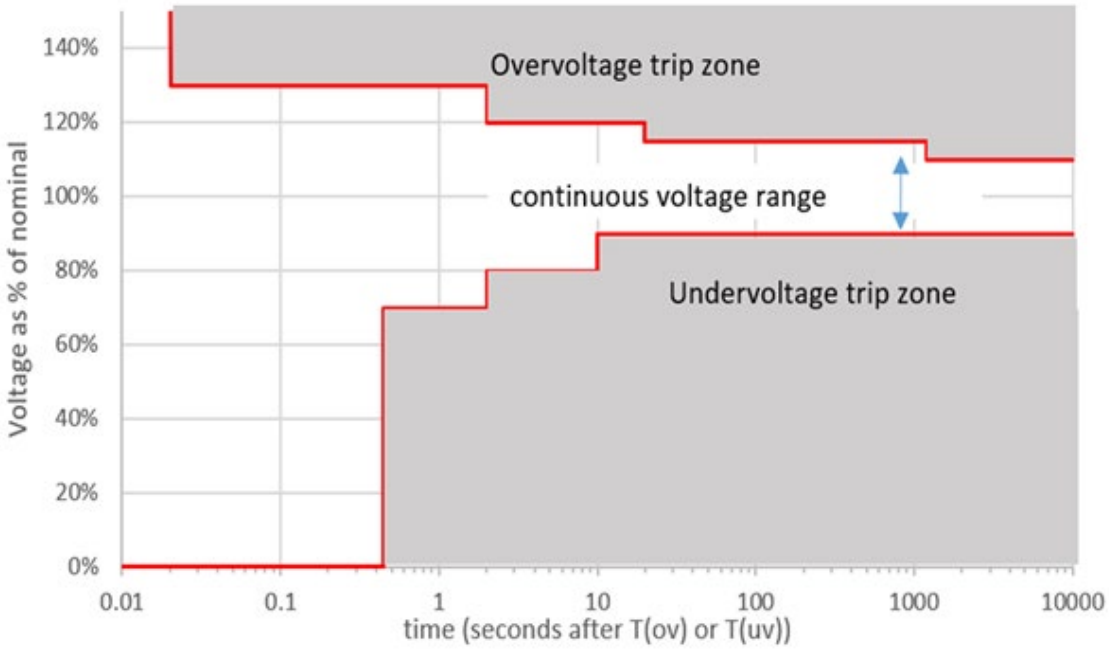


Figure A12.8.2.1: Voltage variations that a Generating System must ride through to meet the ~~Ideal Generator Performance Standard~~ Automatic Access Standard

A12.8.2.2 The Automatic Access Standard in clause A12.8.2.2 is the same as the Minimum Access Standard in clause A12.8.3.4.

A12.8.3. ~~Minimum Generator Performance Standard~~ Minimum Access Standard

A12.8.3.1. A Generating System must maintain Continuous Uninterrupted Operation where a power system ~~disturbance~~ Disturbance causes the voltage to vary within the following ranges:

(a) ~~voltage does not exceed 120% of nominal voltage after T(ov);~~[Blank]

(b) voltage ~~does not exceed~~ exceeds 115% and up to and including 120% of nominal voltage for ~~more than~~ a period of at least 0.1 seconds after T(ov);

(c) voltage ~~does not exceed~~ exceeds 110% and up to and including 115% of nominal voltage for ~~more than~~ a period of at least 0.9 seconds after T(ov);

(d) voltage remains at 0% of nominal voltage for ~~no more than~~ a period of at least 450 milliseconds after T(uv) subject to clause A12.8.3.2;

(e) voltage ~~does not stay~~ stays below 70% and greater than 0% of nominal voltage for ~~more than~~ a period of at least 450 milliseconds after T(uv);

(f) voltage ~~does not stay~~ stays below 80% down to and including 70% of nominal voltage for ~~more than~~ a period of at least 2.0 seconds after T(uv); and

(g) voltage ~~does not stay~~ stays below 90% down to and including 80% of nominal voltage for ~~more than~~ a period of at least 5.0 seconds after T(uv).

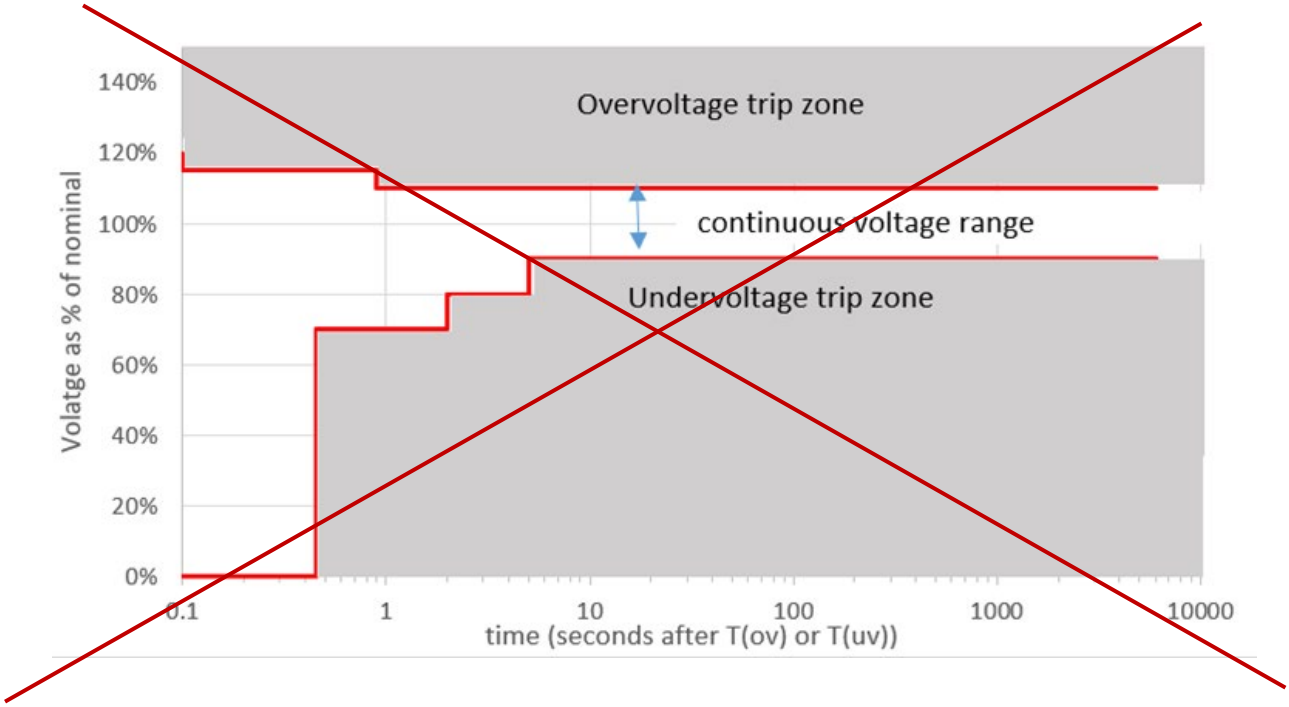
Where:

T(ov) means a point in time when the voltage first varied above 110% of nominal voltage before returning to between 90% and 110% of nominal voltage; and

T(uv) means a point in time when the voltage first varied below 90% of nominal voltage before returning to between 90% and 110% of nominal voltage.

A12.8.3.2. The duration of the zero percent voltage level may be relaxed through agreement with the Network Operator and AEMO, but shall not be lower than the maximum Total Fault Clearance Time with no circuit breaker fail as specified in the Technical Rules.

A12.8.3.3. Any operational arrangements necessary to ensure the Generating System and each of its operating Generating Units will meet its Generator Performance Standard must be provided as part of the Generator Performance Standard.



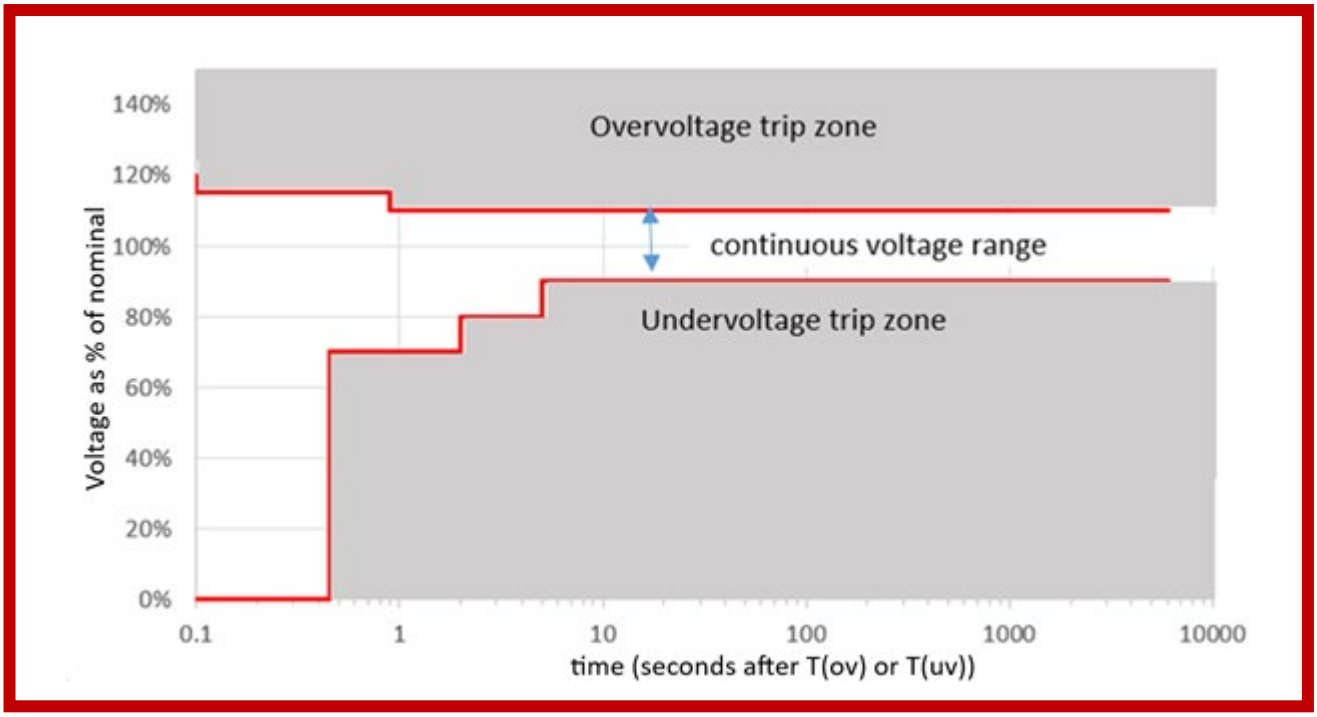


Figure A12.8.3.3: Voltage variations that a Generating System must ride through to meet the ~~Minimum Generator Performance Standard~~ Minimum Access Standard

…

A12.8.3.4. An Asynchronous Generating System with Grid-Forming Capability must initiate the response required in accordance with this Part A12.8 within 20 milliseconds to oppose the positive-sequence voltage magnitude jump.

…

A12.9. Technical Requirement: Disturbance Ride Through for Multiple Disturbances

[Note: This Technical Requirement uses the term 'fault' to include a fault of the relevant type having a metallic conducting path.]

Explanatory Note

Amendments to this Part A12.9 implements review outcome 4 of the Information Paper (Active and reactive current response during and after contingencies) and review outcome 5 (Disturbance ride-through, oscillations and stability).

Common Requirements

- Clauses A12.9.1.1 and A12.9.1.4 are amended to apply the new defined term ‘Disturbance’ and update references to revised clause numbering.
- Clause A12.9.1.6 is amended to apply the new defined terms ‘Total Current, ‘Disturbance’, ‘End of Disturbance’ and ‘Commencement Time’.
- Clause A12.9.1.6(c) is removed and replaced with a blank clause because Common Requirements relating to the negative-sequence behaviour of grid-forming inverter-based resources are deferred pending further consideration.

- Clause A12.9.1.6 also introduces Common Requirements requiring proponents of Asynchronous Generating Units to specify their Total Current contribution during a Disturbance, including positive-sequence current response and, where applicable, negative-sequence current response.

Automatic Access Standard

- The heading of Part A12.9.2, clause A12.9.2.1, the title to Table A12.9.2.1 and associated cross-references are amended to apply the revised Access Standard terminology and updated clause numbering.
- Clause A12.9.2.2 is amended to apply the new defined term 'Disturbance' and clarify that all approved inter-trip schemes are considered.
- Clause A12.9.2.3 is amended to specify the combinations of Disturbances for which a Generating System and each operating Generating Unit must remain in Continuous Uninterrupted Operation. The Automatic Access Standard requires a Generating System to accommodate up to 15 Disturbances within any five-minute period, subject to specified carve-outs.
- Clause A12.9.2.3 also introduces objective criteria relating to disturbance combinations, voltage depression levels, breaker-fail events, fault types and cumulative disturbance exposure, providing greater certainty for connection assessment, compliance and planning activities.
- Clause A12.9.2.4 is amended to apply the new defined term 'Disturbance'.
- Clause A12.9.2.5 is amended to specify the reactive current response requirements for Asynchronous Generating Systems with Grid-Following Capability and Grid-Forming Capability, including the required response, the time at which the response is required, and the requirement for the response to be maintained until the End of the Disturbance. The terminology is also updated to use the concepts of supplying to and absorbing from to accommodate Electric Storage Resources.
- Clause A12.9.2.6 is removed and replaced with a blank clause to remove redundant requirements.
- Clause A12.9.2.7 is amended to apply to Asynchronous Generating Systems with Grid-Following Capability and apply the new defined term 'Adequately Controlled'.
- New clause A12.9.2.7A provides that an Automatic Access Standard for Asynchronous Generating Systems with Grid-Forming Capability is deferred. Until an Automatic Access Standard is prescribed, the corresponding Minimum Access Standard applies.
- Clause A12.9.2.8 is amended to apply the new defined terms 'Total Current' and 'Disturbance'.
- New clauses A12.9.2.7 and A12.9.2.9 establish the Automatic Access Standard for long duration faults and unbalanced faults by adopting the corresponding Minimum Access Standard requirements.

Minimum Access Standard

- The heading of Part A12.9.3, clause A12.9.3.1, the title to Table A12.9.3.1 and associated cross-references are amended to apply the revised Access Standard terminology and updated clause numbering.
- Clause A12.9.3.2 is amended to apply the new defined term 'Disturbance'.
- Clause A12.9.3.2 is amended to specify the combinations of Disturbances for which a Generating System and each operating Generating Unit must remain in Continuous Uninterrupted Operation. The Minimum Access Standard requires a Generating System to accommodate up to six Disturbances within any five-minute period, subject to specified carve-outs, and specifies that the requirement recommences following a minimum recovery period of 30 minutes.

- Clause A12.9.3.5 is amended to apply a revised Minimum Access Standard for reactive current injection ratio during contingencies.

Note: The revised Access Standard that was consulted on with stakeholders proposed 0% reactive current injection per 1% reduction in positive sequence voltage. AEMO and Western Power consider that a revised requirement for a reactive current injection ratio greater than 0% per 1% reduction in positive-sequence voltage is required, as this ensures that the Minimum Access Standard preserves a measurable reactive current response, while allowing the applicable ratio of positive to negative sequence reactive current to be determined through the Generator Performance Standard process.

- Clauses A12.9.3.6 and A12.9.3.8 are removed and replaced with blank clauses to remove redundant requirements.
- Clause A12.9.3.7 is amended and new clauses A12.9.3.7A, A12.9.3.9 and A12.9.3.10 establish the Minimum Access Standard for Asynchronous Generating Systems relating to:
    - reactive current response, including the required response, the at which the response is required, and the requirement for the response to be maintained until the End of the Disturbance or another agreed time; and
    - long duration faults and unbalanced faults, with separate requirements for Grid-Following Capability and Grid-Forming Capability.

Negotiation Criteria

- Clause A12.9.4.1 is amended to replace revised Access Standards terminology.
- New clause A12.9.4.2 requires a Negotiated Access Standard to specify the required response of a Generating System or Generating Unit for each combination of power system disturbances or conditions identified in Appendix 12, with the objective of achieving Continuous Uninterrupted Operation to the greatest extent reasonably practicable.

A12.9.1. Common Requirements

A12.9.1.1. The Common Requirements for ~~disturbance~~ Disturbance ride through for multiple ~~disturbances~~ Disturbance as they apply to different Generating Systems, is specified in Table A12.9.1.1:

Type of Generating System	Relevant requirement
Generating System comprised solely of Synchronous Generating Units.	Clause ~~A12.9.1.3, clause~~ A12.9.1.2 to~~,~~ clause A12.9.1.4, clause A12.9.1.5, and clause A12.9.1.7 ~~and~~ to clause A12.9.1.8.
Generating System comprised solely of Asynchronous Generating Units.	Clause ~~A12.9.1.3, clause~~ A12.9.1.2~~,~~ to clause A12.9.1.4, clause A12.9.1.6, and clause A12.9.1.7 ~~and~~ to clause A12.9.1.8.
Generating System comprised of Synchronous Generating Units and Asynchronous Generating Units.	Clause ~~A12.9.1.3, clause~~ A12.9.1.2~~,~~ to clause A12.9.1.4, clause A12.9.1.7, ~~clause~~ clauses A12.9.1.8 to and: (a) for that part of the Generating System comprised of Synchronous Generating Units, clause A12.9.1.5; (b) for that part of the Generating System comprised of Asynchronous Generating Units, clause A12.9.1.6.

Table A12.9.1.1: Common Requirements for Disturbance Ride through for Multiple Disturbances

…

A12.9.1.4. When assessing multiple ~~disturbances~~ Disturbance, a fault that is re-established following operation of automatic reclose Protection Scheme shall be counted as a separate ~~disturbance~~ Disturbance.

…

Asynchronous Generating Systems

A12.9.1.6. For a Generating System comprised of Asynchronous Generating Units:

(a) the ~~reactive current~~ Total Current contribution must equal or exceed the Maximum Continuous Current of the Generating System, including all operating Asynchronous Generating Units;

(b) [Blank]

(c) ~~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 Operator for the types of disturbances specified in this Technical Requirement; and~~[Blank]

(d) the Generator Performance Standard must record all conditions (which may include temperature) considered relevant by AEMO and the Network Operator under which the reactive current response is required~~.~~;

(e) during the Disturbance, injection of active and reactive current from the Generating System and each of its Generating Units must have a fundamental frequency component the same as the fundamental frequency of the terminal voltage;

(f) during the Disturbance, if the Total Current limit is reached, the incremental positive sequence and negative sequence current may be reduced with a preference for reduction in both currents;

(g) the incremental positive sequence reactive current injection must not be reduced below the incremental negative sequence reactive current;

(h) the Measurement Location for Commencement Time and Rise Time must be the same location; and

(i) during a Disturbance, where the Total Current limit of the Generating System or Generating Unit is reached, or any current-limiting control is engaged, the Generating System must have Equipment capabilities and Control Systems sufficient to ensure that:

i. the response remains Adequately Controlled when entering, operating within, and recovering from current-limited operation;

ii. the response does not cause sustained or growing adverse voltage, current or power oscillations at the Connection Point;

iii. the prioritisation and allocation of active current and reactive current for positive-sequence and negative-sequence currents during current-limited operation is specified in the Generator Performance Standard; and

iv. any reduction in the reactive current response required under this Part A12.9 is no greater than reasonably necessary to preserve stable control, comply with Equipment capability, Protection System settings or current limits, respond to changed Disturbance conditions, or reallocate current in accordance with the current-priority logic specified in the Generator Performance Standard.

…

A12.9.2. ~~Ideal Generator Performance Standard~~ Automatic Access Standard

A12.9.2.1. The ~~Ideal Generator Performance Standard~~ Automatic Access Standard as it applies to different Generating Systems, is specified in Table A12.9.2.1:

Type of Generating System	Relevant requirement
Generating System comprised solely of Synchronous Generating Units.	Clause A12.9.2.2~~,~~ to clause A12.9.2.3 and clause A12.9.2.4.
Generating System comprised solely of Asynchronous Generating Units.	Clause A12.9.2.2, clause A12.9.2.3 and clause A12.9.2.5 to clause ~~A12.9.2.8~~ A12.9.2.10.
Generating System comprised of Synchronous Generating Units and Asynchronous Generating Units.	Clause A12.9.2.2 ~~and~~ to clause A12.9.2.3 and: (a) for that part of the Generating System comprised of Synchronous Generating Units, clause A12.9.2.4; (b) for that part of the Generating System comprised of Asynchronous Generating Units, clause A12.9.2.5 to clause ~~A12.9.2.8~~ A12.9.2.10.

Table A12.9.2.1: Disturbance Ride through for Multiple Disturbances ~~Ideal Generator Performance Standard~~ Automatic Access Standard

A12.9.2.2. A Generating System and each of its operating Generating Units must remain in Continuous Uninterrupted Operation for any ~~disturbances~~ Disturbances caused by:

(a) a Credible Contingency;

(b) a three phase fault in a Transmission System cleared by all relevant primary Protection Systems; ~~and~~ or

(c) a two phase to ground, phase to phase or phase to ground fault in a transmission or distribution system or a three phase fault in a distribution system cleared in:

i. the longest time expected to be taken for a relevant breaker fail Protection System to clear the fault; or

ii. if a Protection System referred to in clause A12.9.2.2.(c)(i) is not installed, the greater of 450 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 SWIS by removing Network elements from service or as a result of the operation of an ~~existing~~ inter-trip, Protection Scheme or runback scheme approved by the Network Operator and AEMO.

A12.9.2.3. A Generating System and each of its operating Generating Units must remain in Continuous Uninterrupted Operation for a series of up to 15 ~~disturbances~~ Disturbances within any 5 minute period~~.~~ caused by any combination of the events described in clause A12.9.2.2 where:

(a) up to six of the Disturbances cause the voltage at the Connection Point to drop below 50% of nominal voltage;

(b) the Automatic Access Standard for A12.9.2.3(b) is the same as the Minimum Access Standard for clause A12.9.3.3.(b);

(c) the time difference between the clearance of one Disturbance and commencement of the next Disturbance may be zero milliseconds;

(d) 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 nominal voltage;

(e) up to one Disturbance is cleared by a breaker fail Protection System or similar back-up Protection System; and

(f) the Automatic Access Standard for clause A12.9.2.3(f) is the same as the Minimum Access Standard for clause A12.9.3.3(e),

provided that none of the events would result in:

(g) the islanding of the Generating System or cause a material reduction in power transfer capability by removing network elements from service, notwithstanding the requirement of clause A12.9.2.3.(e);

(h) the cumulative time that voltage at the Connection Point is lower than 90% of nominal voltage exceeding 1,800 milliseconds within any five minute period; or

(i) the time integral, within any five minute period, of the difference between 90% of nominal voltage and the voltage at the Connection Point when the voltage at the Connection Point is lower than 90% of nominal voltage exceeding 1 pu second.

Synchronous Generating Systems

A12.9.2.4. Subject to any changed power system conditions or energy source availability beyond the operator of the Generating System's reasonable control, a Generating System comprised of Synchronous Generating Units, in respect of the faults referred to in clause A12.9.2.2, must supply to, or absorb from, the Network:

(a) to assist the maintenance of power system voltages during the fault, capacitive reactive current of at least the greater of its ~~pre-disturbance~~ pre-Disturbances 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~~ Disturbances) for each 1% reduction (from the level existing just prior to the fault) of Connection Point voltage or another agreed location in the SWIS (including within the Generating System) during the fault;

(b) after clearance of the fault, Reactive Power sufficient to ensure that the Connection Point voltage or another agreed location in the SWIS (including within the Generating System) is within the range for Continuous Uninterrupted Operation; and

(c) from 100 milliseconds after clearance of the fault, Active Power of at least 95% of the level existing just prior to the fault.

Asynchronous Generating Systems

A12.9.2.5. Subject to any changed power system conditions or energy source availability beyond the operator of the Generation System's reasonable control, a Generating System comprised of Asynchronous Generating Units, for the faults referred to in clause A12.9.2.2, must ~~have equipment capable of supplying to, or absorbing from, the Network~~:

(a) ~~to assist the maintenance of power system voltages during the fault~~ be capable of supplying to, or absorbing from, the Network:

i. positive sequence capacitive reactive current in addition to its ~~pre-disturbance~~ pre-Disturbances level of at least 4% of the Maximum Continuous Current of ~~the Generating System including~~ all operating Asynchronous Generating Units (in the absence of a ~~disturbance~~ Disturbances) for each 1% reduction of positive sequence voltage at the Connection Point below ~~a specified threshold level within the under-voltage range of 85% to 90% of nominal voltage, except where a Generating System is directly connected to the SWIS with no step-up or connection Transformer and voltage at the Connection Point is 5% or lower of nominal voltage~~ the relevant point at which a reactive current

response must commence, as required under clause A12.9.2.5(c); and

ii. positive sequence inductive reactive current in addition to its pre-~~disturbance~~ Disturbances level of at least 6% of the Maximum Continuous Current of ~~the Generating System including~~ all operating Asynchronous Generating Units (in the absence of a ~~disturbance~~ Disturbances) for each 1% increase of positive sequence voltage at the Connection Point above ~~a specified threshold level within the over-voltage range of 110% to 115% of nominal voltage~~ the relevant point at which a reactive current response must commence, as required under clause A12.9.2.5(c),

during the ~~disturbance~~ Disturbances and maintained until Connection Point voltage recovers to between 90% and 110% of nominal voltage, or such other range agreed with the Network Operator and AEMO; ~~and~~

(b) ~~from 100 milliseconds after clearance of the fault, Active Power of at least 95% of the level existing just prior to the fault.~~ be capable of returning to at least 95% of the pre-fault Active Power output:

i. within 100 milliseconds after the End of the Disturbance, where the Generating System is an Asynchronous Generating System with Grid-Following Capability; or

ii. within a period of time after the End of the Disturbance that is agreed by the operator, AEMO and the Network Operator, where the Generating System is an Asynchronous Generating System with Grid-Forming Capability,

(c) commence the response required under clause A12.9.2.5(a) when the voltage:

i. falls to a threshold of 85% of the nominal voltage; or

ii. increases to a threshold of 115% of the nominal voltage,

and in each case may commence a response before the threshold is reached; and

(d) maintain a response required under clause A12.9.2.5(a) until the End of the Disturbance.

A12.9.2.6. ~~The under-voltage and over-voltage range referred to in clause A12.9.2.5(a)(i) and clause A12.9.2.5(a)(ii) may be varied with the agreement of the Network Operator and AEMO (provided the magnitude of the range between the upper and lower bounds remains at 5%).~~[Blank]

A12.9.2.7. Where the Generating System is an Asynchronous Generating System with Grid-Following Capability, ~~T~~the reactive current response referred to in clause A12.9.2.5(a)(i) and clause A12.9.2.5(a)(ii) 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~~ Adequately Controlled.

A12.9.2.7A. The Automatic Access Standard in clause A12.9.2.7A is the same as the Minimum Access Standard in clause A12.9.3.7A.

A12.9.2.8. Subject to a Generating System's thermal limitations as specified in clause A12.9.1.8 and energy source availability, a Generating System must make available at all times:

(a) sufficient current to maintain rated output in accordance with the relevant Australian Standard or ISO Standard for Asynchronous Generating Units of the Generating System including all operating Generating Units (in the absence of a ~~disturbance~~ Disturbances), for all Connection Point voltages above 115% (or otherwise, above the agreed over-voltage range). The details regarding which relevant Australian Standard or ISO Standard applies is documented in the guidelines published by the Network Operator under clause 3A.4.4; and

(b) the ~~Maximum Continuous Current~~ Total Current of the Generating System including all operating Generating Units (in the absence of a ~~disturbance~~ Disturbances) for all Connection Point voltages below 85% (or otherwise, below the agreed under-voltage range),

despite the amount of reactive current injected or absorbed during voltage ~~disturbances~~ Disturbances, except that AEMO and the Network Operator may agree limits on active current injection where required to maintain Power System Security and/or the Quality of Supply to other Equipment connected to the SWIS.

A12.9.2.9. The Automatic Access Standard in clause A12.9.2.9 is the same as the Minimum Access Standard in clause A12.9.3.9.

A12.9.2.10. The Automatic Access Standard in clause A12.9.2.10 is the same as the Minimum Access Standard in clause A12.9.3.10.

A12.9.3. ~~Minimum Generator Performance Standard~~ Minimum Access Standard

A12.9.3.1. The ~~Minimum Generator Performance Standard~~ Minimum Access Standard as it applies to different Generating Systems, is specified in Table A12.9.3.1:

Type of Generating System	Relevant requirement
Generating System comprised solely of Synchronous Generating Units.	Clause A12.9.3.2~~,~~ to clause A12.9.3.3 and clause A12.9.3.4.
Generating System comprised solely of Asynchronous Generating Units.	Clause A12.9.3.2~~,~~ to clause A12.9.3.3 and clause A12.9.3.5 to clause ~~A12.9.3.8~~ A12.9.310.
Generating System comprised of Synchronous Generating Units and Asynchronous Generating Units.	Clause A12.9.3.2 ~~and~~ to clause A12.9.3.3 and: (a) for that part of the Generating System comprised of Synchronous Generating Units, clause A12.9.3.4; (b) for that part of the Generating System comprised of Asynchronous Generating Units, clause A12.9.3.5 to clause ~~A12.9.3.8~~ A12.9.310.

Table A12.9.3.1: Disturbance Ride through for Multiple Disturbances ~~Minimum Generator Performance Standard~~ Minimum Access Standard

All Generating Systems

A12.9.3.2. A Generating System and each of its operating Generating Units must remain in Continuous Uninterrupted Operation for any ~~disturbance~~ Disturbance caused by:

(a) a Credible Contingency; or

(b) a single phase to ground, phase to phase or two phase to ground fault or three phase fault in a transmission or distribution system cleared in 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 SWIS by removing Network elements from service or as a result of the operation of an inter-trip, Protection Scheme or runback scheme approved by the Network Operator and AEMO.

A12.9.3.3. A Generating System and each of its operating Generating Units must remain in Continuous Uninterrupted Operation for a series of up to 6 ~~disturbances~~ Disturbance within any 5 minute period~~.~~ caused by any combination of the events described in clause A12.9.3.2 where:

(a) up to three of the Disturbances cause the voltage at the Connection Point to drop below 50% of nominal voltage;

(b) up to one Disturbance causes the voltage at the Connection Point to vary within the ranges agreed by AEMO and the Network Operator in accordance with clauses A12.8.3.1(f) or A12.8.3.1(g);

(c) the time difference between the clearance of one Disturbance and commencement of the next Disturbance always exceeds 200 milliseconds;

(d) no more than three of the Disturbances occur within 30 seconds; and

(e) all Disturbances are caused by faults other than three phase faults,

provided that none of the events would result in:

(f) the islanding of the Generating System or cause a material reduction in power transfer capability by removing network elements from service;

(g) the cumulative time that voltage at the Connection Point is lower than 90% of nominal voltage exceeding 1,000 milliseconds within any 5 minute period; or

(h) the time integral, within any 5 minute period, of the difference between 90% of nominal voltage and the voltage at the Connection Point when the voltage at the Connection Point is lower than 90% of nominal voltage exceeding 0.5 pu second,

and there is a minimum of 30 minutes where no Disturbances occur following a five minute period of up to 6 Disturbances.

…

Asynchronous Generating Systems

A12.9.3.5. Subject to a Generating System's thermal limitations as specified in clause A12.9.1.8 and any changed power system conditions or energy source availability beyond the operator of the Generating System's reasonable control, a Generating System comprised of Asynchronous Generating Units, for the faults referred to in clause A12.9.3.2, must ~~have equipment capable of supplying to, or absorbing from, the Network~~:

(a) ~~to assist the maintenance of power system voltages during the fault~~ be capable of supplying to, or absorbing from, the Network:

i. positive sequence capacitive reactive current in addition to its ~~pre-disturbance~~ pre-Disturbance level of ~~at least 2%~~ a percentage greater than 0% of the Maximum Continuous Current of ~~the Generating System including~~ all operating Asynchronous Generating Units (in the absence of a ~~disturbance~~ Disturbance) for each 1% reduction of positive sequence voltage at the Connection Point below ~~a specified threshold level agreed by the Network Operator and AEMO within the under-voltage range of 80% to 90% of nominal voltage, except where:~~ the relevant point at which a reactive current response must commence, as required under clause A12.9.3.5(c); and

1. voltage at the Connection Point is 15% or lower of nominal voltage; or

2. where the Generating System is directly connected to the SWIS with no step-up or connection Transformer and voltage at the Connection Point is 20% or lower of nominal voltage; and

ii. positive sequence inductive reactive current in addition to its ~~pre-disturbance~~ pre-Disturbance level of ~~at least 2%~~ a percentage greater than 0 % of the Maximum Continuous Current of ~~the Generating System including~~ all operating Asynchronous Generating Units (in the absence of a ~~disturbance~~ Disturbance) for each 1% increase of positive sequence voltage at the Connection Point ~~above a specified threshold level agreed by the Network Operator and AEMO within the over-voltage range of 110% to 120% of nominal voltage~~ the relevant point at which a reactive current response must commence, as required under clause A12.9.3.5(c),

during the ~~disturbance~~ Disturbance and maintained until the Connection Point voltage recovers to between 90% and 110% of nominal voltage, or such other range agreed ~~with~~ by the Network Operator and AEMO; ~~and~~

(b) be capable of returning to at least 95% of the pre-fault Active Power output~~, after clearance of the fault~~, within a period of time after the End of the Disturbance that is agreed by the operator, AEMO and the Network Operator~~.~~;

(c) commence the response required under clause A12.9.3.5(a) when the voltage:

i. falls to a threshold of 80% of the nominal voltage; or

ii. increases to a threshold of 120% of the nominal voltage,

and in each case may commence a response before the threshold is reached; and

(d) maintain a response required under clause A12.9.3.5(a) until the End of the Disturbance, or such other time agreed by the Network Operator and AEMO.

A12.9.3.6. ~~The under-voltage and over-voltage range referred to in clause A12.9.3.5(a)(i) and clause A12.9.3.5(a)(ii) may be varied with the agreement of the Network Operator and AEMO (provided the magnitude of the range between the upper and lower bounds remains at 10%).~~[Blank]

A12.9.3.7. Where AEMO and the Network Operator require the Asynchronous Generating System with Grid-Following Capability to sustain a response duration of ~~2 seconds~~ 450 milliseconds or less, the reactive current response referred to in clause A12.9.3.5(a)(i) and clause A12.9.3.5(a)(ii) must have a Rise Time of ~~no greater than 40.0~~ 80 milliseconds or a longer period agreed with the Network

Operator and AEMO, and a ~~Settling Time~~ Commencement Time of no greater than ~~70.0~~ 40 milliseconds and must be ~~Adequately Damped~~ Adequately Controlled.

A12.9.3.7A. Where AEMO and the Network Operator require an Asynchronous Generating System with Grid-Forming Capability to sustain a response duration of 450 milliseconds or less, the reactive current response referred to in clause A12.9.3.5(a)(i) and clause A12.9.3.5(a)(ii) must have a Rise Time of up to 80 milliseconds or a longer period agreed with the Network Operator and AEMO, and a Commencement Time of no greater than 30 milliseconds and must be Adequately Controlled.

A12.9.3.8. ~~Where AEMO and the Network Operator require the Generating System to sustain a response duration of greater than 2 seconds, the reactive current Rise Time and Settling Time must be as soon as practicable and must be Adequately Damped. The Rise Time and Settling Time must be provided as part of the Generator Performance Standard.~~[Blank]

A12.9.3.9. For unbalanced faults, in addition to injecting additional positive sequence reactive current, an Asynchronous Generating System with Grid-Following Capability must inject negative sequence current dependent on negative sequence voltage, such that leads the negative sequence voltage by nominally 90 degrees, within a ±10° tolerance;

A12.9.3.10. Subject to Total Current limits and energy source availability, an Asynchronous Generating System with Grid-Forming Capability must be Adequately Controlled and remain in Continuous Uninterrupted Operation, and must not cause sustained or growing adverse negative-sequence voltage or current behaviour at the Connection Point.

A12.9.4. Negotiation Criteria

A12.9.4.1. A ~~Proposed Negotiated Generator Performance~~ Proposed Negotiated Access Standard may be accepted if the connection of the Generating System at the proposed performance level would not cause other Generating Systems or Loads to trip as a result of an event, when they would otherwise not have tripped for the same event.

A12.9.4.2. A Proposed Negotiated Access Standard may be accepted if the required response of the Generating Unit or Generating System, as applicable, to each combination of power system Disturbances or conditions specified in this Appendix is as close to Continuous Uninterrupted Operation as is reasonably practicable, and provided any agreed limitations on the Generating Unit or Generating System, as applicable, do not reduce the overall number of Disturbances within any given period for which the Generating System is required to remain in Continuous Uninterrupted Operation below the level specified in this Appendix 12.

Explanatory Note

New Part A12.9A is inserted to implement review outcome 2 of the Information Paper (Withstand SCR). The new Part establishes Technical Requirements requiring Asynchronous Generating Systems to demonstrate stable operation under low system strength conditions.

Common Requirements

- New Part A12.9A establishes the Common Requirements for assessing Withstand Short Circuit Ratio for Asynchronous Generating Systems. The new Part specifies:
    - the Measurement Location at which the Technical Requirement applies;
    - when the Technical Requirement is to be assessed; and
    - the circumstances in which the Asynchronous Generating System is not required to remain in Continuous Uninterrupted Operation.

Automatic Access Standard

- New Part A12.9A.2 establishes the Automatic Access Standard by adopting the corresponding Minimum Access Standard.

Minimum Access Standard

- New Part A12.9A.3 introduces a Minimum Access Standard requiring an Asynchronous Generating System to remain Adequately Controlled and in Continuous Uninterrupted Operation at a Withstand Short Circuit Ratio of 3 or less;

Negotiation Criteria

- New Part A12.9A.4 specifies that no Negotiated Access Standard applies for this Technical Requirement.

A12.9A. Technical Requirement: Withstand Short Circuit Ratio

A12.9A.1. Common Requirements

A12.9A.1.1. In relation to the application of this Technical Requirement, the requirements apply at the Connection Point unless otherwise specified in the relevant clause, or the Network Operator or AEMO determines that the Technical Requirement must be measured at a different location for the particular Asynchronous Generating Unit or Asynchronous Generating System, in which case the Measurement Location must be recorded as part of the relevant Generator Performance Standard.

A12.9A.1.2. In relation to the application of this Technical Requirement, the requirements apply when operating at any Active Power and Reactive Power level as permitted or required under the other Technical Requirements in this Appendix, except for any agreed operating ranges where the requirement cannot be met due to Network operating limitations, in which case the agreed operating ranges must be recorded as part of the relevant Generator Performance Standard.

A12.9A.1.3. An Asynchronous Generating Unit or Asynchronous Generating System is not required to remain in Continuous Uninterrupted Operation if the network operating conditions result in a Short Circuit Ratio below the Withstand Short Circuit Ratio agreed with AEMO and the Network Operator.

A12.9A.2. Automatic Access Standard

A12.9A.2.1. The Automatic Access Standard is the same as the Minimum Access Standard for Withstand Short Circuit Ratio.

A12.9A.3. Minimum Access Standard

A12.9A.3.1. Subject to clause A12.9A.1.2, an Asynchronous Generating System must have Equipment capability sufficient to be Adequately Controlled and maintain Continuous Uninterrupted Operation while meeting all other Technical Requirements at a Short Circuit Ratio of 3 or less.

A12.9A.4. Negotiation Criteria

A12.9A.4.1. There are no Negotiation Criteria for this Technical Requirement.

Explanatory Note

New Part A12.9B is inserted to implement review outcome 3 of the Information Paper (Contingency Response Requirements).

Common Requirements

- New Part A12.9.B.1 establishes the Common Requirements for assessing Voltage Phase Angle Jump performance for Asynchronous Generating Systems and Asynchronous Generating Units. The new Part specifies:
    - the Measurement Location at which the Technical Requirement applies;
    - when the Technical Requirement is to be assessed; and
    - the circumstances in which an Asynchronous Generating System is not required to remain in Continuous Uninterrupted Operation.

Automatic Access Standard

- New Part A12.9B.2 establishes the Automatic Access Standard by adopting the corresponding Minimum Access Standard.

Minimum Access Standard

- New Part A12.9B.3 establishes the Minimum Access Standard for Voltage Phase Angle Jump. The new requirements provide that:

- an Asynchronous Generating System must remain Adequately Controlled and in Continuous Uninterrupted Operation for a positive-sequence voltage phase angle jump of ±25 degrees; and
- an Asynchronous Generating System with Grid-Forming Capability must initiate a response to oppose the positive-sequence voltage phase angle jump within 20 milliseconds.

Negotiation Criteria

- New Part A12.9B.4 specifies that no Negotiated Access Standard applies to this technical requirement.

A12.9B. Technical Requirement: Voltage Phase Angle Jump

A12.9B.1. Common Requirements

A12.9B.1.1. In relation to the application of this Technical Requirement, the requirements apply at the Connection Point unless otherwise specified in the relevant clause, or the Network Operator or AEMO determines that the Technical Requirement must be measured at a different location for the particular Asynchronous Generating Unit or Asynchronous Generating System, in which case the Measurement Location must be recorded as part of the relevant Generator Performance Standard.

A12.9B.1.2. In relation to the application of this Technical Requirement, the requirements apply when operating at any Active Power and Reactive Power level as permitted or required under the other Technical Requirements in this Appendix, except for any agreed operating ranges where the requirement cannot be met due to Network operating limitations, in which case the agreed operating ranges must be recorded as part of the relevant Generator Performance Standard.

A12.9B.1.3. An Asynchronous Generating Unit or Asynchronous Generating System must be Adequately Controlled and remain in Continuous Uninterrupted Operation for any voltage phase angle changes caused by the occurrence and clearance of balanced and unbalanced faults, provided the positive-sequence angle change does not exceed the relevant Generator Performance Standard in clauses A12.9B.3.1 or A12.9B.3.2.

A12.9B.2. Automatic Access Standard

A12.9B.2.1. The Automatic Access Standard is the same as the Minimum Access Standard for voltage phase angle jump.

A12.9B.3. Minimum Access Standard

A12.9B.3.1. An Asynchronous Generating System must be Adequately Controlled and remain in Continuous Uninterrupted Operation for a positive-sequence phase angle jump of ±25 degrees.

A12.9B.3.2. An Asynchronous Generating System with Grid-Forming Capability must initiate the current response required by clause A12.9B.3.1 in any event within 20 milliseconds in a manner directed to opposing the positive-sequence voltage phase angle jump.

A12.9B.4. Negotiation Criteria

A12.9B.4.1. There are no Negotiation Criteria for this Technical Requirement.

…

A12.10. Technical Requirement: Disturbance Ride Through for Partial Load Rejection

Explanatory Note

Automatic Access Standard

- The heading of Part A12.10.2 is amended to apply the revised Access Standard terminology.
- Clause A12.10.2.1 is amended to insert the word 'Synchronous' and apply the new defined term 'Maximum Active Power', clarifying that Part A12.10 applies only to Synchronous Generating Systems.

Minimum Access Standard

- The heading of Part A12.10.3 is amended to apply the revised Access Standard terminology.
- Clause A12.10.3.1 is amended to insert the term 'Synchronous' and apply the new defined term 'Maximum Active Power', clarifying that Part A12.10 applies only to Synchronous Generating Systems.

…

A12.10.2. ~~Ideal Generator Performance Standard~~ Automatic Access Standard

…

A12.10.2.1. A Synchronous Generating System and each of its operating Generating Units must be capable of Continuous Uninterrupted Operation during and following a sudden reduction in Active Power generation as a result of a Contingency Event, provided that the reduction is less than 30% of the Generating System's ~~Rated~~ Maximum Active Power and the Active Power generation remains above the Generating System's Rated Minimum Active Power output level.

A12.10.3. ~~Minimum Generator Performance Standars~~ Minimum Access Standard

A12.10.3.1. A Synchronous Generating System must be capable of Continuous Uninterrupted Operation during and following a sudden reduction in Active Power generation as a result of a Contingency Event, provided that the

reduction is less than 5% of the Generating System's ~~Rated~~ Maximum Active Power and the Active Power generation remains above the Generating System's Rated Minimum Active Power output level.

…

A12.11. Technical Requirement: Disturbance Ride Through for Quality of Supply

Explanatory Note

The headings of Part A12.11.2 and A12.11.3, and clause A12.11.2.1 are amended to apply the revised Access Standard terminology.

…

A12.11.2. ~~Ideal Generator Performance Standard~~ Automatic Access Standard

A12.11.2.1. The ~~Ideal Generator Performance Standard~~ Automatic Access Standard is the same as the Minimum ~~Generator Performance~~ Minimum Access Standard Standard for Disturbance Ride Through for Quality of Supply.

A12.11.3. ~~Minimum Generator Performance Standard~~ Minimum Access Standard

A12.11.3.1. A Generating System including each of its operating Generating Units and reactive Equipment, must not disconnect from the SWIS as a result of voltage fluctuation, harmonic voltage distortion and voltage unbalance conditions at the Connection Point within the levels specified for flicker, harmonics and negative phase sequence voltage in the Technical Rules.

…

A12.12. Technical Requirement: Quality of Electricity Generated

Explanatory Note

The headings of Parts A12.12.2, A12.12.3 and A12.12.4 are amended to apply the revised Access Standard terminology.

…

A12.12.2. ~~Ideal Generator Performance Standard~~ Automatic Access Standard

A12.12.2.1. A Generating System, when generating and when not generating, must not produce at any of its Connection Points for generation:

(a) voltage fluctuation greater than the limits allocated by the Network Operator that are no more onerous than the lesser of the acceptance levels determined in accordance with either of the stage 1 or the stage 2 evaluation procedures defined in AS/NZS 61000.3.7:2001; and

(b) harmonic voltage distortion greater than emission limits allocated by the Network Operator that are no more onerous than the lesser of the acceptance levels determined in accordance with either of the stage 1 or the stage 2 evaluation procedures defined in AS/NZS 61000.3.6:2001.

A12.12.3. ~~Minimum Generator Performance Standard~~ Minimum Access Standard

A12.12.3.1. A Generating System, when generating and when not generating, must not produce at any of its Connection Points for generation:

(a) voltage fluctuations greater than limits determined by the Network Operator through the negotiation using the stage 3 evaluation procedure defined in AS/NZS 61000.3.7:2001, with the Market Participant responsible for the Transmission Connected Generating System agreeing to fund any works necessary to mitigate adverse effects from accepting this emission level; and

(b) Harmonic voltage distortion greater than emission limits determined by the Network Operator through the negotiation using the Stage 3 evaluation procedure defined in AS/NZS 61000.3.6:2001 with the Market Participant responsible for the Transmission Connected Generating System agreeing to fund any works necessary to mitigate adverse effects from accepting this emission level.

A12.12.4. Negotiation Criteria

A12.12.4.1. A ~~Proposed Negotiated Generator Performance Standard~~ Proposed Negotiated Access Standard must not prevent the Network Operator meeting each SWIS Operating Standard or contractual obligations to existing holders of Arrangements for Access.

…

A12.13. Technical Requirement: Generation Protection Systems

Explanatory Note

Automatic Access Standard

- The heading of Part A12.13.2 and clause A12.13.2 .1 are amended to apply the revised Access Standard terminology.

Minimum Access Standard

- The heading of Part A12.13.3 is amended to apply the revised Access Standard terminology.
- New clause A12.13.3.3A is inserted to implement review outcome 8 of the Information Paper (Instability detection mechanism). The new clause introduces a Minimum Access Standard requiring Grid-Following inverter-based resources to include an instability detection mechanism capable of detecting specified oscillatory behaviour and responding in accordance with the applicable Technical Requirements.
- Clause A12.13.3.4 is amended to apply the new defined term 'Disturbance'.

…

A12.13.2. ~~Ideal Generator Performance Standard~~ Automatic Access Standard

A12.13.2.1. The ~~Ideal Generator Performance Standard~~ Automatic Access Standard is the same as the ~~Minimum Generator Performance~~ Minimum Access Standard for Generation Protection Systems.

A12.13.3. ~~Minimum Generator Performance~~ Minimum Access Standard

A12.13.3.1. A Generating System must meet the protection requirements specified in the Technical Rules for both Generating Systems and the Transmission System (where relevant), including the requirement for faults to be cleared within maximum Total Fault Clearance Times specified in the Technical Rules or, where specified, a Critical Fault Clearance Time developed by the Network Operator.

A12.13.3.2. All Protection Schemes must have the relevant level of redundancy as specified in the Technical Rules and must operate to clear faults within the prescribed times.

A12.13.3.3. Anti-islanding protection must be installed and made available to ensure the Generating System is prevented from supplying an isolated portion of the SWIS when it is not secure to do so. The details regarding the performance requirements for anti-islanding systems for Transmission Connected Generating Systems are documented in accordance with the guidelines produced by the Network Operator under clause 3A.4.4.

A12.13.3.3A. An Asynchronous Generating Systems with Grid-Following Capability must have an instability detection mechanism capable of identifying unstable operation or instability-related control interactions. The performance requirements for instability detection mechanisms are documented in accordance with the guidelines produced by the Network Operator under clause 3A.4.4.

A12.13.3.4. All Protection Schemes necessary to disconnect the Generating System during abnormal conditions in the power system that would threaten the stability of the Generating System, or risk damage to the Generating System, must be installed and available. The settings of these Protection Schemes must deliver

the required performance for ~~disturbance~~ Disturbance ride through specified in Part A12.7, Part A12.8 and Part A12.9 of this Appendix 12 and form part of the Generator Performance Standard.

…

A12.14. Technical Requirement: Remote Monitoring Requirements

Explanatory Note

The headings of Parts A12.14.2 and A12.14.3, and clause A12.14.2.1 are amended to apply the revised Access Standard terminology.

…

A12.14.2. ~~Ideal Generator Performance Standard~~ Automatic Access Standard

A12.14.2.1. The ~~Ideal Generator Performance Standard~~ Automatic Access Standard is the same as the ~~Minimum Generator Performance~~ Minimum Access Standard for Remote Monitoring Requirements.

A12.14.3. ~~Minimum Generator Performance Standard~~ Minimum Access Standard

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A12.15. Technical Requirement: Remote Control Requirements

Explanatory Note

The headings of Parts A12.15.2 and A12.15.3, and clause A12.15.2.1 are amended to apply the revised Access Standard terminology.

A12.15.2. ~~Ideal Generator Performance Standard~~ Automatic Access Standard

A12.15.2.1. The ~~Ideal Generator Performance Standard~~ Automatic Access Standard is the same as the ~~Minimum Generator Performance Standard~~ Minimum Access Standard for Remote Control Requirements.

A12.15.3. ~~Minimum Generator Performance Standard~~ Minimum Access Standard

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A12.16. Technical Requirement: Communications Equipment Requirements

Explanatory Note

The headings of Parts A12.16.2 and A12.16.3, and clause A12.16.2.1 are amended to apply the revised Access Standard terminology.

A12.16.2. ~~Ideal Generator Performance Standard~~ Automatic Access Standard

A12.16.2.1. The ~~Ideal Generator Performance Standard~~ Automatic Access Standard is the same as the ~~Minimum Generator Performance~~ Minimum Access Standard Standard for Communications Equipment Requirements.

A12.16.3. ~~Minimum Generator Performance Standard~~ Minimum Access Standard

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A12.17. Technical Requirement: Generation System Model

Explanatory Note

The headings of Parts A12.17.2 and A12.17.3, and clause A12.17.2.1 are amended to apply the revised Access Standard terminology.

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A12.17.2. ~~Ideal Generator Performance Standard~~ Automatic Access Standard

A12.17.2.1. The ~~Ideal Generator Performance Standard~~ Automatic Access Standard is the same as the ~~Minimum Generator Performance Standard~~ Minimum Access Standard for Generation System Model.

A12.17.3. ~~Minimum Generator Performance Standard~~ Minimum Access Standard

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Part 2: Amending rules to establish a SWIS System framework

Explanatory Note

The relevant proposed amendments for the SWIS System Strength framework include:

- A revised System Strength definition to better capture both the locational nature of system strength and the need to consider behaviour during both steady state operation and disturbance conditions;
- A definition of System Strength Shortfall to provide clarity on how shortfalls are identified and measured;
- Establishing a Forecast and Planning Coordination Group (FPCG) to improve consistency of forecasting and planning inputs and assumptions across the Coordinator of Energy (Coordinator), Western Power and the Australian Energy Market Operator (AEMO);
- Requiring the FPCG to develop the modelling framework, including methodology, modelling approach, inputs, assumptions and scenarios, which should be used to:
    - develop a 10-year Energy Producing Systems capacity and demand outlook on an annual basis (Fleet Forecast'); and
    - identify System Strength Shortfalls.
- Requiring AEMO, the Network Operator and the Coordinator to take the Fleet Forecast, determined by the FPCG, into account when developing the Long Term Projected Assessment of System Adequacy, Transmission System Plan and Whole of System Plan
- Requiring the Network Operator to contribute to, assist with and provide the Forecast and Planning Coordination Group with any information, including data, models and analysis, reasonably required by the group and to enable AEMO to develop a System Strength Report;
- Requiring AEMO to publish the System Strength Report that forecasts System Strength Shortfalls, as agreed by the FPCG;
- Requiring the Network Operator to alleviate a forecast System Strength Shortfall through network reinforcement or the procurement of non-network solutions or services through the Non-Co-optimised Essential System Services (NCESS) framework; and
- Requiring Western Power, when Western Power submits a request to the Coordinator to determine whether to trigger an NCESS procurement process, to allow sufficient lead time to ensure the proposed solutions for alleviating System Strength Shortfalls can be delivered on time

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2.1A. Australian Energy Market Operator

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Explanatory Note

New clause 2.1A.2(cA) is introduced to specifiy AEMO's functions relating to System Strength.

These functions represent an expansion of AEMO's role to include forecasting and reporting on System Strength Shortfalls.

2.1A.2. The ESM Regulations also provide for the ESM Rules to confer additional functions on AEMO. The functions conferred on AEMO are:

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(c) to carry out a Long Term PASA study and to publish the Statement of Opportunities Report;

(cA) to carry out a System Strength Shortfall study, in consultation with the Forecast and Planning Coordination Group, and to publish the results in a System Strength Report;

(d) to do anything that AEMO determines to be conducive or incidental to the performance of the functions set out in this clause 2.1A.2;

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2.2C. Network Operators

Explanatory Note

New clauses 2.2C.1(cB) and 2.2C.1(cC) are introduced specify a Network Operator's functions relating to System Strength.

These functions represent an expansion of a Network Operator's role to include:

- providing information to the Forecast and Planning Coordination Group reasonably required by the group to enable AEMO to develop the System Strength Report; and
- alleviating a forecast System Strength Shortfall through network reinforcement or the procurement of non-network solutions or services.

2.2C.1. The ESM Regulations provide for the ESM Rules to confer functions on registered participants of a specified class. The functions conferred on each Network Operator are to:

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(cA) perform the functions in relation to the standard or technical level of performance in respect of a Technical Requirement applicable to Transmission Connected Generating Systems electrically connected to the Network that the Network Operator operates as set out in Chapter 3A and Appendix 12 of these ESM Rules;

(cB) contribute to, assist and provide to the Forecast and Planning Coordination Group any information, including data, models and analysis, required by the Forecast and Planning Coordination Group to enable AEMO to develop a System Strength Report in accordance with section 4.5D;

(cC) alleviate a forecast System Strength Shortfall through network reinforcements or the procurement of non-network solutions or services;

(d) do anything that the Network Operator determines to be conducive or incidental to the performance of the functions set out in this clause 2.2C.1; and

(e) carry out any other functions conferred, and perform any other obligations imposed, on Network Operators under these ESM Rules.

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3.11A. Triggering Procurement of Non-Co-optimised Essential System Services (NCESS)

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Explanatory Note:

Clause 3.11A.3(b) is amended to clarify the requirement that the procurement of non-network solutions or services through the NCESS framework should occur with enough lead time to alleviate a System Strength Shortfall before it is forecast to emerge.

3.11A.3. A submission by a Network Operator or AEMO under clause 3.11A.2 must:

(a) be in writing;

(b) be made by a date that the Network Operator or AEMO, as applicable, reasonably considers allows sufficient time to enable the NCESS procurement process set out in section 3.11B to be conducted; ~~and~~

(bA) if the submission is for a proposed non-network solution, the date in clause 3.11A.3(b) must allow for the solution to be procured, developed and delivered in time to alleviate or materially reduce the impact of the event identified under clauses 3.11A.2(a), 3.11A.2(b), 3.11A.2(c), 3.11A.2(d), 3.11A.2(e) or 3.11A.2(f); and

(c) contain sufficient information and analysis regarding the potential or actual impact on Power System Security, Power System Reliability or costs for each trigger event in clause 3.11A.2 that is specified in the submission to enable the Coordinator to consider the factors outlined in clause 3.11A.7.

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4.5. Long Term Projected Assessment of System Adequacy

Explanatory Note:

Clauses 4.5.2(c) and 4.5.2(d) are amended to correct typographical errors.

Clauses 4.5.2(f) and 4.5.2(g) are amended to reflect minor editorial changes associated with the introduction of new clauses 4.5.2(h) and 4.5.2(i).

New clause 4.5.2(h) is introduced to require AEMO, through the Long Term Projected Assessment of System Adequacy (LT PASA), to take into account the Energy Producing Systems forecast developed by the Forecast and Planning Coordination Group under proposed new clause 4.5C.2(b)(ii).

New clause 4.5.2(i) is introduced to clarify that AEMO, through the LT PASA, must take into account any other information specified as an input by the Forecast and Planning Coordination Group established under proposed new section 4.5C.

4.5.1. The Long Term PASA must be performed annually by AEMO and must address each of the years in the Long Term PASA Study Horizon.

4.5.2. The Long Term PASA must take into account:

(a) demand growth scenarios, including peak and annual energy requirements;

(b) expected Demand Side Programme capabilities;

(c) generation capacity expected to be available, including details of any Early Certified Reserve Capacity, seasonal capacities, Essential System Service capabilities, long duration ~~outages~~ Outages, and production profiles for Intermittent Generating Systems;

(d) expected transmission network capabilities allowing for expansion plans, losses and ~~constraints~~ Contraints;

(e) the capacity described in clause 4.5.2A;

(f) expected Electric Storage Resource capabilities; ~~and~~

(g) expected Constrained Access Loads according to the information received under clause 4.5.4;

(h) the forecast developed by the Forecast and Planning Coordination Group under clause 4.5C.2(b)(ii); and

(i) any other information specified by the Forecast and Planning Coordination Group as being an input for the purposes of this clause 4.5.2(i).

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4.5A. Whole of System Plan

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Explanatory Note:

Clauses 4.5A.6(c) and 4.5A.6(d) are amended to reflect minor editorial changes associated with the introduction of new clause 4.5A.6(e).

New clause 4.5A.6(e) is introduced to require the Coordinator, through the Whole of System Plan, to take into account the Loads and Energy Producing Systems forecast developed by the Forecast and Planning Coordination Group under proposed new clause 4.5C.2(b).

4.5A.5. The purposes of a Whole of System Plan are to:

(a) plan for the efficient development of the SWIS to meet the power system needs of the SWIS including with respect to Power System Security and Power System Reliability for a planning horizon of at least 20 years;

(b) assist in the transition to a lower-emissions power system by guiding the efficient integration of renewable generation and identifying opportunities for new technologies, such as energy storage;

(c) identify requirements for network investment and inform the regulatory test for network projects;

(d) inform industry's decisions regarding efficient power system investment opportunities in the SWIS; and

(e) inform policy makers on the future needs of the power system.

4.5A.6. A Whole of System Plan must:

(a) identify options for the development of the SWIS to maintain Power System Security and Power System Reliability at the lowest sustainable cost across demand growth scenarios, including peak and annual energy requirements;

(b) test alternative scenarios through the use of modelling and sensitivities, including the assessment of the impact on the power system and its various components across the different scenarios;

(c) identify investment options that would minimise costs to consumers; ~~and~~

(d) test alternative network investment options and identify optimal network investment options~~.~~; and

(e) take into account the forecast developed under clause 4.5C.2(b) and any other information specified by the Forecast and Planning Coordination Group as being an input for the purposes of this clause 4.5A.6(e).

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4.5B. Transmission System Plan

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Explanatory Note:

Amendments to section 4.5B are introduced to specify new functions of the Network Operator, including:

- Clause 4.5B.2 is amended to align the publication date of the Transmission System Plan with the publication of the System Strength Report as introduced by new clause 4.5D.1, thereby ensuring that the System Strength Shortfall forecasts are available for use as inputs to the Transmission System Plan. The requirement to publish the Transmission System Plan in conjunction with its Network Opportunity Map is removed, as the publication date for the Network Opportunity Map is prescribed by the Electricity Networks Access Code 2004.
- New clause 4.5B.4(b)(ii) requires identification of a set of network or non-network investment options to address a System Strength Shortfall identified in the System Strength Report.
- Clause 4.5B.5 is amended to correct a typographical error.
- Clause 4.5B.6 is amended and a new clause 4.5B.6(bA) is introduced, to outline the obligation for the Network Operator to use the 10-year load, generation and storage capacity forecast developed in accordance with the proposed new clause 4.5C.2(b) as a modelling input.

The inclusion of System Strength Shortfalls in the Transmission System Plan allows the Network Operator to use this as an NCESS trigger in accordance with clauses 3.11A.2(c) and 3.11A.2(d).

4.5B.2. A Network Operator must publish a Transmission System Plan by no later than 1 ~~October~~ April each year~~, in conjunction with its Network Opportunity Map~~.

4.5B.3. A Transmission System Plan must:

(a) establish a plan for the efficient development of a transmission system for a planning horizon of at least 10 years;

(b) meet the Power System Security and Power System Reliability requirements; and

(c) be in the long-term interests of consumers.

4.5B.4. A Transmission System Plan must include:

(a) a summary of any significant costs to the Wholesale Electricity Market that have arisen, or may potentially arise, due to the condition of the transmission network, including:

i. binding Network Constraints, and the estimated market costs of those binding Network Constraints; and

ii. the frequency and magnitude of Energy Uplift Payments, including for Facilities subject to Network Constraints;

(b) a set of investment options for developing the transmission system over the relevant planning horizon, which must consider network and non-network solutions to address~~: the matters identified under clause 4.5B.4(a);~~

i. the matters identified under clause 4.5B.4(a); and

ii. any System Strength Shortfall identified in the most recent System Strength Report published under clause 4.5D.3 in effect at the time of the development of the Transmission System Plan;

(c) analysis of market related data and an assessment of the costs and benefits, including to the Wholesale Electricity Market, of the investment options identified under clause 4.5B.4(b);

(d) a recommended development path for the transmission system that would maximise net benefits and seek to minimise the long-term costs of electricity supplied to consumers; and

(e) a high-level assessment of how the recommended development path referred to in clause 4.5B.4(d) will meet the long-term interests of consumers.

4.5B.5. In developing a Transmission System Plan a Network Operator must take into account:

(a) the WEM Technical Standards under clause 2.8.14;

(b) power system security and reliability standards and requirements under the ESM Rules and the Technical Rules;

(c) any Priority Project identified in the Whole of System Plan or major augmentation that ~~Western Power~~ the Network Operator is able to progress in accordance with the Access Code;

(d) the Network Quality and Reliability of Supply Code;

(e) any government policy specified in the Whole of System Plan that the Coordinator considers may impact on the development of the Transmission System Plan, as may be advised by the Coordinator pursuant to the consultation process referred to in clause 4.5B.6 or specified in the Whole of System Plan published by the Coordinator under section 4.5A; and

(f) any other matters that the Network Operator considers relevant to the Transmission System Plan.

4.5B.6. A Network Operator must consult with AEMO and the Coordinator on the assumptions, inputs and scenarios the Network Operator must use in developing and updating a Transmission System Plan, including:

(a) forecasted demand growth or reduction scenarios, including from the Long Term PASA and Whole of System Plan;

(b) scheduled and forecasted connection of new ~~loads~~ Loads ~~or generators~~;

(bA) forecasted connection of Energy Producing Systems prepared in accordance with clause 4.5C.2(b)(ii);

(c) expected Network modifications, augmentations, or retirement of existing Facilities or Network assets that impact costs in the Wholesale Electricity Market;

(d) the Credible Contingency Events and other commonly occurring credible contingencies that may significantly impact the SWIS;

(e) a range of facility dispatch scenarios or credible dispatch patterns;

(f) data, modelling and results from the testing of scenarios in the Whole of System Plan, to the extent they are relevant as inputs to the Transmission System Plan;

(g) relevant information from the Short Term PASA, Medium Term PASA and Long Term PASA studies conducted by AEMO under these ESM Rules; and

(h) other Market Information that the Network Operator, AEMO or the Coordinator considers relevant to meeting the requirements for developing the Transmission System Plan in this section 4.5B.

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4.5C. The Forecast and Planning Coordination Group

Explanatory Note:

New section 4.5C is introduced to:

- establish a Forecast and Planning Coordination Group (FPCG) comprising representatives of the Coordinator, AEMO and Western Power aimed at aligning forecasting inputs and assumptions; and
- introduce obligations for this group to;
    - develop annually a 10-year generation, storage and load capacity forecast for the SWIS ('Fleet Forecast'); and
    - develop the modelling framework, including methodology, modelling approach, inputs, assumptions and scenarios to be used to;
        - determine the Fleet Forecast; and
        - identify System Strength Shortfalls in the System Strength Report.

New clause 4.5C.2 is introduced to outline the core high-level functions of the FPCG.

New clause 4.5C.3 is introduced to require the Coordinator to develop terms of reference for the FPCG, which will determine the details of the functions described in clause 4.5C.2, including:

- the operational aspects of the FPCG;
- consultation and publication process; and
- data and information sharing processes and considerations.

New clauses 4.5C.4 and 4.5C.5 are introduced to require that the initial high-level methodology for developing the Fleet Forecast and identifying System Strength Shortfalls be publicly consulted on.

New clause 4.5C.6 is introduced to require the Coordinator to publish the Fleet Forecast, a summary of public submissions and the methodology agreed by the FPCG.

4.5C.1. The Forecast and Planning Coordination Group is a group comprising representatives of the Coordinator, AEMO and Western Power.

4.5C.2. The functions of the Forecast and Planning Coordination Group are to;

(a) facilitate improved coordination of forecasting approaches and activities between the Coordinator, AEMO and Western Power for the purpose of improving consistency and alignment of planning processes;

(b) annually develop and agree a forecast, over a planning horizon of at least 10 years, of the forecast connection and Electrical Location of:

i. any new Loads, or increase or reduction of any existing Loads; and

ii. any new Energy Producing Systems, or increase or reduction of the capacity of any existing Energy Producing Systems;

(c) develop and agree the modelling framework, including methodology, modelling approach, inputs, assumptions and scenarios, used to:

(i) develop the forecast outlined in clause 4.5C.2(b); and

(ii) identify System Strength Shortfalls to be included in the System Strength Report;

(d) once a year, review the methodology developed under clause 4.5C.2(c) and amend it if the review identifies potential improvements, taking into account the State Electricity Objective; and

(e) contribute to and agree the key inputs used in the development of the System Strength Report in accordance with section 4.5D.

4.5C.3. The Coordinator must, in consultation with AEMO and Western Power, develop and publish on the Coordinator's Website the terms of reference for the Forecast and Planning Coordination Group that specify:

(a) how the Forecast and Planning Coordination Group will perform its functions under clause 4.5C.2;

(b) the process for making decisions, including if the members of the Forecast and Planning Coordination Group do not agree on a matter and the circumstances in which the Coordinator may make a determination;

(c) the consultation and publication processes to be followed by the Forecast and Planning Coordination Group; and

(d) the information requirements to support the functions of the Forecast and Planning Coordination Group under clause 4.5C.2, and the development of the System Strength Report under section 4.5D.

4.5C.4. The Forecast and Planning Coordination Group must, through the Coordinator, invite public submissions on a draft methodology developed in accordance with clause 4.5C.2(c).

4.5C.5. The Forecast and Planning Coordination Group must take into account any submissions received under clause 4.5C.4 on a draft methodology developed in accordance with clause 4.5C.2(c) and make appropriate amendments.

4.5C.6 The Coordinator must publish on the Coordinator's Website:

(a) public submissions received by the Forecast and Planning Coordination Group under clause 4.5C.4; and

(b) the forecast and methodology agreed by the Forecast and Planning Coordination Group under clauses 4.5C.2(b) and 4.5C.2(c) and if any amendments are made, the amended methodology,

redacting any Confidential Information.

4.5D. System Strength Report

Explanatory Note:

New section 4.5D is introduced to require AEMO to publish a System Strength Report that forecasts System Strength Shortfalls.

The following clauses introduce new requirements for AEMO (and where applicable Western Power):

- New clause 4.5D.1 outlines an obligation for AEMO to publish a System Strength Report every two years.
- New clause 4.5D.2 establishes a streamlined update pathway for intervening years where changes to fleet outlooks or system conditions are material but do not justify a full reassessment. In these circumstances, and subject to agreement by the FPCG, AEMO may publish a streamlined update to the System Strength Report to ensure the information remains current and reflects material changes since the most recent report.
- New clause 4.5D.3 outlines the information to be included in the System Strength Report, in particular the modelling approach and modelling outcomes for the assessment and identification of System Strength Shortfalls.
- New clause 4.5D.4. outlines requirements and considerations as part of the development of the System Strength Report.
- New clause 4.5D.5 introduces a requirement for Western Power to provide information to AEMO required for it to effectively develop the System Strength Report.
- New clause 4.5D.6 introduces a definition for System Strength Shortfalls.
- New clause 4.5D.7 establishes the WEM Procedure to be developed by AEMO, outlining the process to be followed by AEMO in the identification of System Strength Shortfalls.

4.5D.1. AEMO must prepare and publish a System Strength Report every two years in accordance with this section 4.5D by the date and time specified in clause 4.1.16A.

4.5D.2 If, in a year in which AEMO is not required to publish a System Strength Report under clause 4.5D.1:

(a) the Forecast and Planning Coordination Group considers that there has been a material change to the fleet outlook or system conditions that may affect the conclusions of the most recent System Strength Report; and

(b) the Forecast and Planning Coordination Group, by 30 April that year, agrees that a full reassessment of the most recent System Strength Report is not required,

AEMO must publish a targeted update to the most recent System Strength Report by the date and time specified in clause 4.5D.1.

4.5D.3. A System Strength Report must include:

(a) a description of the modelling approach, inputs, assumptions and scenarios used by the Forecast and Planning Coordination Group for the assessment of System Strength Shortfalls;

(b) at each Transmission Node for a planning horizon of at least 10 years, the minimum fault level and the short circuit ratio requirements; and

(c) the modelling outcomes, identifying System Strength Shortfalls by Transmission Node, outlining:

i. the difference between the minimum fault level requirement and the expected fault level; and

ii. the difference between the applicable short circuit ratio requirement and the expected short circuit ratio,

aggregated by:

iii. relevant Facility Technology Types; and

iv. the lowest granularity region of the SWIS such that it does not directly or indirectly disclose Confidential Information.

4.5D.4. In developing the System Strength Report, AEMO must:

(a) consult with the Forecast and Planning Coordination Group;

(b) use the methodology and forecast agreed by the Forecast and Planning Coordination Group under clauses 4.5C.2(b) and 4.5C.2(c);

(c) carry out the minimum fault level assessment and short circuit ratio screening according to the WEM Procedure developed under clause 4.5D.7, taking into account the information provided by Western Power under clause 4.5D.5; and

(d) provide the results of the analysis outlined in clause 4.5D.3(c), including the identification of a System Strength Shortfall to the Forecast and Planning Coordination Group, seeking its agreement.

4.5D.5. At the request of AEMO, Western Power must provide any information, including data, models and analysis, reasonably required by AEMO to effectively develop the System Strength Report.

4.5D.6. A System Strength Shortfall is identified at a Transmission Node if an assessment under clause 4.5D.4(c) has determined that at least one of the following is present:

(a) the minimum three phase fault level falls below the minimum fault level required for network protection operation (shortfall in the effective level of System Strength); or

(b) the stable voltage waveform cannot be maintained for the level and type of forecast inverter-based resources for the relevant year at the relevant Transmission Node (shortfall in the sufficient level of System Strength):

i. in steady state conditions; and/or

ii. following any Credible Contingency Event.

4.5D.7. AEMO, in consultation with the Forecast and Planning Coordination Group, must document in a WEM Procedure the process to be followed by AEMO in the identification of a System Strength Shortfall under this section 4.5D. The WEM Procedure must include the methodology used to:

(a) calculate the shortfall in the effective level of System Strength required by clause 4.5D.6(a); and

(b) identify a shortfall in the sufficient level of System Strength required by clause 4.5D.6(b).

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11. GLOSSARY

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Explanatory Note:

A new definition of the Forecast and Planning Coordination Group is introduced.

Forecast and Planning Coordination Group: A group established under clause 4.5C.1.

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Explanatory Note:

The definition for System Strength is amended to better capture both the locational nature of system strength and the need to consider behaviour during both steady state operation and disturbance conditions.

~~**System Strength**: Is a measure of how resilient the voltage waveform is to disturbances such as those caused by a sudden change in Load or an Energy Producing System, the switching of a Network element, tapping of transformers and other types of faults.~~

System Strength: A measure of the ability of the power system at a given location to maintain stable voltage magnitude, voltage angle, and waveform quality following Disturbances such as those caused by a sudden change in Load or an Energy Producing System, the switching of a Network element, tapping of transformers and other types of faults.

Explanatory Note:

A new definition of a System Strength Report is introduced.

System Strength Report: A report prepared and published by AEMO in accordance with section 4.5D.

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Explanatory Note:

A new definition for System Strength Shortfall is introduced to clarify what aspects of System Strength are being measured and how shortfalls are assessed.

System Strength Shortfall: A condition identified at a Transmission Node using the process outlined in clause 4.5D.6 and the WEM Procedure developed in accordance with clause 4.5D.7.