AEMC

GUIDELINES

Reliability Panel AEMC

Draft Template

Template for Compliance Programs

2 April 2026

Purpose of this document

The purpose of this Template for compliance programs (Template) is to support and guide Registered Participants to develop compliance programs to verify and monitor plant performance consistent with the requirements in rule 4.15(c) of the National Electricity Rules (NER or Rules).

The Template also assists the Australian Energy Regulator (AER) with the enforcement and monitoring of Registered Participants' compliance with the technical standards under the NER. Effective compliance with performance standards contributes to the delivery of reliable and secure electricity to consumers in the National Electricity Market (NEM).

The key changes in this draft revision of the Template, published on 2 April 2026, include:

- Changes to reflect amendments to the NER from the *Improving the NEM access standards - Package 1* 2025 Rule, including:
  - amending the name of the Template
  - broadening the Template to cover integrated resource systems, synchronous condenser systems, loads and HVDC links.
- Revised compliance principles, including two new principles relating to:
  - the impact of plant changes on compliance; and
  - that variations from the Template must be consistent with the compliance principles
- Additional guidance in the following areas:
  - Plant changes and the impacts on compliance
  - Model validation and updates
  - Information provision and retention
  - Non-compliances with performance standards
  - Market-based obligations in connection with performance standards
  - Interdependent and concurrent performance standards
- Additional information to assist with interpreting and applying the tables:
  - Continuous plant monitoring
  - Testing frequency
  - Hardware-in-the-loop testing
  - Provided examples of the defined terms, 'significant disturbance', 'major disturbance' and 'major event'
- Revisions to the previous 'table to assist development of generator compliance programs', now in Appendix A
- Inclusion of two new appendices with numerous compliance tables to assist development of compliance programs for schedule 5.3 plant (loads and distribution networks) and schedule 5.3a plant (HVDC links).

Further information on the Template can be obtained by either emailing the Reliability Panel Secretariat (telephone (02) 8296 7800, or email panel@aemc.gov.au), or by accessing previously published Panel reports for past reviews of the Template from the Panel's website (www.aemc.gov.au).

Contents

Tables

1 General overview of the compliance framework

The following chapter provides an overview of the Reliability Panel's role in modifying the Template and the NER obligations on Registered Participants to institute and maintain a compliance program for their plant.

This chapter also provides an overview of the broader compliance program and the role of the Template within this.

1.1 The Reliability Panel periodically reviews and publishes the Template

Under the NER, the Reliability Panel (Panel) must determine, modify as necessary, and publish the Template for compliance programs.[1] The Rules also require the Panel to conduct a review of the Template at least every five years from the date the Template is determined, and at such times as the Australian Energy Market Commission (AEMC or Commission) may request.[2] Following such a review, the Panel may amend the Template in accordance with any recommendations that it makes in a report that is submitted to the AEMC.[3]

Under the Rules, the Template must:[4]

- cover all *performance standards*; and
- define suitable testing and monitoring regimes for each *performance standard* so that a *Registered Participant* can select a regime that complies with the obligations set out in the Rules for its particular plant.

Registered Participants have performance standards obligations requiring that their plant:

- meets or exceeds applicable performance standards; and
- does not materially adversely affect power system security.[5]

In that regard, a Registered Participant who controls or operates plant to which a performance standard applies, must institute and maintain a compliance program which:[6]

- is consistent with the Template
- includes procedures to monitor the performance of the plant in a manner that is consistent with good electricity industry practice
- is modified to be consistent with any amendments made under clause 8.8.3(ba) of the NER to the Template, by no later than 6 months after amendments to the Template are published, or by a date determined by the Panel; and
- provides reasonable assurance of ongoing compliance with each applicable performance standard.

The Panel recognises that it is not practical for the Template to provide a complete and exhaustive list of compliance choices. Such an approach would not be efficient or representative of good electricity industry practice. The approach taken is to support a flexible application of the Template with appropriate controls. Therefore, the Panel has designed the Template on the basis that it forms part of a plant's overall compliance management process.

1 NER, clause 8.8.1(a)(2B). The Panel must determine the Template in accordance with clause 8.8.3 of the Rules.
2 NER, clause 8.8.3(ba).
3 NER, clause 8.8.3(j).
4 NER, rule 4.15(ca).
5 NER, rule 4.15(a)
6 NER, rules 4.15(b) and (c)

1.2 The Template is one element of the broader compliance framework

The Template is only one element of the broader compliance framework. This section provides a general overview of the compliance framework. However, Registered Participants are advised to seek their own independent professional advice as to the compliance framework that is specific to their individual circumstances and how it will be applied.

1.2.1 Registered Participants must comply with the performance standards applicable to their plant

Generally speaking, the compliance framework should be viewed in the context of the connection arrangements that allow the plant to connect to the electricity network. Under the NER, all Registered Participants must plan, design, operate and maintain their facilities to ensure that they are operated to comply with;

- the performance standards applicable to those facilities;[7]
- any connection agreement which is applicable to those facilities; and
- the *system standards*.[8]

Except in cases where a Registered Participant's facilities meet all aspects of the 'automatic access standards', performance standards are generally negotiated and form part of a connection agreement with the relevant Network Service Provider (NSP).[9]

The relevant NSP is required to consult with the Australian Energy Market Operator (AEMO) upon receipt of a proposed negotiated access standard.[10] AEMO then establishes and maintains a register of the performance standards that is applicable for that particular plant, as advised by the relevant NSP, Connection Applicant or Registered Participant.[11]

1.2.2 Registered Participants may also be required to comply with other market-based or NER obligations

In addition to complying with the performance standards, Registered Participants may have requirements to comply with other market-based or NER obligations.

The Template does not provide for testing or monitoring methods for these additional market-based and NER obligations. However, it is critical Registered Participants consider the appropriateness of instituting any compliance regimes to ensure compliance with these obligations.

7 NER, clauses 5.2.1(b)(2) and 5.2.2(e).

8 NER, clauses 5.2.1 and 5.2.2.

9 The automatic access standards, minimum access standards and performance criteria required for the connection of schedule 5 plant are set out in Rules schedules 5.2, 5.3 and 5.3a. These form the basis for specific performance standards that are registered with AEMO. If an NSP has schedule 5.2 plant or schedule 5.3a plant incorporated as part of its own network, then there may be no relevant connection agreement for those plant.

10 NER, clause 5.3.4A.

11 NER, rule 4.14(n).

2 Compliance principles

This chapter presents information, compliance principles and guidance that may be useful for Registered Participants to institute, maintain and update their compliance programs.

2.1 Compliance programs should be consistent with the compliance principles

When instituting, maintaining or updating a compliance program, a Registered Participant should be consistent with the following compliance principles. The Panel considers that these principles will assist Registered Participants in complying with the requirements of NER rule 4.15(c).

Chapters 3 and 4 contain additional information, guidance and examples in relation to each of the compliance principles.

2.2 List of compliance principles

Principle 1: Compliance programs must balance costs against the risks to power system security

When selecting, developing or amending a testing or monitoring regime for a performance standard, a *Registered Participant* must consider and balance the materiality related to the costs and benefits of implementing a compliance regime. This includes consideration for the costs and risks related to undertaking testing, against the risk of non-compliance with a performance standard and the associated risk of an adverse impact on power system security.

Principle 2: Continuous plant monitoring is preferred, where practicable

Subject to Principle 1, and where it is practicable to do so, a *Registered Participant* should institute continuous monitoring regimes to analyse *plant* performance during events, disturbances and normal operation to demonstrate ongoing compliance against its *performance standards.* Where continuous monitoring is not practicable, a *Registered Participant* must document its reasons and implement alternative monitoring and testing regimes that provide reasonable assurance of ongoing compliance.

Principle 3: Testing frequency should be proportional to the risk of non-compliance

A *Registered Participant* is accountable for testing the functionality and integrity of relevant systems and settings to ensure compliance with the *plant's performance standards*, in accordance with the *plant's* compliance program. The frequency of such tests should take into account the expected variation of plant performance over time and be proportional to the risk of a potential non-compliance against the *plant's performance standards*.

Principle 4: Compliance programs must provide reasonable assurance of ongoing compliance with plant performance standards

A *Registered Participant's* active use and implementation of a compliance program must provide reasonable assurance of ongoing compliance with the *plant's performance standards*. As part of a *Registered Participant's* compliance management framework, a *Registered Participant* should review and update its compliance program(s) periodically.

Principle 5: The impact of plant changes on compliance must be assessed

Where *plant* performance may be affected by hardware modifications, equipment replacements, software updates, firmware changes, or any similar *plant* change, a *Registered Participant* must promptly assess whether such changes could have an impact on their compliance with their existing *performance standards* or require updates to any data and models previously provided to *AEMO* and the relevant *Network Service Provider*.

Principle 6: Compliance programs must align with good electricity industry practice

The Template supports the development of compliance programs that align with and represent *good electricity industry practice*. The Template specifies the objectives and outcomes to be achieved by each suggested testing or monitoring regime, and an appropriate test interval. Using the Template as a guide, a *Registered Participant* should exercise diligence and *good electricity industry practice* to determine the detailed methods and procedures to be employed as part of a compliance program for its *plant*.

Principle 7: Variations from the Template must be consistent with the compliance principles

Where a *Registered Participant*'s compliance program deviates from the guidance or testing and monitoring regimes set out in this Template, a *Registered Participant* must ensure that the variation is consistent with these compliance principles. A *Registered Participant* must document the reasons for any variation, having regard to these compliance principles.

3 Supporting information for compliance programs

3.1 Plant changes and potential impacts on compliance

In line with compliance principle 5, a Registered Participant should assess whether any relevant plant changes may have an adverse effect on providing reasonable assurance of ongoing compliance with the plant's existing performance standards.

Relevant plant changes that could affect a plant's compliance with its performance standards include, but are not limited to:

- hardware modifications, such as the addition of new auxiliary equipment
- equipment replacements, such as the replacement of an ageing transformer
- software updates or firmware changes, such as an update for an inverter's control systems or settings.

For *Schedule 5.2 Participants* in respect of their *schedule 5.2 plant* (that is, relevant *generating systems*, *integrated resource systems* or *synchronous condenser systems*), clause 5.3.9(d) of the NER specifies a list of plant alterations that are deemed to require a submission under clause 5.3.9. Other alterations may still require a submission under clause 5.3.9 if the plant alteration:

- will affect the performance of the plant relative to any of the technical requirements set out in clauses S5.2.5, S5.2.6, S5.2.7 and S5.2.8 of the NER;[12] or
- will, in AEMO's reasonable opinion, have a *general system strength impact;*[13] or
- will, in AEMO's reasonable opinion, adversely affect *network capability*, *power system security*, quality or reliability of *supply*, *inter-regional power transfer capability* or the use of a *network* by another *Network User*.[14]

If a plant change affects settings for a *control system* or *protection system* that are necessary to comply with an existing *performance standard*, then a Registered Participant may be required to seek approval from the relevant NSP and AEMO.[15]

As of the time of writing, AEMO maintains a NER 5.3.9 Process Guideline that outlines the process for proposing an alteration under NER clause 5.3.9. When a Registered Participant (who is a *Schedule 5.2 Participant*) is considering a plant alteration, the Panel encourages submitting a 'Generating system or integrated resource system change form' to commence a NER 5.3.9 scoping process with the NSP and AEMO. Participating in this optional scoping process is consistent with compliance principle 5, as it will assist a Registered Participant with its assessment of any adverse effects on its compliance with its performance standards.

For *Schedule 5.3 Participants* or *Schedule 5.3a Participants* in respect of their *schedule 5.3 plant* (loads or distribution networks) or *schedule 5.3a plant* (HVDC links), plant changes may also require a submission under clause 5.3.12 of the NER. Changes to settings for *control systems* and *protection systems* may also require approval from the relevant NSP and AEMO.[16]

The Panel encourages Registered Participants (who are either a *Schedule 5.3 Participant* or a *Schedule 5.3a Participant*) to engage and consult with their relevant NSP and AEMO to help assess whether a plant change may affect compliance with their existing performance standards, and whether a submission under clause 5.3.12 of the NER may be necessary.

12 NER, clause 5.3.9(a)(1).
13 NER, clause 5.3.9(a)(2)
14 NER, clause 5.3.9(a)(3).
15 NER, clauses S5.2.2, S5.3.4 and S5.3a.2.
16 NER, clauses S5.3.4 and S5.3a.2.

3.2 Model validation and updates

3.2.1 A compliance program can complement R2 model validation

When establishing a compliance program for its plant, a Registered Participant should consider whether any gaps remain in the model validation performed as part of commissioning and R2 testing.[17] This could arise if significant system events did not occur during the test period resulting in incomplete model validation. In situations where R2 model validation is incomplete, the Registered Participant should take this into account when developing the compliance program and, where appropriate, choose test methods that support gathering the data necessary to complete the validation of the model.

For example, during commissioning, there may not have been a power system event or fault that would have allowed the plant to demonstrate its compliance against certain performance standards, such as those specified by S5.2.5.5/S5.2.5.5A of the current Rules. A Registered Participant should then ensure that any outstanding R2 model validation that may need to be completed is incorporated into the plant's compliance program.[18]

Clause S5.2.4(d)(1) of the NER requires *Schedule 5.2 Participants* to provide updated dynamic plant models, within three months after commissioning tests are completed. The Panel encourages Registered Participants who are *Schedule 5.2 Participants* to refer to AEMO's Commissioning Guideline and section 6.3.3 of the Power System Model Guidelines for more information on R2 model validation.

3.2.2 Compliance programs should detect when models are out-of-date

A Registered Participant's compliance program should be sufficient to detect situations when the model information supplied to AEMO and the relevant NSP is incomplete, inaccurate, or out of date. The Panel considers that, where models are readily available to the Registered Participant, including testing or monitoring regimes into a compliance program that could enable a Registered Participant to perform periodic model validation would reflect good electricity industry practice.

Ongoing periodic model validation after plant commissioning can also assist a Registered Participant comply with a NSP's review of all data provided under Schedule 5.5 of the NER.[19]

Registered Participants should be familiar with all applicable model requirements in AEMO's Power System Model Guidelines, and should ensure that they remain aware of any updates to these guidelines.

3.2.3 Model overlays can be an effective means of demonstrating compliance

A model overlay typically refers to the comparison of a plant's actual response to a power system event against a simulated model's response to identical or similar power system event and conditions.

Where practicable, the use of continuous plant monitoring can assist Registered Participants demonstrate compliance with their performance standards by using model overlays following certain power system events (for specific examples, see appendix A).

17 'R2' is a term that refers to plant data provided post-*connection* but can also commonly refer to commissioning and post-commissioning processes.

18 AEMO, Commissioning Guideline, page 12.

19 NER, clause S5.5.3.

Where a Registered Participant chooses to use model overlays to demonstrate ongoing compliance with certain performance standards, it should ensure that the model has been validated and accurately represents the plant's behaviour and response.

3.2.4 Registered Participants must provide updated and accurate models to AEMO and the relevant NSP

Whenever a Registered Participant becomes aware that their previously supplied models, data or information is incomplete, inaccurate or out of date, they must provide updated information to AEMO within 5 business days in accordance with NER clause 5.3.8(f).[20] The Registered Participant should also promptly provide the updated information to the relevant NSP.

Registered Participants should also be aware that NSPs and/or AEMO may also request a Registered Participant to provide updated models or to validate existing models under several circumstances.[21]

3.3 Records in relation to compliance programs

A Registered Participant is required to maintain compliance program records for seven years, and if requested, deliver such records to the AER within five business days or other specified period.[22]

To be consistent with *good electricity industry practice*, the Panel encourages Registered Participants to:

- promptly record and document the outcomes of any periodic monitoring or tests conducted, as part of their compliance program(s)
- retain the data and information captured by plant monitoring equipment, in relation to:
  - any event that may demonstrate the plant's ongoing compliance with its performance standards (see section 4.10 and the Appendix tables for more information)
  - any event that may be indicative of a potential non-compliance with a performance standard
  - a reviewable operating incident as defined by NER clause 4.8.15.[23]
- document the reasons why any tests could not be performed according to schedule, as may be specified in a compliance program
- keep a detailed record of all changes that are made to a plant's compliance program, including the reasons why such changes were considered necessary
- document the reasons why a compliance program may deviate from the Panel's Template, while having regard to the compliance principles (see section 3.3.1 below).

3.3.1 Deviations from the Template

Appendices A, B and C of this Template provide Registered Participants with a range of compliance methods that may be used as part of an effective compliance program. However, the supporting information and guidance in this Template are not intended to cover all scenarios or circumstances that Registered Participants may encounter. Similarly, the appendices are not intended to be an exhaustive list of methods that may be used by Registered Participants.

20 NER, clauses 5.3.8(f) and S5.2.4(d)(2).

21 NER, clause S5.2.4(d)(3); see also sections 2.1 to 2.4 of AEMO's Power System Model Guidelines.

22 NER, rule 4.15(e).

23 AEMO may request a Registered Participant to provide information relating to the performance of the Registered Participant's equipment during and after a reviewable operating incident. A Registered Participant must provide this information within 20 business days, unless AEMO agrees to a longer period. See NER clause 4.8.15(f)-(h).

As set out in compliance principle 7, where a Registered Participant chooses to deviate from the guidance or from the compliance tables listed in this Template, a Registered Participant should ensure that such deviations are consistent with the compliance principles. A Registered Participant should also record the reasons for such deviations, so that it is reasonably clear that any deviations remain consistent with *good electricity industry practice*.

Examples of where a Registered Participant may deviate from the Template include (but are not limited to):

- the specific suggested testing frequencies listed in the compliance tables
- the details of a particular compliance method (for example, where a method may need to be adapted or modified for older plant)
- where a different compliance method that has not been contemplated by the Panel still provides reasonable assurance of ongoing compliance with performance standards
- where performance standard-specific requirements may contradict certain elements of the Template (for example, if a performance standard is measured at a location that is different to the plant's connection point).

3.4 Dry stored or mothballed plant

The term 'dry stored' is used to identify the status of a generation facility (or other plant) that is not in a state of readiness to allow it to be dispatched in the NEM, but remains physically intact, and, after a period of restoration, would be capable of being returned to service. Similar terminology used to refer to this state includes 'care and maintenance' or 'mothballing'.

The Rules require all Registered Participants' facilities, including any dry stored plant, to develop and maintain compliance programs that are consistent with the Template.[24] While the Rules do not prohibit a Registered Participant's plant from entering a period of 'dry storage' and maintaining registration throughout, ongoing registration with AEMO obliges the Registered Participant's plant to retain compliance with the Rules.

When a plant is being prepared for a significant period of dry storage, a Registered Participant should consider whether the plant's existing compliance program for performance standards is appropriate. There are a range of factors that a Registered Participant should consider before implementing any amendment to its existing compliance program for the plant in question, some of which may include:[25]

- The period of time likely to elapse before the facility might be returned to service, and how the Registered Participant would communicate any return to service arrangements to AEMO.
- How the Registered Participant would inform AEMO of the status of the facility and the facility's expected time to return to service after a period of storage.
- When the Registered Participant is preparing its dry stored plant for a return to service, any required testing that can be conducted off-line should occur prior to the plant's return to service. For example, this may include any steps that are considered necessary to verify plant changes that may have occurred during and after the period of storage, or where there has been a change to a performance standard. The Registered Participant should also consider how and when it will advise AEMO of its plans to bring the plant back into service. The Registered Participant should also keep all compliance-related information up to date.

24 NER, rule 4.15(c).

25 These suggested range of factors have been based on information contained in the AEMO document, *Guidance for Dry-Stored Generators* (version 1, published 9 August 2013), as referenced in AEMO's submission to the Issues Paper for the 2015 review.

- If compliance testing is due, but the Registered Participant has not been able to verify its compliance with all of its performance standards prior to returning to active service, then all residual verifications should be carried out as soon as practicable following its return to service. For example, this may include making prior arrangements for the necessary tests to be carried out without avoidable delay after the plant's return to service in order to minimise risk to other power system users, and for the timing and results of tests to be independently verifiable at a later time. Consideration should also be given to whether certain tests need to be advised to AEMO and/or the relevant NSP(s).

3.5 Performance of remote equipment operated by another party

Some of the performance standards specified in clause S5.2.5 allow a Schedule 5.2 Participant to provide plant and equipment at the connection point that delivers a level of performance which is lower than the level of performance acceptable to AEMO and the relevant NSP, provided the Schedule 5.2 Participant reaches a commercial agreement with another Registered Participant or with the relevant NSP for the provision of additional capability via plant and equipment located elsewhere in the power system.

For example, S5.2.5.1 requires a Schedule 5.2 Participant to pay compensation to the NSP for the provision of the deficit of reactive power capability via network plant and equipment installed at a location which differs from the connection point.[26] The compliance program developed by the Schedule 5.2 Participant should not be required to assess the ongoing ability of the remote plant and equipment, where it is operated by another party.

Where a control system has been installed to ensure correct operation of the schedule 5.2 plant should the remote equipment be unavailable, the functionality of that control system should be tested as part of the Schedule 5.2 Participant's compliance program.

3.6 Non-compliance with performance standards

3.6.1 Notifying AEMO and the relevant Network Service Provider

A Registered Participant is required to immediately notify AEMO if its plant is breaching, or is likely to breach, a performance standard.[27] It must also notify AEMO and the relevant Network Service Provider when the plant has returned to compliance with the relevant performance standard immediately following the *Registered Participant* becoming aware of the return of the *plant* to compliance with the *performance standard*.[28]

AEMO has developed and published a *Notice of Non-compliance with Registered Performance Standards*.[29] A Registered Participant must complete and submit this form immediately when it becomes aware that its plant is being non-compliant in accordance with rule 4.15(f) of the NER. AEMO forwards a copy of all non-compliance notices to the AER and the relevant NSP.

As per NER rule 4.15 clauses (i) and (j), AEMO determines a reasonable period for a Registered Participant to rectify a performance standards breach. It will notify the Registered Participant and the relevant NSP of its decision. NER clauses 4.15(n)-(p) also provide a mechanism involving the AER in the event the Registered Participant considers AEMO has not reasonably applied the criteria under rule 4.15(j).

26 NER, clause S5.2.5.1(d)(1)-(3).
27 NER, rule 4.15(f).
28 NER, rule 4.15(h).
29 AEMO, Notice of Non-Compliance with the Registered Performance Standards – Clause 4.15.

Clause 5.7.3(c) of the NER outlines further obligations on Generators and Integrated Resource Providers (IRP) in the instance that a generating system or integrated resource system is not compliant with one or more of the technical requirements of schedule 5.2.5 or the relevant connection agreement.

3.6.2 The AER may conduct technical compliance audits to assess compliance

The AER is responsible for monitoring whether Registered Participants' compliance programs meet the mandatory requirements and for investigation of breaches, or possible breaches, of performance standards obligations under rule 4.15 of the NER. A Registered Participant is required to maintain compliance program records and other prescribed records[30] for seven years, and if requested, deliver such records to the AER within five business days or other specified period.[31] See further details on maintaining compliance program records in section 3.3.

The AER conducts regular technical compliance audits to ensure participants have developed and are maintaining robust and effective compliance programs. This is achieved by determining whether, as required by rule 4.15(c), the compliance programs:

- are consistent with the Template for compliance programs
- include procedures to monitor the performance of the Registered Participant's plant in a manner that is consistent with good electricity practice
- are modified to be consistent with any amendments made to the Template by the Reliability Panel
- provide reasonable assurance of ongoing compliance with each applicable performance standard.

3.7 Interdependency between performance standards

There are several performance standards that are either interdependent or need to be provided concurrently. For example, S5.2.5.1 (reactive power capability), S5.2.5.13 (voltage and reactive power control) and 5.2.5.14 (active power control) are interdependent and cross-referenced in the NER. It is also the case that plant is required to meet multiple schedule 5.2 clauses concurrently. In practice, the performance against one standard may materially affect the performance against another. Therefore, it may be prudent for Registered Participants to consider testing methods that ensure performance standards are met concurrently and at all required times.

30 NER, clause 5.7.3(g), relating to tests to demonstrate compliance with connection requirements for Generators and Integrated Resource Providers under clause 5.7.3 of the NER.

31 NER, rule 4.15(e).

3.8 Pre-existing compliance with performance standards

The tables in Appendix A, B and C are designed on the assumption that any analysis undertaken at the time of connection and subsequent commissioning tests conducted by the Registered Participant have established the plant's compliance with its performance standards. This is also assumed for older plant, that were connected in accordance with older versions of the Rules or the National Electricity Code (Code). As a result, a Registered Participant's connection agreements for older plant may, in some cases, specify the testing and monitoring requirements, which may be based on the need to maintain compliance with older versions of the Rules or Code that applied at the time when such connection agreements were established.

Nothing in this Template seeks to override any existing requirements in a connection agreement.

4 Guidance for applying the compliance tables

4.1 Introduction

Appendix A, B and C include tables that have been provided to assist Registered Participants to develop their own compliance programs. The following material provides explanatory notes to these tables and defines important terms that are used in those tables. Registered Participants should read this explanatory material before referring to the tables as it provides important context for the application of the tables' provisions.

The terms defined in section 4.10 of this chapter and underlined in the table, are only intended to be used for the purposes of the Template. Italicised terms are defined in Chapter 10 of the Rules.

4.2 Applying the compliance tables

The compliance tables provide a series of options for Registered Participants to assist in developing compliance programs. It is not an exhaustive list of tests and methodologies that can demonstrate compliance. The tables have been designed on the basis that it is one of a number of resources that should be consulted in implementing and modifying a Registered Participant's overall compliance management process.

The compliance tables are not designed to take the place of alternative advice. Registered Participants should consider the compliance principles, set out in chapter 2 of this document, which illustrate that Registered Participants will need to exercise judgement in how best to apply the Template to meet their compliance requirements.

As explained in section 3.3.1, deviations from the tables should be recorded and explained in the Registered Participant's compliance program. Deviations should still remain consistent with the compliance principles listed in section 2.2.

4.3 Power system security

The AEMO power system security responsibilities are set out in clause 4.3.1 of the Rules. The Registered Participant needs to take care that any tests do not jeopardise power system security. Otherwise, under clause 4.8.1 of the Rules, the Registered Participant must promptly advise AEMO or a relevant System Operator at the time that the Registered Participant becomes aware, of any circumstance which could be expected to adversely affect the secure operation of the power system or any equipment owned or under the control of the Registered Participant or a NSP. Nothing in the tables seek to override these responsibilities, and all testing should be devised and undertaken recognising the need to maintain power system security.

4.4 Changes to NER technical requirements over time

The Panel has sought to take into account all the relevant versions of the technical requirements in the Rules that may apply to a particular Registered Participant for their plant's performance standards. However, Registered Participants should be aware that, in developing their compliance programs, the technical requirements set out in the Rules for a particular performance standard may have changed over time. There may also have been changes to the version of the Rules, clause numbering and titles in some places.

However, the Panel notes that changes to the technical requirements in the Rules do not generally affect existing performance standards.[32]

For older plant, performance standards may have been determined in accordance with the Code. Registered Participants for these plant should refer to the relevant version of the Code when determining the relevant technical requirements applicable for their plant.

At the time that this Template was last updated, version 243 of the Rules was the latest version. References to version 243 of the Rules in the table should be taken to mean the latest version of the Rules, unless there have been changes to the particular provision in the table.

Until the Template is next updated, Registered Participants should base their compliance programs in regard to any such matters on other information in the Template, the application of their management program and *good electricity industry practice*.

4.5 Compliance methods

The tables list several compliance methods for the applicable performance standards. These different methods can be selected by the Registered Participant to suit its specific plant characteristics. The method or methods on which a particular plant's compliance program is based should be selected within the broader compliance management framework of the Registered Participant, and should include consideration of all relevant factors including:

- the compliance principles listed in chapter 2;
- the technology of the plant, including whether its performance is likely to drift or degrade over a particular timeframe;
- experience with the particular technology, including any manufacturer's advice;
- the connection point arrangement; and
- an assessment of the risk and costs of different testing methods, including consideration of the relative size of the plant.

4.6 Continuous plant monitoring

Continuous plant monitoring is a very common option for monitoring and compliance, due to its increased affordability compared to the past and it being a common outcome of the connection process for new plant.

Continuous plant monitoring, including when used in conjunction with periodic testing, can have several benefits over periodic testing alone. These benefits include:

- providing Registered Participants with information about the ongoing performance of their plant, including automated alerting to any potential non-compliance – leading to superior compliance outcomes. See section 3.6 for actions to take in the instance of non-compliance.
- reducing the need for more frequent testing, as these tests can be focused on validating plant performance against edge cases and following plant changes only. See section 4.7 for further details on how continuous monitoring can complement testing regimes.

In developing a compliance program, Registered Participants should consider whether continuous high-speed monitoring can be implemented in lieu of staged testing in instances where staged tests cannot be conducted.

32 For example, see NER clause 11.186.6(a).

For several technical requirements, suggested methods that utilise continuous plant monitoring has been included in Appendix A, B and C of this document.

Equally, there are circumstances in which continuous monitoring may not be practicable. This may be due to cost, plant technology capability or purpose, the materiality of non-compliance, or otherwise. Circumstances where continuous monitoring may not be practicable include:

- for older thermal or existing plant, where the potential costs of retrofitting continuous monitoring equipment may be significant
- where existing monitoring methods provide sufficient assurance of compliance
- where instituting a continuous monitoring regime would not be proportionate to the level of risk of a potential non-compliance.

Where continuous monitoring is not implemented, a Registered Participant should document its reasons for not instituting continuous monitoring as part of its compliance program. Refer to compliance principle 2 for overarching guidance on this matter.

4.6.1 Monitoring where performance standards are not measured at the connection point

Monitoring should record electrical quantities at the locations where the requirements are set in the performance standards. This is typically at the connection point, but may be at other locations. If it is not practical to monitor at these locations, then additional modelling or data processing may be needed to show compliance.

4.7 Frequency of tests

In the tables in Appendix A, B and C, the column titled, 'Suggested frequency of testing' indicates the suggested cycle of recurrent tests for a particular method.

While the tables recommend the frequency of each testing method and provide a baseline requirement, the determined frequency contained within a plant's compliance program should be considered within the broader compliance framework and in line with good electricity industry practice. It should include consideration of all relevant factors, including:

- the materiality of non-compliance with a performance standard;[33]
- an assessment of the frequency required to provide reasonable assurance of compliance, including accounting for where continuous monitoring is in place;
- the Registered Participant's experience with the particular plant technology, including the potential for the plant's performance to drift over time;
- the impact of any potential plant changes (such as the replacement of plant equipment);[34]
- any manufacturer's advice with respect to the particular model;[35]
- the cost of testing;[36]
- any risks associated with conducting a test.

As per clause 5.7.5 of the NER, a Registered Participant proposing to conduct a test on equipment related to a connection point, which requires a change to the normal operation of that equipment, must give notice to the relevant NSP of at least 15 days, except:

33 See compliance principle 3.

34 See compliance principle 5 and section 3.1.

35 This could include considering any specific requirements related to the minimum number of operational hours required prior to undertaking major inspections.

36 See compliance principle 1.

- in an emergency; or
- where AEMO has notified the NSP of the proposed date and time of the test.

4.7.1 Impact of continuous monitoring on testing frequency

Continuous monitoring is becoming increasingly common and, when implemented, can complement a plant's testing regime. When in place, testing can focus on edge cases only and plant performance during more severe power system conditions that may not occur under normal operation.

Conversely, where continuous monitoring is not in place, Registered Participants should exercise prudence and act in accordance with good electricity industry practice to demonstrate ongoing compliance. In these cases, more frequent testing may be necessary.

4.7.2 Alignment of testing with plant maintenance and outages

Where consistent with good industry practice, it may be appropriate to align testing with operational factors, such as planned outages, existing maintenance schedules or original equipment manufacturer (OEM) availability.

In doing so, consistent with compliance principle 1, a Registered Participant should assess the cost of the compliance regime against the risks and costs of non-compliance. In other words, a test should not be delayed if the risk of non-compliance with a performance standard exceeds the foreseen benefits of delaying a test.

4.7.3 Other factors in determining testing frequency

In the compliance tables, the column titled 'Suggested frequency of testing' provides a time-based recommendation for testing frequency. The recommended frequency should be considered the baseline requirement, and if deviated from, the reasoning for doing so should be documented in line with compliance principle 7.

However, testing frequency may also be managed with regard to safety, other compliance programs and the overall asset management program for the plant.[37] The actual frequency of testing in a plant's compliance program, especially for mechanical systems, may be described in terms of:

- elapsed time;
- plant operating hours;
- the number of MWhrs generated or transferred;
- a number of plant starts between testing; or
- any other factors the Registered Participant considers relevant.

4.8 Hardware-in-the-loop testing

Hardware-in-the-loop (HIL) testing refers to a simulation technique and framework that uses hardware that is identical or very close to what will be commissioned and in operation.

While HIL testing can complement pre-commissioning and commissioning studies, as well as modelling and testing during plant changes and model validation, the Panel does not consider that

37 Registered Participants may need to consider whether plant that is less often employed should be subject to more rigorous compliance testing to ensure that it would operate when required.

the sole use of HIL would provide a Registered Participant with a reasonable assurance of ongoing compliance with its performance standards.

HIL testing should not replace stringent monitoring and testing of 'as-built' plant and equipment. The Panel considers some degree of end-to-end monitoring and testing is necessary to provide reasonable assurance of ongoing compliance.

4.9 Basis for compliance assessment

In the tables, the column titled 'Basis for compliance assessment' indicates the type of measure required as the benchmark for a particular method. The specific measure for the acceptance or otherwise of test results should be developed by the Registered Participant when applying the Template to develop their compliance program, taking into account any specific requirements that may form part of its performance standards.

4.10 Defined terms

For the purposes of interpreting and applying the compliance tables in Appendix A, B and C, several terms have been defined below. These defined terms have been underlined in the compliance tables to remind Registered Participants to refer to this section.

plant change means when the replacement of components or equipment or a refurbishment or change of system takes place, and the relevant *Registered Participant* considers that event may affect the plant's capability to meet a particular *performance standard*. A plant change may include a change to software or firmware associated with digital control and protection systems.

Changes to plant that would trigger the processes described in clauses 5.3.9, 5.3.12, S5.2.4, S5.3.4 or S5.3a.2 of the NER would also constitute a plant change.

See section 3.1 for more information on plant changes.

relevant sub-system means any subcomponents which contribute to a *schedule 5.2 plant, schedule 5.3 plant* or *schedule 5.3a plant* achieving its capability to meet the particular *performance standard* (e.g. excitation systems, connection equipment including associated reactive plant, auxiliary power supplies, protection relays, circuit breakers, etc.). An appropriate process needs to be established under the *Registered Participant's* compliance management framework to identify what sub-systems are relevant to achieving and maintaining the plant's performance with respect to each *performance standard*.

Appropriate testing for relevant sub-systems needs to be devised, taking into account:

- the technology of the particular sub-system, including whether its performance is likely to drift or degrade over a particular timeframe;
- experience with the particular generation technology;
- manufacturer's advice with respect to the particular model; and
- an assessment of the frequency required to provide reasonable assurance of compliance.

type testing means testing, on a regular basis, a reasonable sample of plant within a larger population of plant of the identical type and model.

monitoring means active routine monitoring of the system to ensure ongoing compliance and not just mere logging. All monitoring should include quantitative analysis to confirm plant performance against:

- past performance;
- known performance characteristics; or
- plant performance models.

This definition should not be confused with *monitoring equipment* as defined in the Rules.

plant trip means the trip of a *production unit, production system, schedule 5.3 plant* or *schedule 5.3a plant*, or when a *production system* consists of multiple units, the trip of a significant number of those units or of critical ancillary *plant*.

significant disturbance means a power system disturbance that significantly varies frequency, voltage or power quality at the connection point beyond normal system conditions. Significant disturbances provide a trigger for investigating plant trips to assess whether the trip indicates an inability of the *schedule 5.2 plant, schedule 5.3 plant* or *schedule 5.3a plant* to remain in *continuous uninterrupted operation* as required by its performance standard.

Examples:

1. Frequency goes outside the limits for *continuous uninterrupted operation* set in the performance standard (S5.2.5.3/S5.3a.13) and exceeds the plant protection settings. Event should be reviewed to confirm that the plant trips, as expected.
2. Voltage goes outside the limits for *continuous uninterrupted operation* set in the performance standard (S5.2.5.4/S5.3a.13) and exceeds the plant protection settings. Event should be reviewed to confirm that the plant trips, as expected.
3. Protection operation resulting in plant trip that occurs during or immediately following contingency events, network faults or multiple network faults in close succession.

major disturbance means a power system disturbance that a *Registered Participant* considers will provide a significant test of the ability of the *schedule 5.2 plant, schedule 5.3 plant* or *schedule 5.3a plant* to remain in *continuous uninterrupted operation* as required by its performance standard.

Unlike significant disturbances, major disturbances may not coincide with a plant trip. The Template uses the term major disturbance with methods that assess performance using high speed monitoring. These methods often require periodic assessment of performance and the major disturbance definition is intended to differentiate from significant disturbance requiring the Registered Participant to select a disturbance in the period that best tests the ability to meet *continuous uninterrupted operation* obligations.

Examples:

1. Frequency goes outside the *operational frequency tolerance band* but not the limits for *continuous uninterrupted operation* (magnitude and time) set in the performance standard (S5.2.5.3/S5.3a.13). Event should be reviewed to confirm that the plant does not trip.
2. Voltage goes outside 90% to 110% of *nominal voltage* (at the connection point) but not the limits for *continuous uninterrupted operation* (magnitude and time) set in the performance standard (S5.2.5.4/S5.3a.13). Event should be reviewed to confirm continuous uninterrupted operation.

major event means an event on the power system that the *Registered Participant* considers best tests the ability of its *plant* to meet its *performance standards*.

The definition is intended to focus the compliance assessment on the event that provides the best test of the ability to meet their *performance standards*. The event will generally result in a major disturbance, but this may not always be the case. Therefore, the definition does not limit major events to just those that result in major disturbances.

Examples:

1. S5.2.5.5/S5.2.5.5A/S5.3a.14:
   a. *Credible contingency events*
   b. Network faults
   c. Multiple network faults in close succession
   d. Network faults or voltage disturbances that activate Fault Ride Through (FRT) modes in asynchronous plant
2. S5.2.5.6: Power-quality metrics at the connection point (voltage fluctuation, harmonic voltage distortion and voltage unbalance) exceed the values given in S5.1a.5, S5.1a.6 and S5.1a.7 or reach their highest value in three years.
3. S5.2.5.7/S5.2.5.8: High frequency event where the frequency moves above the *operational frequency tolerance band* or largest available over frequency event every five years (whichever is more frequent).
4. S5.2.5.11: Frequency goes outside the *normal operating frequency exclusion band* but not the limits for *continuous uninterrupted operation* (magnitude and time) set in the performance standard (S5.2.5.3). Event should be reviewed to confirm frequency control performance.
5. S5.2.5.13/S5.3a.15: Network voltage disturbances large and fast enough to test voltage control systems. There may be switching of network reactive plant, switching of lines, transformer tap changes or other voltage disturbances including disturbances into limiters.

A Compliance tables for generating systems, integrated resource systems and synchronous condenser systems (schedule 5.2 plant)

This appendix is intended as a guide to Schedule 5.2 Participants for developing and modifying compliance programs for their generating systems, integrated resource systems and synchronous condenser systems. It is not an exhaustive list of tests and methodologies, as new, and more effective, approaches may develop over time. Registered Participants should consider the compliance principles set out in Chapter 2 of the document when applying this table. Chapters 3 and 4 of this document provide important context for the application of this table and emphasises that participants should exercise their own judgement in determining how best to apply the Template to meet their compliance requirements.

A.1 Reactive power capability (S5.2.5.1)

As required under S5.2.5.1 in versions 1-243 of the Rules.

Testing should consider voltage range around the mid-point voltage and temperature derating, where relevant under the performance standard.

To test the reactive range while minimising impact on network voltages, the reactive output of the plant may be offset by other units or network equipment. This should be arranged in consultation with the NSP and AEMO.

Table A.1: Suggested compliance methods for reactive power capability

Method	Suggested testing frequency	Basis for compliance assessment
Method 1 (continuous monitoring, supplemented with active testing)		
• Continuous monitoring of reactive power with reference to voltage or reactive power setpoint; and	Annual review of performance.	Reactive power is limited at the required level and not limited with the required range.
• At rated power output, adjust the reactive power to specified levels.	Every five years when full range has not been demonstrated through continuous monitoring in the previous five years, and after plant change.	Be capable of achieving reactive power range, subject to not exceeding network voltage limits.
Method 2 (active testing, applicable to all plant)		
At rated power output, adjust the reactive power to specified levels.	Every three years and after plant change.	Be capable of achieving reactive power requirements of the performance standard

Method	Suggested testing frequency	Basis for compliance assessment
		subject to not exceeding network voltage limits.
Method 3 (active testing, applicable to synchronous machines)		
Exercise the over and under excitation limits at as close to rated power output as practical. This may be done in conjunction with step testing of AVR limiters.	Every three years and after plant change.	Be capable of achieving reactive power requirements of the performance standard subject to not exceeding network voltage limits.
Method 4 (applicable to wind farms and solar farms where other methods are not practical)		
• Capability will be tested by component; and	Testing of ancillary plant and type testing of sample turbines, solar installation following plant change.	Be capable of achieving performance standard.
• Capability will be monitored using SCADA under normal wind and solar farm operation.	Annual review of a selection of events.	Consistency with plant characteristics
Supplementary Methods (to be used in conjunction with other methods, if applicable)		
Verify performance while not generating active power (where applicable under performance standard).	Continuous monitoring or direct measurement every three years and after plant change.	Consistent with performance standard.
Verify performance while generating units are disconnected (where applicable under performance standard).	Continuous monitoring or direct measurement every three years and after plant change.	Consistent with performance standard.
Routine testing of relevant sub-systems. Applicable to a wide range of generating plant and systems, including capacitor banks, harmonic filters, STATCOMs, and synchronous condensers.	As appropriate to the technology of the relevant sub-system.	Consistency with plant characteristics.

A.2 Quality of electricity generated (S5.2.5.2)

As required under S5.2.5.2 in versions 1-243 of the Rules.

Table A.2: Suggested compliance methods for quality of electricity generated

Method	Suggested testing frequency	Basis for compliance assessment
Method 1 (continuous monitoring)		
• Continuous monitoring of in-service performance through use of Power Quality Monitors, with alarms for exceedances; and	Continuous monitoring. Specific review every three years and following plant change.	Monitors set against the performance standard are not raising alarms. Performance of the schedule 5.2 plant and its contribution to power quality may need to be separated from the contribution of others to show compliance.
• Testing and/or calibration of any relevant sub-systems.	As appropriate to the technology of the relevant sub-system.	Consistency with plant characteristics. Important when power quality at the connection point is dependent on ancillary plant or power electronic control systems.
Method 2 (periodic measurement)		

• Direct measurements using power quality meters to derive:
  • voltage fluctuation levels;
  • voltage balance; and
  • harmonics, flicker and negative phase sequence voltage; and
	Every three years and after plant change.	Be capable of achieving reactive power requirements of the performance standard subject to not exceeding network voltage limits.

• Routine testing of any relevant sub-systems.	As appropriate to the technology of the relevant sub-system.	Consistency with plant characteristics. Important when power quality at the connection point is dependent on ancillary plant or power electronic control systems.

A.3 Response to frequency disturbances (S5.2.5.3)

As required under S5.2.5.3 in versions 1-129 of the Rules.

Table A.3: Suggested compliance methods for frequency disturbance responses

Method	Suggested testing frequency	Basis for compliance assessment
Method 1 (continuous high-speed monitoring with/without automated assessment tools)		
• Investigate significant disturbances using continuous high-speed monitoring; and	On every event. See significant disturbance example 1.	Event should be reviewed to confirm that the plant trips, as expected. Consistency with models provided in accordance with clause S5.2.4 may be used to show compliance with performance standard.
• Investigate major disturbances using continuous high-speed monitoring; and	On every event. See major disturbance example 1.	Event should be reviewed to confirm that the plant does not trip. Consistency with models provided in accordance with clause S5.2.4 may be used to show compliance with performance standard.

• Routine testing and/or calibration of relevant sub-systems including:
  • testing of control system and/or protection system response to disturbances by the injection of simulated frequency / speed control signals; and
  • Routine tests of electrical / mechanical over speed devices.
	As appropriate to the technology of the relevant sub-system.	Achieve performance standard.

Method 2 (investigation of events where continuous high-speed monitoring is not practical)		
• Investigating plant trips that occur during significant disturbances; and	On every event. See significant disturbance example 1.	Achieve performance standard

Method	Suggested testing frequency	Basis for compliance assessment

• Routine testing and/or calibration of relevant sub-systems including:
  • testing of control system and/or protection system response to disturbances by the injection of simulated frequency / speed control signals; and
  • Routine tests of electrical / mechanical over speed devices.
	As appropriate to the technology of the relevant sub-system.	As above

Method 3 (continuous high-speed monitoring with Generating Unit (GU) testing applicable to wind, solar and BESS) Only applicable to small asynchronous generating units or bidirectional units with digital controls that are distributed and that do not materially differ in terms of their design and settings. Each unit is not material and performance slippage is unlikely.		
• Verify the modelled performance of a sample of turbines / inverter units; and	Following plant change.	Operation over the frequency range specified and agreed in the performance standard
• Verify the performance by testing response to an introduced disturbance; and	Type testing and verification every 10 years.	Consistent with the performance standard registered at the connection point
• Investigate significant disturbances using continuous high-speed monitoring; and	On every event. See significant disturbance example 1.	Event should be reviewed to confirm that the plant trips, as expected. Consistency with models provided in accordance with clause S5.2.4 may be used to show compliance with performance standard.
• Investigate major disturbances using continuous high-speed monitoring; and	On every event. See major disturbance example 1.	Event should be reviewed to confirm that the plant does not trip. Consistency with models provided in accordance with clause S5.2.4 may be used to show compliance with the performance standard.

Method	Suggested testing frequency	Basis for compliance assessment

• Routine testing and/or calibration of relevant sub-systems including:
  • testing of control system response to disturbances by the injection of simulated frequency / speed control signals; and
  • Routine tests of electrical / mechanical over speed devices.
	As appropriate to the technology of the relevant sub-system.	As above.

Method 4 (applicable to synchronous generation, where continuous high-speed monitoring is not practical)		
• Performance of relevant sub-systems will be monitored using the following systems under normal machine operation: digital protection relays; other data-logging equipment as required; and	Every three years by reviewing the response to a disturbance where the system frequency moves outside of the *operational frequency tolerance band,* and after plant change.	Achieve performance standard.

• Routine testing and/or calibration and validation of relevant sub-system performance including:
  • electrical protection; and
  • turbine protection.
	As appropriate to the technology of the relevant sub-system.	As above.

A.4 Response to voltage disturbances (S5.2.5.4)

As required under S5.2.5.4 in versions 13-243 and S5.2.5.3 in versions 1-12 of the Rules.

Table A.4: Suggested compliance methods for voltage disturbance responses

Method	Suggested testing frequency	Basis for compliance assessment
Method 1 (continuous high-speed monitoring with/without automated assessment tools)		
• Investigate significant disturbances using continuous high-speed monitoring; and	On every event. See significant disturbance example 2.	Event should be reviewed to confirm that the plant trips, as expected. Consistency with models provided in accordance with clause S5.2.4 may be used to show compliance with performance standard.
• Investigate major disturbances using continuous high-speed monitoring; and	At least one major voltage disturbance every three years. See major disturbance example 2.	Event should be reviewed to confirm that the plant maintains *continuous uninterrupted operation*. Consistency with models provided in accordance with clause S5.2.4 may be used to show compliance with performance standard.

• Routine testing and/or calibration of relevant sub-systems including:
  • AVR systems;
  • Auxiliary power systems; and
  • Protection relays
	As appropriate to the technology of the relevant sub-system.	Achieve performance standard.
		Consistency with models provided in accordance with clause S5.2.4 may be used to show compliance with performance standard.
		Where possible, testing of auxiliary power systems should include simulated disturbance testing.

Method 2 (investigation of events where continuous high-speed monitoring is not practical)		
• Investigating plant trips that occur during significant disturbances; and	On every event.	Achieve performance standard

Method	Suggested testing frequency	Basis for compliance assessment

• Routine testing and/or calibration of relevant sub-systems including:
  • testing of control system and/or protection system response to disturbances by the injection of simulated frequency / speed control signals; and
  • Routine tests of electrical / mechanical over speed devices.
	As appropriate to the technology of the relevant sub-system.	Consistency with plant characteristics.

Supplementary methods (to be used in conjunction with other methods, if applicable)		
Applies only to 415 V drives. With the generator out of service, test the ability of nominated 415 V drives to sustain a specified voltage interruption.	Every four years and after plant change.	Successful ride through of system voltage disturbances, as per the agreed performance standard.

A.5 Response to disturbances following contingency events / Disturbance ride-through capability (S5.2.5.5/S5.2.5.5A)

As required under S5.2.5.5 in versions 13-243 and S5.2.5.5A in versions 234-243 of the Rules.

Table A.5: Suggested compliance methods for contingency event response and disturbance ride-through

Method	Suggested testing frequency	Basis for compliance assessment
Method 1 (continuous high-speed monitoring for synchronous plant)		
• Investigate plant trips and significant disturbances using continuous high-speed monitoring; and	Every event. See significant disturbance example 3.	Confirm plant trips are consistent with performance standard.
• Analyse major events; and	Selection of events reviewed no less than once	Event should be reviewed to confirm that the plant

Method	Suggested testing frequency	Basis for compliance assessment
	every three years. Events should be chosen to test the range of performance standard requirements. See major event example 1.	meets the performance standard, which may include: • *continuous uninterrupted operation* • reactive current magnitude • post fault reactive power requirements • post fault active power recovery Consistency with models provided in accordance with clause S5.2.4 may be used to show compliance with performance standard.
• Routine monitoring and testing and/or calibration of relevant sub-systems.	As appropriate to the technology of the relevant sub-system.	As above.
Method 2 (continuous high-speed monitoring for asynchronous plant)		
• Investigate plant trips and significant disturbances using continuous high-speed monitoring; and	Every event. See significant disturbance example 3.	Confirm plant trips are consistent with performance standard
• Analyse major events; and	Selection of events reviewed no less than once every three years. Events should be chosen to test the range of performance standard requirements. See major event example 1.	Event should be reviewed to confirm that the plant meets the performance standard, which may include: • *continuous uninterrupted operation* • reactive current injection magnitude • positive/negative sequence contribution • reactive current commencement time • reactive current rise time • reactive current settling time or control requirements

Method	Suggested testing frequency	Basis for compliance assessment
		• post fault reactive power requirements • post fault active power recovery Consistency with models provided in accordance with clause S5.2.4 may be used to show compliance with performance standard.
• Routine monitoring and testing and/or calibration of relevant sub-systems.	As appropriate to the technology of the relevant sub-system	As above.
Method 3 (investigation of events where continuous high-speed monitoring is not practical)		
• Investigate plant trips and significant disturbances; and	On every event. See significant disturbances example 3.	Achieve performance standard
• Routine monitoring and testing and/or calibration of relevant sub-systems including suitable testing to confirm circuit breaker operating times.	As appropriate to the technology of the relevant sub-system.	As above
Supplementary methods (to be used in conjunction with other methods, if applicable)		
Check control system settings against commissioned values and model settings.	Every five years and after plant change.	Control system settings are consistent with models and expected values.

A.6 Quality of electricity generated and continuous uninterrupted operation / Response to abnormal voltage quality (S5.2.5.6)

As required under S5.2.5.6 in versions 13-243 of the Rules.

Table A.6: Suggested compliance methods for abnormal voltage quality

Method	Suggested testing frequency	Basis for compliance assessment
Method 1 (continuous monitoring)		
Continuous monitoring of in-service performance using power quality meters supplied via measurement transformers and transducers with sufficient bandwidth.	Investigating plant trips to ensure the trip is not caused by power-quality protection (harmonics or voltage unbalance), unless permitted by the performance standard. Review at least one major event every three years. See major event example 2.	Achieve performance standard.
Method 2 (direct measurement and event investigation)		

• Direct measurements using power quality meters supplied via measurement transformers and transducers with sufficient frequency bandwidth to test:
  • voltage fluctuation levels;
  • voltage balance; and
  • harmonics, flicker and negative phase sequence voltage prior to synchronisation
and to ensure protection settings align to the performance standard; and
	Following plant changes.	Achieve performance standard and ensure protection settings are consistent with the performance standard.

• Investigating plant trips to ensure the trip is not caused by power-quality protection (harmonics or voltage unbalance); and	Following each event.	Achieve performance standard.

Method	Suggested testing frequency	Basis for compliance assessment
• Routine monitoring and testing and/or calibration of any relevant sub-systems.	As appropriate to the technology of the relevant sub-system.	As above.

A.7 Partial load rejection (S5.2.5.7)

As required under S5.2.5.7 in versions 13-243 and S5.2.5.4 in versions 1-12 of the Rules.

Table A.7: Suggested compliance methods for partial load rejection

Method	Suggested testing frequency	Basis for compliance assessment
Method 1 (monitoring and event investigation)		
• Measure response of the schedule 5.2 plant to system over-frequency and analyse the unit performance; and	On every high frequency event where the frequency moves above the *operational frequency tolerance band,* or the largest available over frequency event every five years (whichever is more frequent) and after plant change as appropriate to the technology of the relevant sub-system. See major event example (3).	Achieve performance standard.
• Investigation of plant trips.	On every event.	As above.
Method 2 (routine testing and event investigation)		
• Routine testing and/or calibration of relevant sub-systems including: • Analytical simulation of generator, auxiliary systems and critical protections; and	As appropriate to the technology of the relevant sub-system.	Simulation demonstrates ride through of load rejection event specified in performance standard.

Method	Suggested testing frequency	Basis for compliance assessment
• Secondary injection testing of critical protection systems; and		
• Assess any plant trip for relationship to load rejection event.	On every event.	Operation over the conditions specified and agreed in the performance standard. Type test permissible where multiple units are involved.
• Routine monitoring and testing and/or calibration of any relevant sub-systems.	As appropriate to the technology of the relevant sub-system.	As above.

A.8 Protection from power system disturbances (S5.2.5.8)

As required under S5.2.5.8 in versions 1-243 of the Rules.

Table A.8: Suggested compliance methods for protection from power system disturbances

Method	Suggested testing frequency	Basis for compliance assessment
Method 1 (continuous high-speed monitoring)		
• Continuous monitoring using high speed recorders; and	On every high frequency event (frequency moves above the *operational frequency tolerance band*) or largest available over frequency event every five years (whichever is more frequent). See major event example 3.	Consistency with the performance standard and latest plant models is the preferred basis for compliance for 5-yearly testing. Overlaying test data with model responses, using verified models, shows that performance is consistent with past performance, as well as showing the models provided in accordance with clause S5.2.4 are accurate. Where performing model overlays is not practical,

Method	Suggested testing frequency	Basis for compliance assessment
		this should be substituted with comparison with past performance. If suitable models are not available, the Registered Participant should consider if a model update is required under S5.2.4(d)(2). RMS type models are generally suitable for this test.

• Routine testing and/or calibration of relevant sub-systems including:
  • protection system relays (by secondary injection)
  • runback schemes, emergency frequency control schemes and trip schemes; and
	As appropriate to the technology of the relevant sub-system.	Protection systems operate in accordance with design and the performance standard.

• Investigate protection trips.	On every event.	As above.
Method 2 (where continuous high-speed monitoring is not practical)		

• Routine testing and/or calibration of relevant sub-systems including:
  • protection system relays (by secondary injection)
  • runback schemes, emergency frequency control schemes and trip schemes; and
	As appropriate to the technology of the relevant sub-system.	Achieve performance standard.

• Investigate plant trips.	On every event.	As above.

A.9 Protection systems that impact on power system security (S5.2.5.9)

As required under S5.2.5.9 in versions 1-243 of the Rules.

Table A.9: Suggested compliance methods for protection systems that impact on power system security

Method	Suggested testing frequency	Basis for compliance assessment
Method 1 (continuous high-speed monitoring)		

• Routine testing and/or calibration of relevant sub-systems including:
  • protection system testing by secondary injection;
  • checking of circuit breaker opening times;
  • redundancy of primary protection systems;
  • timing of trip signal issued by the breaker fail protection system; and
	As appropriate to the technology of the relevant sub-system.
	Injection testing at each major overhaul and/or least every five years and after plant change.
		That all protection relays operate satisfactorily and to within design tolerance of setting value.

• Assessment of protection system performance in the event of protection system operation.	On every event.	That protection system is operated in accordance with design and the performance standard. May use fault recorder data, protection relay records and/or high-speed continuous monitoring.
Supplementary methods (to be used in conjunction with other methods, if applicable)		
Verification of database registered protection settings to occur in conjunction with injection testing.	Every five years.	Changes to generating unit control parameters will be controlled such that the performance of the plant is not compromised in relation to the performance standard.

A.10 Asynchronous operation of synchronous generating units / Protection to trip plant for unstable operation (S5.2.5.10)

As required under S5.2.5.10 in versions 1-243 of the Rules.

Table A.10: Suggested compliance methods for protection systems to trip plant for unstable operation

Method	Suggested testing frequency	Basis for compliance assessment
Method 1 (applicable to synchronous plant)		
• Routine testing and/or calibration of relevant sub-systems including protection system testing by secondary injection; and	As appropriate to the technology of the relevant sub-system. At least every five years and after plant change.	That all protection relays operate satisfactorily and to within design tolerance of setting value.
• Assessment of protection system performance in the event of protection system operation or of asynchronous operation.	On every event.	That protection system is operated in accordance with design and the performance standard.
Method 2 (applicable to asynchronous plant with instability detection systems)		
• Routine testing and/or calibration of instability detection system including hierarchy of actions based on trigger conditions; and	At least every five years and after plant change.	Instability detection system operates in accordance with design and the performance standard.
• Review of instability detection alarms.	Every event.	Instability detection system operates in accordance with design and the performance standard.

A.11 Frequency control / Frequency responsiveness and/or governor stability (S5.2.5.11)

As required under S5.2.5.11 in versions 1-243 of the Rules.

Table A.11: Suggested compliance methods for frequency control

Method	Suggested testing frequency	Basis for compliance assessment
Method 1 (continuous high-speed monitoring)		
Monitor in-service performance using high speed frequency data.	After every major disturbance, and a selection of major events, reviewed no less than once every three years. See major disturbance example 1 and major event example 4.	Consistency with the performance standards, as well as consistency with latest plant models for a selection of events at least every five years. Overlaying test data with model responses, using verified models, shows that performance is consistent with past performance, as well as showing the models provided in accordance with clause S5.2.4 are accurate. Where performing model overlays is not practical, this should be substituted with comparison with past performance. If suitable models are not available, the Registered Participant should consider if a model update is required under S5.2.4(d)(2). RMS type models are generally suitable for this clause.
Method 2 (event investigation applicable to synchronous plant)		
Assessment of governor system performance, or the performance of other control systems designed to modulate the active power response to a frequency disturbance, during events involving significant variation to system	After every major disturbance, and a selection of major events, reviewed no less than once every three years. See major disturbance example 1 and major event	That governor system response is within the tolerance specified by the performance standards. Assessment takes into account inertial response,

Method	Suggested testing frequency	Basis for compliance assessment
frequency.	example 4.	overall governor droop setting, etc.
Method 3 (high-speed monitoring with simulation)		
• Analytical simulation of turbine and governor systems, or other control systems designed to modulate active power in response to a frequency disturbance; and	Type test permissible where multiple units are involved.	Achieve performance standard.
• Assess generator response to disturbances using high speed recording data.	After every major disturbance, and a selection of major events, reviewed no less than once every three years. See major disturbance example 1 and major event example 4.	Consistency of operation with the latest plant model provided in accordance with clause S5.2.4 if the models are available; OR consistency with past performance only if the models are not available
Method 4 (active testing)		
• Step response test of the governor, or other control systems designed to modulate active power in response to a frequency disturbance, to test damping and droop characteristics; and	Every four years and after plant change.	Plant performance complies with its performance standard.
• Routine calibration tests.	Every four years.	As above.

A.12 Stability / Impact on Network Capability (S5.2.5.12)

As required under S5.2.5.12 in versions 1-243 of the Rules.

Table A.12: Suggested compliance method for impact on network capability

Method	Suggested testing frequency	Basis for compliance assessment
• Monitor in-service performance for relevant performance characteristics not otherwise tested; and	Following plant changes.	Consistency of operation with the latest plant model provided in accordance with clause S5.2.4 if the models are available; OR consistency with past performance if the models are not available Registered Participants can only be held responsible for ensuring the performance of their generating system, integrated resource system or synchronous condenser system contributes to meeting their performance standard.
• Routine monitoring and testing and/or calibration of relevant sub-systems including suitable testing to confirm power system stabiliser performance (if relevant).	As appropriate to the technology of the relevant sub-system.	As above.

A.13 Voltage and reactive power control / Excitation control system (S5.2.5.13)

As required under S5.2.5.13 in versions 1-243 of the Rules.

Testing and monitoring regimes should consider control modes and conditions where voltage control may operate differently, including:

- Low and high solar irradiance conditions for solar farms
- Reactive power on demand mode for solar farms
- Low and high State of Charge (SoC) conditions for BESS

Table A.13: Suggested compliance methods for voltage and reactive power control

Method	Suggested testing frequency	Basis for compliance assessment
Method 1 (continuous high-speed monitoring for asynchronous plant, supplemented with active testing)		
• Analysis of voltage disturbances; and	Selection of major events reviewed no less than once every three years. Events should be chosen to test the range of performance standard requirements. See major event example 5.	Plant performance complies with its performance standard. Models provided in accordance with clause S5.2.4 may be used to show compliance with performance standard.
• Analysis of voltage regulation with reference to voltage setpoint and droop (where applicable); and	Ongoing monitoring.	Plant performance complies with its performance standard.
• Reference steps tests in primary control modes, including steps into reactive limiters; and	Every five years or after plant change.	Consistency with the performance standard and latest plant models is the preferred basis for compliance for 5-yearly testing. Overlaying test data with model responses, using verified models, shows that performance is consistent with past performance, as well as showing the models provided in accordance with clause S5.2.4 are accurate. Where performing model overlays is not practical, this should be substituted with comparison with past performance. If suitable models are not available the Registered Participant should consider if a model update is required under S5.2.4(d)(2). RMS type models are generally suitable for this clause.
	Every five years or after plant change.	As above.

Method	Suggested testing frequency	Basis for compliance assessment
• Reference step tests in secondary control modes (where applicable under the performance standard).		
Method 2 (continuous high-speed monitoring for synchronous plant, supplemented with active testing)		
• Analysis of voltage disturbances; and	Selection of major events reviewed no less than once every three years. Events should be chosen to test the range of performance standard requirements. See major event example 5.	Plant performance complies with its performance standard. Models provided in accordance with clause S5.2.4 may be used to show compliance with performance standard.
• Analysis of voltage regulation with reference to voltage setpoint and droop (where applicable); and	Ongoing monitoring.	Plant performance complies with its performance standard
• Synchronized AVR step response tests including step response test of OEL and UEL operation; and	Every five years or after plant change. Analogue AVRs should be tested at shorter intervals and testing should include transfer function measurement.	Consistency with the performance standard and latest plant models is the preferred basis for compliance for 5-yearly testing. Overlaying test data with model responses, using verified models, shows that performance is consistent with past performance, as well as showing the models provided in accordance with clause S5.2.4 are accurate. Where performing model overlays is not practical, this should be substituted with comparison with past performance. If suitable models are not available the Registered Participant should consider if a model update is required under S5.2.4(d)(2). RMS type models are generally suitable for this

Method	Suggested testing frequency	Basis for compliance assessment
		clause.
• Reference steps tests in secondary control modes, including steps into reactive limits (where applicable under the performance standard); and	Every five years or after plant change.	As above.
• AVR and PSS transfer function measurements; and	After plant change.	As above.
• Unsynchronized AVR step response tests	After plant change.	As above.
Method 3 (active testing of synchronous plant)		
• Transfer function measurements and step response tests with the unit unsynchronised and at full load; and	Every four years and after plant change. Testing frequency may be reduced for modes that are not routinely used to control the output of the schedule 5.2 plant.	Tests should address all control modes specified in the performance standard as commissioned control modes. Consistency of operation with the latest plant model provided in accordance with clause S5.2.4 if the models are available; OR consistency with past performance if the models are not available.
• Assess the stability of limiter operation; and	Every four years and after plant change for the primary commissioned control mode.	As above.
• Monitoring in-service performance or undertake transfer function measurements.	On every event or Every four years for the primary commissioned control mode.	As above.
Method 4 (active testing of synchronous plant)		
• AVR step response tests; and	Every four years and after plant change for the primary commissioned control mode.	Consistency of operation with the latest plant model provided in accordance with clause S5.2.4 if the models are available; OR consistency with past performance if the models are not available
• AVR step response test of OEL and UEL operation; and	Every four years and after plant change for the primary commissioned control mode.	As above

Method	Suggested testing frequency	Basis for compliance assessment
• AVR and PSS transfer function measurements over required frequency range.	Every four years and after plant change for the primary commissioned control mode.	As above
Supplementary methods (to be used in conjunction with other methods, if applicable)		
Performance of relevant sub-systems will be monitored using the following systems: high speed monitors, digital protection relays; other data-logging equipment as required.	As appropriate to the technology of the relevant sub-system.	Consistency of operation with the latest plant model provided in accordance with clause S5.2.4 if the models are available; OR consistency with past performance if the models are not available.
Check control system settings against commissioned values and model settings.	Every five years and after plant change.	Control system settings are consistent with models and expected values.

A.14 Active power control (S5.2.5.14)

As required under S5.2.5.14 in versions 13-243 of the Rules.

Table A.14: Suggested compliance methods for active power control

Method	Suggested testing frequency	Basis for compliance assessment
Method 1 (continuous monitoring)		
• Continuous monitoring of active power output with reference to dispatch target and required ramp between dispatch intervals	Ongoing.	Achieve performance standard.
• Local active power step testing and/or AEMO active power setpoint or semi dispatch testing, as relevant to plant change	Following plant change.	Achieve performance standard.
Method 2 (monitoring using dispatch compliance systems)		
• Monitor non-compliance with dispatch market systems	Investigate each non-compliance.	Achieve performance standard.
	Following plant change.	Achieve performance standard.

Method	Suggested testing frequency	Basis for compliance assessment
• Local active power step testing and/or AEMO active power setpoint or semi dispatch testing, as relevant to plant change		

A.15 Short circuit ratio (S5.2.5.15)

As required under S5.2.5.15 in versions 196-243 of the Rules.

Table A.15: Suggested compliance method for short circuit ratio

Method	Suggested testing frequency	Basis for compliance assessment
Request AEMO's opinion on the potential impact of the proposed alteration, in accordance with the System Strength Impact Assessment Guidelines (SSIAG).	Before plant change.	Meet SSIAG requirements.

A.16 Voltage phase angle shift (S5.2.5.16)

As required under S5.2.5.16 in versions 196-233 of the Rules, and S5.2.5.8(b6) in versions 234-243 of the Rules.

Table A.16: Suggested compliance method for voltage phase angle shift

Method	Suggested testing frequency	Basis for compliance assessment
• Model based assessment of ability to meet performance standard	Before plant change.	Achieve performance standard
• Relay testing of vector shift or similar relay or protective function **that** acts upon voltage phase angle (where applicable)	At least every five years and after plant change.	Achieve performance standard.

A.17 Remote monitoring (S5.2.6.1)

As required under S5.2.6.2 in versions 13-243 and S5.2.6.3 in versions 1-12 of the Rules, with additional requirements in 4.11.3 of the Rules.

Table A.17: Suggested compliance methods for remote monitoring

Method	Suggested testing frequency	Basis for compliance assessment
Method 1		
• Calibrate transducers; and	Following plant change and every five years.	Confirmation at each end of the communications system by both parties.
• Verify the accuracy of transmitted data.	Following plant change and every five years.	As above.
Method 2 (applicable to asynchronous plant)		
• Check SCADA monitored values and farm panel metering.	Every five years.	Achieve performance standard.
• Calibrate transducers and metering.	At each major outage or once every five years.	As above.

A.18 Communications equipment (S5.2.6.2)

As required under S5.2.6.2 in versions 13-243 and S5.2.6.3 in versions 1-12 of the Rules, with additional requirements in 4.11.3 of the Rules.

Table A.18: Suggested compliance method for communications equipment

Method	Suggested testing frequency	Basis for compliance assessment
• Confirmation of the availability of communication links, including any backup links with AEMO; and	Annual and after plant change.	Achieve performance standard.
• Testing of relevant sub-systems including any power backup or UPS system.	As appropriate to the technology of the relevant sub-system.	As above.

A.19 Power station / generation auxiliary supplies (S5.2.7)

As required under S5.2.7 in versions 13-243 and S5.2.8 in versions 1-12 of the Rules.

Only applicable when auxiliary supplies are taken from a location that is different to the schedule 5.2 plant's connection point and a performance standard is established under clause S5.3.5.

Table A.19: Suggested compliance methods for auxiliary supplies

Method	Suggested testing frequency	Basis for compliance assessment
Method 1		
• Metering of active and reactive power at the auxiliary supply connection point; and	Every four years and after plant change.	Power factor, quality of supply and protection and control requirements within allowable range / specification.
• Testing and/or calibration of any relevant sub-systems including capacitor banks and circuit breakers.	As appropriate to the technology of the relevant sub-system.	Performance to specification.
Method 2 (applicable to wind and solar farms with small station service auxiliary load requirements).		
Performance will be monitored as part of condition monitoring and maintenance routines.	As appropriate to the technology of the relevant sub-system.	Achieve performance standard.

A.20 Fault level / current (S5.2.8)

As required under S5.2.8 in versions 13-243 and S5.2.9 in versions 1-12 of the Rules.

Table A.20: Suggested compliance methods for fault current

Method	Suggested testing frequency	Basis for compliance assessment
Method 1		
• Monitoring in-service performance during faults near the connection point; and	Review following any event.	Calculation confirms fault current contribution.
• Review and recalculation of fault levels; and	Following plant change.	As above.
• Routine testing of any relevant sub-systems.	As appropriate to the technology of the relevant sub-system.	As above.
Method 2		
• Modelling and simulation of plant characteristics to make sure the plant is capable of meeting agreed standards; and	Following plant change.	Achieve performance standard.
• Monitoring of plant contribution on fault event.	Review following any event.	As above.
Method 3		
• Performance of relevant sub-systems will be monitored using the following systems: digital protection relays; other data-logging equipment as required; and	As appropriate to the technology of the relevant sub-system.	Achieve performance standard.
• Where recorded data is available, comparison to be made of measured fault currents and computer simulations; and	Following a fault.	Consistency of operation with the latest plant model provided in accordance with clause S5.2.4 if the models are available; OR consistency with past performance if the models are not available.
• Review and recalculation of fault levels.	Following plant change.	As above.

A.21 Other requirements

Technical requirements, in addition to those under Schedule 5.2, may apply to Schedule 5.2 plant. Where applicable, these requirements should be considered in the design of an overall compliance program.The hyperlinks in the footnotes below are current, as of the time of the publication of this Template. Where documents are updated or revised following the publication of this Template, Registered Participants should refer to the most recent version of the documents listed below.

A.21.1 Frequency Control Anciliary Service (FCAS) requirements

Refer to the Market Ancillary Service Specification (MASS).

A.21.2 Non-market ancillary service requirements

Refer to power system operating procedure SO_OP_3708.

A.21.3 Primary Frequency Response (PFR) requirements

Refer to the Primary Frequency Response Requirements (PFRR).

A.21.4 Remote monitoring equipment requirements

Refer to the Power System Data Communications Standard (PSDCS).

A.21.5 Communications failure requirements

Refer to Communication System Failure Guidelines (CSFG).

A.21.6 Dispatch requirements

Refer to power system operating procedure SO_OP_3705.

B Compliance tables for loads and distribution networks (schedule 5.3 plant)

This appendix is intended as a guide to Schedule 5.3 Participants for developing and modifying compliance programs for their loads and distribution networks. It is not an exhaustive list of tests and methodologies, as new and more effective, approaches may develop over time. Registered Participants should consider the compliance principles set out in Chapter 2 of the document when applying this table. Chapters 3 and 4 of this document provide important context for the application of this table and emphasises that participants should exercise their own judgement in determining how best to apply the Template to meet their compliance requirements.

Method: Where there is more than one method provided, only one method is required to be used.

Suggested testing frequency:

See section 4.7 of the Template for more information on the factors to be considered when determining the actual frequency.

B.1 Design standards (S5.3.2)

As required under S5.3.2 in versions 1-243 of the Rules.

Table B.1: Suggested compliance method for design standard requirements

Method	Suggested testing frequency	Basis for compliance assessment
Review plant changes against the design standard requirements	Before plant change.	Plant change meets all design requirements.

B.2 Protection systems and settings (S5.3.3)

As required under S5.3.3 in versions 1-243 of the Rules.

Table B.2: Suggested compliance method for protection systems and settings

Method	Suggested testing frequency	Basis for compliance assessment

• Routine testing and/or calibration of relevant sub-systems including:
  • protection system testing by secondary injection;
  • checking of circuit breaker opening times;
  • redundancy of primary protection systems; and
  • timing of trip signal issued by the breaker fail protection system; and
	As appropriate to the technology of the relevant sub-system.
	Injection testing at least every five years and after plant change.
		That all protection relays operate satisfactorily and to within design tolerance of setting value.

• Assessment of protection system performance in the event of protection system operation.	On every event.	That protection system is operated in accordance with design and the performance standard. May use fault recorder data, protection relay records and/or high-speed continuous monitoring.
Supplementary methods (to be used in conjunction with method above, if applicable)		
Verification of database registered protection settings to occur in conjunction with injection testing.	Every five years.	As above.

B.3 Settings of protection and control systems (S5.3.4)

As required under S5.3.4 in versions 1-243 of the Rules.

Table B.3: Suggested compliance method for settings of protection and control systems

Method	Suggested testing frequency	Basis for compliance assessment
Document settings changes and communication with Network Service Provider on settings changes.	Ongoing.	Settings changes managed in accordance with requirements.

B.4 Power factor requirements (S5.3.5)

As required under S5.3.5 in versions 1-243 of the Rules.

Table B.4: Suggested compliance methods for power factor

Method	Suggested testing frequency	Basis for compliance assessment
Method 1 (continuous monitoring)		
Continuous monitoring of power factor.	Review of data at least every three years.	Power factor within allowable range.
Method 2 (periodic measurement)		
Direct measurement of power factor.	Every three years and following plant change	Power factor within allowable range.

B.5 Balancing of load currents (S5.3.6)

As required under S5.3.6 in versions 1-243 of the Rules.

Table B.5: Suggested compliance methods for balancing of load currents

Method	Suggested testing frequency	Basis for compliance assessment
Method 1 (continuous monitoring)		
Continuous monitoring of current unbalance.	Review of data at least every three years.	Current unbalance within allowable range.
Method 2 (periodic measurement)		
Direct measurement of current unbalance.	Every three years and following plant change	Current unbalance within allowable range.

B.6 Voltage fluctuations (S5.3.7)

As required under S5.3.7 in versions 1-243 of the Rules.

Table B.6: Suggested compliance methods for voltage fluctuations

Method	Suggested testing frequency	Basis for compliance assessment
Method 1 (continuous monitoring)		
Continuous monitoring of in-service voltage fluctuations using power quality monitors.	Review of data at least every three years.	Voltage fluctuations within allowable range.
Method 2 (periodic measurement)		
Direct measurements using power quality meters to derive voltage fluctuation levels.	Every three years and following plant change	Voltage fluctuations within allowable range.

B.7 Harmonic voltage distortion (S5.3.8)

As required under S5.3.8 in versions 1-243 of the Rules.

Performance of load and its contribution to power quality may need to be separated from the contribution of others to show compliance.

Table B.7: Suggested compliance methods for harmonic voltage distortion

Method	Suggested testing frequency	Basis for compliance assessment
Method 1 (continuous monitoring)		
Continuous monitoring in-service performance using power quality meters supplied via measurement transformers and transducers with sufficient bandwidth.	Review of data at least every three years.	Harmonic voltage distortion within allowable range.
Method 2 (periodic measurement)		
Direct measurements using power quality meters supplied via measurement transformers and transducers with sufficient bandwidth to measure harmonic voltage distortion.	Every three years and following plant change	Harmonic voltage distortion within allowable range.

B.8 Design requirements for Schedule 5.3 Participants substations (S5.3.9)

As required under S5.3.9 in versions 1-243 of the Rules.

Table B.8: Suggested compliance method for substation design requirements

Method	Suggested testing frequency	Basis for compliance assessment
Review plant changes against the design standard requirements.	Before plant change.	Plant change meets all design requirements.

B.9 Load shedding facilities (S5.3.10)

As required under S5.3.10 in versions 1-243 of the Rules.

Table B.9: Suggested compliance method for substation design requirements

Method	Suggested testing frequency	Basis for compliance assessment
Routine testing and/or calibration of relevant sub-systems including testing of protection system response to disturbances by the injection of simulated frequency signals.	As appropriate to the technology of the relevant sub-system.	Achieve performance standard.

B.10 Short circuit ratio (S5.3.11)

As required under S5.3.11 in versions 1-243 of the Rules.

Table B.10: Suggested compliance method for short circuit ratio

Method	Suggested testing frequency	Basis for compliance assessment
Request AEMO's opinion on the potential impact of the proposed alteration, in accordance with the System Strength Impact Assessment Guidelines (SSIAG).[1]	Before plant change.	Meet SSIAG requirements.

Note: [1]See AEMO's System Strength Impact Assessment Guidelines.

B.11 Other requirements

Technical requirements, in addition to those under Schedule 5.3, may apply to Schedule 5.3 plant. Where applicable, these requirements should be considered in the design of an overall compliance program.The hyperlinks in the footnotes below are current, as of the time of the publication of this Template. Where documents are updated or revised following the publication of this Template, Registered Participants should refer to the most recent version of the documents listed below.

B.11.1 Frequency control ancillary service (FCAS) requirements

Refer to the Market Ancillary Service Specification (MASS).

B.11.2 Non-market ancillary service requirements

Refer to power system operating procedure SO_OP_3708.

B.11.3 Dispatch requirements

Refer to power system operating procedure SO_OP_3705.

C Compliance tables for HVDC networks (schedule 5.3a plant)

This appendix is intended as a guide to Schedule 5.3a Participants for developing and modifying compliance programs for their HVDC networks. It is not an exhaustive list of tests and methodologies, as new and more effective, approaches may develop over time. Registered Participants should consider the compliance principles set out in Chapter 2 of the document when applying this table. Chapters 3 and 4 of this document provide important context for the application of this table and emphasises that participants should exercise their own judgement in determining how best to apply the Template to meet their compliance requirements.

Method: Where there is more than one method provided, only one method is required to be used.

Suggested testing frequency: See section 4.7 of the Template for more information on the factors to be considered when determining the actual frequency.

C.1 Remote monitoring (S5.3a.4.1)

As required under S5.3a.4.1 in versions 1-243 of the Rules.

Table C.1: Suggested compliance method for remote monitoring

Method	Suggested testing frequency	Basis for compliance assessment
Calibrate transducers and verify the accuracy of transmitted data.	Following plant change and every five years.	Confirmation at each end of the communications system by both parties.

C.2 Detection and response to unstable operation

As required under S5.3a.4.2 in versions 234-243 of the Rules.

Table C.2: Suggested compliance method for detection and response to unstable operation

Method	Suggested testing frequency	Basis for compliance assessment
• Routine testing and/or calibration of relevant sub-systems including instability detection system and hierarchy of actions based on trigger conditions; and	At least every five years and after plant change	Instability detection system operates in accordance with design and the performance standard.
• Review of instability detection alarms.	Every event	Instability detection system operates in accordance with design and the performance standard.

C.3 Communications equipment (S5.3a.4.3)

As required under S5.3a.4.3 in versions 1-243 of the Rules.

Table C.3: Suggested compliance method for communications equipment

Method	Suggested testing frequency	Basis for compliance assessment
• Confirmation of the availability of communication links, including any backup links with AEMO; and	Annual and after plant change.	Achieve performance standard.
• Testing of relevant sub-systems including any power backup or UPS system.	As appropriate to the technology of the relevant sub-system.	As above.

C.4 Design standards (S5.3a.5)

As required under S5.3a.5 in versions 1-243 of the Rules.

Table C.4: Suggested compliance method for design standards

Method	Suggested testing frequency	Basis for compliance assessment
Review plant changes against the design standard requirements.	Before plant change.	Plant change meets all design requirements.

C.5 Protection systems and settings (S5.3a.6)

As required under S5.3a.6 in versions 1-243 of the Rules.

Table C.5: Suggested compliance method for protection systems and settings

Method	Suggested testing frequency	Basis for compliance assessment

• Routine testing and/or calibration of relevant sub-systems including:
  • protection system testing by secondary injection;
  • checking of circuit breaker opening times;
  • redundancy of primary protection systems; and
  • timing of trip signal issued by the breaker fail protection system; and
	As appropriate to the technology of the relevant sub-system.
	Injection testing at least every five years and after plant change.
		That all protection relays operate satisfactorily and to within design tolerance of setting value.

• Assessment of protection system performance in the event of protection system operation.	On every event.	That protection system is operated in accordance with design and the performance standard. May use fault recorder data, protection relay records and/or high-speed continuous

Method	Suggested testing frequency	Basis for compliance assessment
		monitoring.
Supplementary methods (to be used in conjunction with method above, if applicable)		
Verification of database registered protection settings to occur in conjunction with injection testing.	Every five years.	As above.

C.6 Short circuit ratio (S5.3a.7)

As required under S5.3a.7 in versions 196-243 of the Rules.

Table C.6: Suggested compliance method for short circuit ratio

Method	Suggested testing frequency	Basis for compliance assessment
Request AEMO's opinion on the potential impact of the proposed alteration, in accordance with the System Strength Impact Assessment Guidelines (SSIAG).[1]	Before plant change.	Meet SSIAG requirements.

Note: [1]See AEMO's System Strength Impact Assessment Guidelines.

C.7 Reactive power capability (S5.3a.8)

As required under S5.3a.8 in versions 1-243 of the Rules.

Table C.7: Suggested compliance methods for reactive power capability

Method	Suggested testing frequency	Basis for compliance assessment
Method 1 (applicable to voltage source converter based HVDC)		
• Continuous monitoring of reactive power at the connection points; and	Annual review of performance.	Reactive power is limited at the required level and not limited with the required range.
• At rated power output, adjust the reactive power at the connection point to specified levels (at both connection points).	Every five years when full range has not been demonstrated through continuous monitoring in the previous five years. After plant change.	Be capable of achieving reactive power range, subject to not exceeding network voltage limits.
Method 2 (applicable to line-commutated converter (LCC) HVDC without dynamic reactive power control)		
• Continuous monitoring of reactive power at the connection points; and	Annual review of performance.	Reactive power is maintained with the required range.
• Routine testing of relevant sub-systems including harmonic filters, capacitor banks and their control systems.	As appropriate to the technology of the relevant sub-system.	Performance consistent with design.

C.8 Balancing of load currents (S5.3a.9)

As required under S5.3a.9 in versions 1-243 of the Rules.

Table C.8: Suggested compliance methods for balancing of load currents

Method	Suggested testing frequency	Basis for compliance assessment
Method 1 (continuous monitoring)		
Continuous monitoring of current unbalance.	Review of data at least every three years.	Current unbalance within allowable range.
Method 2 (periodic measurement)		
Direct measurement of current unbalance.	Every three years and following plant change.	Current unbalance within allowable range.

C.9 Voltage fluctuations (S5.3a.10)

As required under S5.3a.10 in versions 1-243 of the Rules.

Table C.9: Suggested compliance methods for voltage fluctuations

Method	Suggested testing frequency	Basis for compliance assessment
Method 1 (continuous monitoring)		
Continuous monitoring of in-service voltage fluctuations using power quality monitors.	Review of data at least every three years.	Voltage fluctuations within allowable range.
Method 2 (periodic measurement)		
Direct measurements using power quality meters to derive voltage fluctuation levels.	Every three years and following plant change.	Voltage fluctuations within allowable range.

C.10 Harmonic voltage distortion (S5.3a.11)

As required under S5.3a.11 in versions 1-243 of the Rules.

Performance of HVDC network and its contribution to power quality may need to be separated from the contribution of others to show compliance.

Table C.10: Suggested compliance methods for harmonic voltage distortion

Method	Suggested testing frequency	Basis for compliance assessment
Method 1 (continuous monitoring)		
Continuous monitoring in-service performance using power quality meters supplied via measurement transformers and transducers with sufficient bandwidth.	Review of data at least every three years and following plant change.	Harmonic voltage distortion within allowable range.
Method 2 (periodic measurement)		
Direct measurements using power quality meters supplied via measurement transformers and transducers with sufficient bandwidth to measure harmonic voltage distortion.	Every three years and following plant change.	Harmonic voltage distortion within allowable range.

C.11 Design requirements for substations (S5.3a.12)

As required under S5.3a.12 in versions 1-243 of the Rules.

Table C.11: Suggested compliance method for substation design requirements

Method	Suggested testing frequency	Basis for compliance assessment
Review plant changes against the design standard requirements.	Before plant change.	Plant change meets all design requirements.

C.12 Response to disturbances in the power system (S5.3a.13)

As required under S5.3a.13 in versions 1-243 of the Rules.

Table C.12: Suggested compliance method for power system disturbance response

Method	Suggested testing frequency	Basis for compliance assessment
• Investigate significant disturbances for voltage and frequency using continuous high-speed monitoring; and	On every event. See significant disturbance examples 1 and 2.	Event should be reviewed to confirm that the plant trips, as expected. Consistency with models provided in accordance with clause S5.2.4 may be used to show compliance with performance standard.
• Investigate major disturbances for voltage and frequency using continuous high-speed monitoring; and	At least one major disturbance for voltage and one major disturbance for frequency every three years. See major disturbance examples 1 and 2.	Event should be reviewed to confirm that the plant maintains *continuous uninterrupted operation*. Consistency with models provided in accordance with clause S5.2.4 may be used to show compliance with performance standard.
• Routine testing and/or calibration of relevant sub-systems including testing of control system and/or protection system response to disturbances by the injection of simulated frequency / speed control signals.	As appropriate to the technology of the relevant sub-system.	Achieve performance standard.

C.13 Disturbance ride through and response capability / Protection of market network services from power system disturbances (S5.3a.14)

As required under S5.3a.14 in versions 1-243 of the Rules.

Table C.13: Suggested compliance method for disturbance ride through capability

Method	Suggested testing frequency	Basis for compliance assessment
• Investigate plant trips and significant disturbances using continuous high-speed monitoring; and	On every event. See significant disturbance example 3.	Confirm plant trips are consistent with performance standard. Consistency with models provided in accordance with clause S5.2.4 may be used to show compliance with performance standard.
• Analyse major events; and	Selection of events reviewed no less than once every three years. Events should be chosen to test the range of performance standard requirements. See major event example 1.	Event should be reviewed to confirm that the plant meets the performance standard for behaviour during faults and post fault. Consistency with models provided in accordance with clause S5.2.4 may be used to show compliance with performance standard.
• Routine monitoring and testing and/or calibration of relevant sub-systems.	As appropriate to the technology of the relevant sub-system.	As above.
Supplementary method (to be used in conjunction with method above, if applicable)		
Check control system settings against commissioned values and model settings.	Every five years and after plant change.	Control system settings are consistent with models and expected values.

C.14 Voltage and reactive power control (S5.3a.15)

As required under S5.3a.15 in versions 234-243 of the Rules.

Table C.14: Suggested compliance methods for voltage and reactive power control

Method	Suggested testing frequency	Basis for compliance assessment
Method 1 (applies to voltage source converter based HVDC)		
• Analysis of voltage disturbances using high speed data; and	Selection of major events reviewed no less than once every three years. Events should be chosen to test the range of performance standard requirements. See major events example 5.	Plant performance complies with its performance standard. Models provided in accordance with clause S5.2.4 may be used to show compliance with performance standard.
• Reference steps tests including steps into reactive limiters.	Every five years or after plant change.	Consistency with the performance standard and latest plant models is the preferred basis for compliance for 5-yearly testing. Overlaying test data with model responses, using verified models, shows that performance is consistent with past performance, as well as showing the models provided in accordance with clause S5.2.4 are accurate. Where performing model overlays is not practical, this should be substituted with comparison with past performance. Where suitable models are not available, the Registered Participant should consider if a model update is required under S5.2.4(d)(2). RMS type models are generally suitable for this clause.

Method	Suggested testing frequency	Basis for compliance assessment
• Routine monitoring and testing and/or calibration of relevant sub-systems.	As appropriate to the technology of the relevant sub-system.	As above.
Method 2 (applies to Line Commutated Converter (LCC) HVDC without dynamic reactive power control)		
• Analysis of voltage disturbances using high speed data; and	Selection of major events reviewed no less than once every three years. Events should be chosen to test the range of performance standard requirements. See major event example 5.	Plant performance complies with its performance standard. Models provided in accordance with clause S5.2.4 may be used to show compliance with performance standard.
• Routine testing of relevant sub-systems including harmonic filters, capacitor banks and their control systems.	As appropriate to the technology of the relevant sub-system.	Performance consistent with design.
Supplementary methods (to be used in conjunction with other methods, if applicable)		
Check control system settings against commissioned values and model settings.	every five years and after plant change.	Control system settings are consistent with models and expected values.

C.15 Active power control (S5.3a.16)

As required under S5.3a.16 in versions 234-243 of the Rules.

Table C.15: Suggested compliance methods for active power control

Method	Suggested testing frequency	Basis for compliance assessment
Method 1 (continuous monitoring)		
• Continuous monitoring of active power output with reference to dispatch target and required ramp between dispatch intervals; and	Ongoing.	Achieve performance standard.
• Local active power step testing and/or AEMO active power setpoint testing, as relevant to plant change.	Following plant change	Achieve performance standard.
Method 2 (monitoring using dispatch compliance systems)		
• Monitor non-compliance with dispatch market systems.	Investigate each non-compliance.	Achieve performance standard.
• Local active power step testing and/or AEMO active power setpoint testing, as relevant to plant change.	Following plant change.	Achieve performance standard.

C.16 Other requirements

Technical requirements, in addition to those under Schedule 5.3a, may apply to schedule 5.3a plant. Where applicable, these requirements should be considered in the design of an overall compliance program.The hyperlinks in the footnotes below are current, as of the time of the publication of this Template. Where documents are updated or revised following the publication of this Template, Registered Participants should refer to the most recent version of the documents listed below.

C.16.1 Dispatch requirements

Refer to power system operating procedure SO_OP_3705.

Abbreviations

AEMC	Australian Energy Market Commission
AEMO	Australian Energy Market Operator
AER	Australian Energy Regulator
AVR	Automatic voltage regulator
BESS	Battery energy storage systems
Code	National Electricity Code
Commission	See AEMC
CSFG	Communication System Failure Guidelines
FCAS	Frequency control ancillary service
FFR	Fast frequency response
FRT	Fault ride through
GU	Generating unit
HIL	Hardware-in-the-loop
HVDC	High voltage direct current
IRP	Integrated Resource Provider
LCC	Line-commutated converter
MASS	Market ancillary service specification
MW	Megawatt
NEL	National Electricity Law
NEO	National electricity objective
NER or Rules	National Electricity Rules
NSP	Network service provider
OEL	Over-excitation limiter
OEM	Original equipment manufacturer
Panel	Reliability Panel
PFR	Primary frequency response
PFRR	Primary frequency response requirements
PSDCS	Power System Data Communication Standard
PSS	Power system stabiliser
R2	A term that refers to plant data provided post-connection, but can also commonly refer to commissioning and post-commissioning processes.
RMS	Root mean square
SCADA	Supervisory Control and Data Acquisition
SCR	Short circuit ratio
SSIAG	System Strength Impact Assessment Guidelines
SoC	State of charge
UPS	Uninterruptible power supply