# TEMPLATE FOR GENERATOR COMPLIANCE PROGRAMS

~~18 June 2015~~ 19 December 2019

**Inquiries**

Reliability Panel
c/o Australian Energy Market Commission
PO Box A2449
Sydney South NSW 1235

**E**: panel@aemc.gov.au
**T**: (02) 8296 7800
**F**: (02) 8296 7899

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**About the Reliability Panel**

The Reliability Panel (Panel) is a specialist body established by the AEMC and comprises industry and consumer representatives. It is responsible for monitoring, reviewing and reporting on reliability, security and safety of the national electricity system and advising the AEMC in respect of such matters. The Panel's responsibilities are specified in section 38 of the National Electricity Law.

# Contents

## Purpose of this document

Under the National Electricity Rules (Rules), the Reliability Panel (Panel) must determine, modify as necessary, and publish the template for generator compliance programs (template).[1] The Rules also require the Panel to conduct a review of the template at least every ~~three~~ five years from the date the template is determined, and at such times as the Australian Energy Market Commission (AEMC) 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 its obligations as set out in the Rules for its plant.

Registered participants have performance standards obligations requiring that their plant meets or exceed applicable performance standards and that their plant 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 Rules 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 purpose of this document is to provide assistance and clarity to registered participants, particularly Generators, to develop performance standards compliance programs that include monitoring procedures that they consider to be consistent with good electricity industry practice. It is also intended to assist the Australian Energy Regulator (AER) with the enforcement and monitoring of the Generators' compliance with the technical requirements under the Rules. Effective compliance with

1 Rules clause 8.8.1(a)(2b). The Panel must determine the template in accordance with clause 8.8.3 of the Rules.

2 Rules clause 8.8.3(ba).

3 Rules clause 8.8.3(j).

4 Rules clause 4.15(ca).

5 Rules clause 4.15(a).

6 Rules clause 4.15(b) and (c).

performance standards contributes to the delivery of reliable and secure electricity to customers in the National Electricity Market (NEM).

This document is structured as follows:

- Chapter 1 presents:
  - the ten compliance principles;
  - a general overview of the compliance framework;
  - information on continuous plant monitoring;
  - general information on dry-storage generators; and
- Chapter 2 presents:
  - a detailed table for developing generator compliance programs.

Further information on the template can be obtained by either emailing the 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).

# 1 Supporting information for compliance programs

## 1.1 Introduction

This chapter presents material that may be considered useful by registered participants in terms of helping to inform their compliance programs.

## 1.2 Compliance principles

The Panel used the following compliance principles in developing its template. These principles should also be considered by generators in developing and modifying their compliance programs.

Principle 1: Where plant system performance may be variable with time, as for example with plant protection, control and alarm (PCA) systems, *Generators* are accountable for managing the functionality and integrity of systems and settings in accordance with the performance standards compliance program.

Principle 2: The corollary of the Principle #1 is that where plant parameters are not subject to variability with time, the compliance regime should be restricted to confirmation that the plant continues to perform as intended with repeat testing when there are reasonable grounds to believe that the plant performance may have changed.

Principle 3: The materiality of the issue must be considered when contemplating a compliance testing regime.

Principle 4: A *Generator's* active use and implementation of a compliance program that is consistent with the approved template and the Generator's compliance management framework will provide a reasonable assurance of compliance with the Generator's registered performance standards.

Principle 5: The template must therefore support the development of compliance programs which represent "good electricity industry practice". The template should specify the objectives and outcomes to be achieved by the testing or monitoring, and an appropriate test interval. The *Generator* should exercise diligence and good electricity industry practice to determine the detailed methods and procedures to be employed for its plant.

Principle 6: The compliance testing regime must be efficient, and reflect an equitable balance between risk management and the risk created by the test regime itself.

Principle 7: Where appropriate, analysis of performance during an event or disturbance could be used to demonstrate compliance in lieu of a performance test.

Principle 8: Where compliance to a performance standard cannot be directly tested, the compliance program should include a range of other compliance testing methods to provide reasonable assurance that the performance standard continues to be met.

Principle 9: When developing a compliance program and operating under that program, a *Generator* can only be reasonably held accountable for the compliance of its plant to its registered performance standards and to equipment settings approved or provided by AEMO and/or the transmission network service provider (TNSP).

Principle 10: Compliance programs should be reviewed and updated periodically.

## 1.3 General overview of the compliance framework

It is important to recognise that the template is only one element of the broader compliance framework.

The Panel recognises that the template cannot be a prescriptive 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. The Panel, therefore, designed the template on the basis that it forms part of a Generator's overall compliance management process.

Provided below is 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.

Generally speaking, the compliance framework should be viewed in the context of the connection arrangements that allow the Generator to connect to the electricity network. Under the Rules, a Generator must plan and design its facilities and ensure that they are operated to comply with the performance standards applicable to those facilities, its connection agreement which is applicable to those facilities, and the system standards.[7] Except in cases where a Generator's facilities meet all aspects of the 'automatic access standards', performance standards are generally negotiated and form part of a Generator's connection agreement with the relevant network service provider.[8]

Following the receipt of a proposed negotiated access standard, the relevant network service provider is required to consult with AEMO with regard to the proposed negotiated access standard.[9] AEMO then establishes and maintains a register of the

7 Rules clause 5.2.5(a).

8 The automatic access standards, minimum access standards and performance criteria required for the connection of generators are set out in Rules schedule 5.2. These form the basis for specific performance standards that are registered with AEMO.

9 Rules clause 5.3.4A.

performance standards that is applicable for that particular plant, as advised by the relevant network service provider or Generator.[10]

Under the Rules, a Generator is required to comply with the performance standards applicable to its facilities.[11] That is, it is required to comply with those standards that are set out in its connection agreement. A Generator is also required to develop and maintain a performance standards compliance program that is consistent with the template.[12] Such a program must be developed as soon as reasonably practicable, but no later than:

- six months after the day that AEMO gives notice to the registered participant of registration of the performance standards; or
- six months after the day on which the relevant plant commences operation.[13]

A Generator is also required to modify its compliance program to be consistent with any amendments made to the template by the Panel, by no later than 6 months after amendments to the template are published, or by a date determined by the Panel.[14]

The AER is responsible for monitoring whether Generators' compliance programs meet the mandatory requirements and for investigation of breaches, or possible breaches, of performance standards obligations under clause 4.15 of the Rules. A Generator is required to maintain compliance program records and other prescribed records[15] for seven years, and if requested, deliver such records to the AER within five business days or other specified period.[16]

A Generator is also required to immediately notify AEMO if its plant is breaching a performance standard or is likely to breach.[17] It must also notify AEMO and the relevant network service provider when the plant has returned to compliance with the relevant performance standard.[18] AEMO forwards a copy of all non-compliance notices to the AER and the relevant network service provider.

Generators should be aware that clause S5.2.2 of the NER requires any changes to generating system control or protection system settings, identified as necessary through compliance testing, to be approved by the NSP and AEMO if involving advisory matters under clause 5.3.4A(c) of the Rules.

10 Rules clause 4.14(n).

11 Rules clauses 5.2.1(b)(2) and 5.2.5(a)(1).

12 Rules clause 4.15(c).

13 Rules clause 4.15(b).

14 Rules clause 4.15(c)(3).

15 Relating to tests to demonstrate compliance with connection requirements under clause 5.7.3 of the Rules.

16 Rules clause 4.15(e).

17 Rules clause 4.15(f).

18 Rules clause 4.15(h).

~~Further details of the compliance framework for Generator performance standards are provided in the AER's Generator Performance Standards, Information Booklet, published in August 2013.[19]~~

## 1.4 Continuous plant monitoring

Where plant is normally running (that is, not "peaking plant" that operates intermittently), continuous plant monitoring could have a number of benefits over periodic testing, or if used in conjunction with periodic testing. Benefits are likely to accrue not only in relation to demonstrating compliance with technical performance standards, but also in providing information to plant owners about the ongoing performance of their plant.

Continuous plant monitoring is increasingly becoming a more affordable option than it has been in the past. AEMO has advised the Panel that the adoption of affordable continuous plant monitoring options is increasingly an outcome of the connection negotiation process for new plants.[20]

Generators could also consider whether continuous high speed monitoring could be considered in lieu of staged testing in some instances where staged tests cannot be implemented, such as for response to system disturbances.

For a number of performance standards in Table 1 in Chapter 2 of this document, continuous plant monitoring has been included as an option for a suitable monitoring and testing methodology. Where continuous plant monitoring has not been included in the table, Generators should also consider the suitability of applying continuous plant monitoring as a monitoring and testing methodology in these other situations.

## 1.5 Dry stored generators

The term "dry stored" is used to identify the status of a generation facility (or 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 generating facilities, including dry stored Generators, to develop and maintain compliance programs that are consistent with the template.[21] While the Rules do not prohibit a Generator from entering a period of "dry storage" and maintaining registration throughout, ongoing registration with AEMO obliges the Generator to retain compliance with the Rules.

When a generating plant is being prepared for a significant period of dry storage, a Generator should consider whether the plant's existing compliance program for performance standards is appropriate. There are a range of factors that a Generator

~~[19] www.aer.gov.au/node/21331~~

[20] AEMO submission, 16 December 2014, p.2. Confirmed through feedback received via survey of from representative stakeholders completed by GHD in July 2019.

[21] Rules clause 4.15(c).

should consider before implementing any amendment to its existing compliance program for the plant in question, some of which may include:[22]

- The period of time likely to elapse before the facility might be returned to service, and how the Generator would communicate any return to service arrangements to AEMO;
- How the Generator 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 Generator 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 Generator should also consider how and when it will advise AEMO of its plans to bring the plant back into service. The Generator should also keep all compliance related information up to date.
- If compliance testing is due, but the Generator has not been able to verify its compliance with all standards prior to re-synchronisation with the power system, then all residual verifications should be carried out as soon as practicable following re-synchronisation. For example, this may include making prior arrangements for the necessary tests to be carried out without avoidable delay after synchronisation 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 network service provider(s).

22 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.

# 2 Table for developing generator compliance programs

## 2.1 Introduction

Table 1, included at the end of this chapter, has been provided to assist Generators to develop their own compliance programs ('the table'). The following material provides explanatory notes to this table and defines important terms used in its development. Generators should read this explanatory material before referring to the table as it provides important context for the application of the table's provisions.

The terms defined in section 2.9 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.

## 2.2 Applying the table

The table provides a series of options for Generators to assist in developing compliance programs. It is not a prescriptive list of tests and methodologies to demonstrate compliance. The template has been designed on the basis that it is one of a number of resources that should be consulted in implementing and modifying a Generator's overall compliance management process.

The template is not designed to take the place of alternative advice. Generators should consider the compliance principles, set out in Chapter 1 of this document, most of which illustrate that Generators will need to exercise judgement in how best to apply the template to meet their compliance requirements.

## 2.3 Pre-existing compliance

The table is designed on the assumption that any analysis undertaken at the time of connection and subsequent commissioning tests conducted by the Generator 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 Code. As a result, a Generator'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.

## 2.4 Power system security

The AEMO power system security responsibilities are provided under clause 4.3.1 of the Rules. The Generator needs to take care that its compliance testing regime does not jeopardise power system security. Otherwise, under clause 4.8.1 of the Rules, the Generator must promptly advise AEMO or a relevant System Operator at the time that the Generator 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 Generator or a network service provider (NSP). Nothing in the table seeks to override these responsibilities and all testing should be devised and undertaken recognising the need to maintain power system security.

## 2.5 Performance standards

The Panel has sought to take into account all the relevant versions of the performance standards that may apply to a particular Generator. However, Generators should be aware in developing their compliance programs that the particular requirements under a performance standard may have changed over time. There may also have been changes in the version of the Rules, clause numbering and title in some places. At the time that this template was last updated, version 12971 of the Rules was the latest version. Reference to version 12971 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, Generators 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.

## 2.6 Compliance methods

The table lists a number of different compliance methods for the applicable performance standards. These different methods can be selected by the Generator 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 Generator, and should include consideration of all relevant factors including:

- the technology of the plant, including whether its performance is likely to drift or degrade over a particular timeframe;
- experience with the particular generation technology, including 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.

## 2.7 Frequency of tests

In the table, the column titled, "Suggested frequency of testing", indicates the suggested cycle of recurrent tests for a particular method. The actual frequency of testing on which a particular plant's compliance program is based should be determined within the broader compliance management framework of the Generator, and should include consideration of all relevant factors including:

- the technology of the plant specific to that performance standard;
- experience with the particular generation technology;
- manufacturer's advice with respect to the particular model;[30] and

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

- an assessment of the frequency required to provide reasonable assurance of compliance.

The frequency may also be managed within the broader framework to integrate NEM compliance testing with safety and other compliance programs and the overall asset management program for the plant.[31] The actual frequency of testing may be described in terms of the:

- elapsed time;
- plant operating hours;
- MWhrs generated; or
- number of plant starts

between testing.

## 2.8 Performance of remote equipment

Some of the performance standards specified in section S5.2.5 allow a generator 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 TNSP provided the generator arranges the provision of additional capability via plant and equipment located elsewhere in the power system. For example, S5.2.5.1 allows a generator to fund the provision of additional reactive power capability via plant and equipment installed at a location which differs from the connection point. The compliance program developed by the generator should not be required to assess the ongoing ability of the remote plant and equipment. Where a control system has been installed to ensure correct operation of the generator should the remote equipment be unavailable, the functionality of that control system should be tested as part of the generator compliance program.

## 2.9 Model validation and model updates

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

Completing model validation as part of the compliance program will facilitate the generator delivering updated, validated, models to AEMO and the relevant NSP within 3 months after commissioning tests have been completed, as required under Clause S5.2.4(d)(1) of the NER.

[31] Generators 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.

A generator'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. Generators should be aware of their obligations under Clause S5.2.4(d)(2) of the NER to provide updated model information to AEMO and the relevant NSP when the generator become aware that this is the case.

## 2.10 ~~8~~ Basis for compliance assessment

In the table, 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 Generator when applying the template to develop their compliance program.

## 2.11 ~~9~~ Defined terms

In the design of the template, it was decided that certain terms used in the table should be defined to aid clarity and assist Generators in using the template to develop their specific compliance programs:

**plant change** means when the replacement of components or equipment or the refurbishment or change of system takes place and that the relevant *Generator* considers that event may affect the plant's capability to meet the particular *performance standard*. A plant change may include a change to software or firmware associated with digital control and protection systems. An appropriate process needs to be established under the *Generator's* compliance management framework to ensure all changes to plant are noted and appropriately reviewed as to whether they constitute a plant change event in respect to each *performance standard*.

The generator should pay careful attention to software and firmware changes, and carefully assess whether they have the potential to modify the performance of the generating system. A software or firmware change that is assessed as having the potential to change the performance of the generating system should be treated as a plant change.

Changes to a generating system that would trigger the process described in clause 5.3.9 of the NER would also constitute a plant change.

**relevant sub-system** means any subcomponents which contribute to a *generating system* 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 *Generator'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.

**routine testing** may require testing and calibration of equipment.

**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** for the purposes of this template means the trip of a *generating unit* or a *generating system*, or when a *generating system* consists of more than ten identical units, the trip of a significant number of those units or of critical ancillary plant.

**significant disturbance** for the purposes of this template 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 *generating system* to remain in *continuous uninterrupted operation* as required by its performance standard.

**major disturbance** for the purposes of this template means a power system disturbance that the generator considers will provide a significant test of the ability of the *generating system* 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 generator to select a disturbance in the period that best tests the ability to meet the continuous uninterrupted operation obligations.

**major event** for the purposes of this template means an event on the power system that the generator considers best tests the ability of the *generating system* to meet its performance standard.

Major event is used in the template for the methods to assess compliance with S5.2.5.5 response to disturbance following contingency events, S5.2.5.6 Quality of electricity generated and continuous uninterrupted operation, and S5.2.5.14 Active Power Control. The definition is intended to focus the compliance assessment on the event that provide 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.

## Table 1 Table to assist development of generator compliance programs

This table is intended as a guide to Generators that is one of a number of potential resources for developing and modifying compliance programs. It is not an exhaustive list of tests and methodologies, as new, and more effective, approaches may develop over time. Generators should consider the compliance principles set out in Chapter 1 of the document when applying this table. Chapters 1 and 2 of this document provide important context for the application of this table and emphasises that Generators should exercise their own judgement in determining how best to apply the template to meet their compliance requirements.

| **Performance Standard/Rules/Code Provision** | **Suitable testing and monitoring methodology[25]** | **Suggested frequency of testing[26]** | **Notes** | **Basis for compliance assessment** |
|---|---|---|---|---|
| **Reactive Power Capability**<br>(as required under S5.2.5.1 in versions 1-~~71~~ 129 of the Rules, the initial Code, and all amended versions of the Code)[27] | Method 1 (of 5):<br>At rated power output, adjust the reactive power at the connection point to specified levels | Every 3 years and after plant change | Directly Measurable.<br>Applies to synchronous and conventional plant, entire wind farms and solar farms | Be capable of achieving reactive power requirements of the performance standard subject to not exceeding network voltage limits. |
| | Method 2 (of 5):<br>Exercise the over and under excitation limits at as close to rated power output as practical | Every 3 years and after plant change | Directly Measurable.<br>Applies to synchronous and conventional plant | Be capable of achieving reactive power requirements of the performance standard |

25 Where there is more than one method provided, only **one** method is required to be used.

26 See section 2.7 of the template for more information on the factors to be considered when determining the actual frequency.

27 This provision was amended in the Code on 9 August 2001 and on 27 March 2003, and in version 13 of the Rules.

| Performance Standard/Rules/Code Provision | Suitable testing and monitoring methodology[25] | Suggested frequency of testing[26] | Notes | Basis for compliance assessment |
|---|---|---|---|---|
| | | | | subject to not exceeding network voltage limits. |
| | Method 3 (of 5):<br>Step testing of AVR limiters | Every 3 years and after plant change | Applies to conventional plant | Be capable of achieving reactive power requirements of the performance standard subject to not exceeding network voltage limits. |
| **Reactive Power Capability**<br>(as required under S5.2.5.1 in versions 1-~~71~~ 129 of the Rules, the initial Code, and all amended versions of the Code)[28] | Method 4 (of 5):<br>(a) Capability will be tested by component: and | Testing of ancillary plant and type testing of sample turbines/solar installation following plant change | Applies to wind farms plant and solar farms | Be capable of achieving performance standard |
| | (b) Capability will be monitored using SCADA under normal wind and solar farm operation. | Annual review of a selection of events | | Consistency with plant characteristics |

28 This provision was amended in the Code on 9 August 2001 and on 27 March 2003, and in version 13 of the Rules.

| Performance Standard/Rules/Code Provision | Suitable testing and monitoring methodology[25] | Suggested frequency of testing[26] | Notes | Basis for compliance assessment |
|---|---|---|---|---|
| | Method 5 (of 5):<br>Routine testing of relevant sub-systems | As appropriate to the technology of the relevant sub-system | Applicable to a wide range of generating plant and systems | Consistency with plant characteristics |
| **Power Factor Requirements**<br>(as required under S5.3.5 in versions 1-~~71~~ 129 of the Rules, the initial Code, and all amended versions of the Code) | Method 1 (of 1):<br>Direct measurement and calculation of power factor when not generating | Every 3 years and following plant change | Only applies where there is a circuit breaker, allowing auxiliary supply to be drawn through the main connection point | Power factor within allowable range / specification |
| **Quality of Electricity Generated**<br>(as required under S5.2.5.2 in versions 1-~~71~~ 129 of the Rules, the initial Code, and all amended versions of the Code)[29] | Method 1 (of 2):<br>(a) Direct measurements using power quality meters to derive:<br>i. voltage fluctuation levels;<br>ii. voltage balance; and | Following plant change | Performance of generator and its contribution to power quality needs to be separated from the contribution of others | Achieve performance standard or demonstrate consistency with plant characteristics used in determining original compliance |

29 This provision was amended in the Code on 27 March 2003, and in version 13 of the Rules.

| Performance Standard/Rules/Code Provision | Suitable testing and monitoring methodology[25] | Suggested frequency of testing[26] | Notes | Basis for compliance assessment |
|---|---|---|---|---|
| | iii. harmonics, flicker and negative phase sequence voltage; and | | | |
| **Quality of Electricity Generated**<br>(as required under S5.2.5.2 in versions 1-~~71~~ 129 of the Rules, the initial Code, and all amended versions of the Code)[30] | (b) Routine testing of any relevant sub-systems. | As appropriate to the technology of the relevant sub-system | Important when power quality at the connection point is dependent on ancillary plant of power electronic control systems | As above |
| | Method 2 (of 2):<br>(a) Monitoring in-service performance through use of Power Quality Monitors; and | Routine monitoring<br>Specific review every 3 years and following plant change | | Monitors set against the performance standard are not raising alarms.<br>Consistency with plant characteristics (no deterioration). |
| | (b) Testing and/or calibration of any relevant sub-systems. | As appropriate to the technology of the relevant sub-system | Important when power quality at the connection point is dependent on | Consistency with plant characteristics. |

30 This provision was amended in the Code on 27 March 2003, and in version 13 of the Rules.

| Performance Standard/Rules/Code Provision | Suitable testing and monitoring methodology[25] | Suggested frequency of testing[26] | Notes | Basis for compliance assessment |
|---|---|---|---|---|
| | | | ancillary plant of power electronic control systems | |
| **Response to Frequency Disturbances**<br>(as required under S5.2.5.3 in versions 1-~~71~~ 129 of the Rules, the initial Code, and all amended versions of the Code)[31] | Method 1 (of 4):<br>(a) Investigating plant trips that occur during significant frequency disturbances; and | On every event | | Achieve performance standard |
| | (b) Routine testing and/or calibration of relevant sub-systems including:<br>i. testing of control system and/or protection system response to disturbances by the injection of simulated frequency / speed control signals; and<br>ii. Routine tests of electrical / mechanical over speed devices. | As appropriate to the technology of the relevant sub-system | | As above |

31 This provision was amended in the Code on 27 March 2003, and in version 13 of the Rules.

| Performance Standard/Rules/Code Provision | Suitable testing and monitoring methodology[25] | Suggested frequency of testing[26] | Notes | Basis for compliance assessment |
|---|---|---|---|---|
| | | | | |
| **Response to Frequency Disturbances**<br>(as required under S5.2.5.3 in versions 1-12971 of the Rules, the initial Code, and all amended versions of the Code)[32] | Method 2 (of 4):<br>(a) Investigating system performance using high speed data recorders; and | Every event where the plant trips and disturbances where the frequency moves out of the *operational frequency tolerance band* | Appropriate to use where high speed monitors are available and models have been used in establishing compliance | Consistency of operation with ~~plant models used to establish initial compliance~~ 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 or sufficiently sophisticated. |
| | (b) Routine testing and/or calibration of relevant sub-systems including:<br>i. testing of control system and/or protection system response to disturbances by the injection of simulated | As appropriate to the technology of the relevant sub-system | | As above |

32 This provision was amended in the Code on 27 March 2003, and in version 13 of the Rules.

| Performance Standard/Rules/Code Provision | Suitable testing and monitoring methodology[25] | Suggested frequency of testing[26] | Notes | Basis for compliance assessment |
|---|---|---|---|---|
| | frequency / speed control signals; and<br>ii. Routine tests of electrical / mechanical over speed devices. | | | |
| **Response to Frequency Disturbances**<br>(as required under S5.2.5.3 in versions 1-12971 of the Rules, the initial Code, and all amended versions of the Code)[33] | Method 3 (of 4):<br>(a) Verify the modelled performance of a sample of turbines/solar inverter units; | Following plant change~~, which may include control system setting or protection system setting change~~ | Only applicable to small asynchronous generators with digital controls that are aggregated and that do not materially differ in terms of their design and settings | Operation over the frequency range specified and agreed in the Generator Performance Standard |
| | (b) Verify the performance by testing response to an introduced disturbance; | Type testing and verification every 10 years | Each unit is not material and performance slippage is unlikely | Consistent with the performance standard registered at the connection point |
| | (c) Continuous monitoring (high speed) of performance at the connection point; and | | Appropriate to use where high speed monitors are available and models have been | Operation over the frequency range specified and agreed in |

33 This provision was amended in the Code on 27 March 2003, and in version 13 of the Rules.

| Performance Standard/Rules/Code Provision | Suitable testing and monitoring methodology[25] | Suggested frequency of testing[26] | Notes | Basis for compliance assessment |
|---|---|---|---|---|
| | | | used in establishing compliance | the Generator Performance Standard |
| **Response to Frequency Disturbances**<br>(as required under S5.2.5.3 in versions 1-12971 of the Rules, the initial Code, and all amended versions of the Code)[34] | (d) Routine testing and/or calibration of relevant sub-systems including:<br>i. testing of control system response to disturbances by the injection of simulated frequency / speed control signals; and<br>ii. Routine tests of electrical / mechanical over speed devices. | As appropriate to the technology of the relevant sub-system | | As above |
| | Method 4 (of 4):<br>(a) Performance of relevant sub-systems will be monitored using the following systems under normal machine operation: digital protection relays; | Every 3 years by reviewing the response to a disturbance where the system frequency moves outside of the *operational frequency* | | Achieve performance standard |

34 This provision was amended in the Code on 27 March 2003, and in version 13 of the Rules.

| Performance Standard/Rules/Code Provision | Suitable testing and monitoring methodology[25] | Suggested frequency of testing[26] | Notes | Basis for compliance assessment |
|---|---|---|---|---|
| | other data-logging equipment as required; and | *tolerance band,* and after plant change | | |
| | (b) Routine testing and/or calibration and validation of relevant sub-system performance including:<br>i. electrical protection; and<br>ii. turbine protection. | As appropriate to the technology of the relevant sub-system | | As above |
| **Response to Voltage Disturbances**<br>(as required under: S5.2.5.4 in versions 13-129~~71~~ and S5.2.5.3 in versions 1-12 of the Rules ; and S5.2.5.3 in the initial Code, and all amended versions of the Code)[35] | Method 1 (of 3):<br>(a) Investigating plant trips that occur during significant voltage disturbances; and | On every event | | Achieve performance standard |
| | (b) Routine testing and/or calibration of relevant sub-systems including: | As appropriate to the technology of the relevant sub-system | | Consistency with plant characteristics |

35 This provision was amended in the Code on 27 March 2003, and in version 13 of the Rules.

| Performance Standard/Rules/Code Provision | Suitable testing and monitoring methodology[25] | Suggested frequency of testing[26] | Notes | Basis for compliance assessment |
|---|---|---|---|---|
| | i. AVR systems;<br>ii. Auxiliary power systems; and<br>iii. Protection relays. | | | |
| **Response to Voltage Disturbances**<br>(as required under: S5.2.5.4 in versions 13-12~~971~~ and S5.2.5.3 in versions 1-12 of the Rules; and S5.2.5.3 in the initial Code, and all amended versions of the Code)[36] | Method 2 (of 3):<br>(a) Continuous high speed monitoring; and | On every event where the plant trips or on at least one major voltage disturbance every 3 years | Appropriate to use where high speed monitors are available and models have been used in establishing compliance | Consistency of operation with ~~plant models used to establish initial compliance~~ 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 |
| | (b) Routine testing and/or calibration of relevant sub-systems including:<br>i. AVR systems; | As appropriate to the technology of the relevant sub-system | Where possible, testing of auxiliary power systems should include simulated disturbance testing | As above |

36 This provision was amended in the Code on 27 March 2003, and in version 13 of the Rules.

| Performance Standard/Rules/Code Provision | Suitable testing and monitoring methodology[25] | Suggested frequency of testing[26] | Notes | Basis for compliance assessment |
|---|---|---|---|---|
| | ii. Auxiliary power systems; and<br>iii. Protection relays. | | | |
| | Method 3 (of 3):<br>(a) With the generator out of service, test the ability of nominated 415 V drives to sustain a specified voltage interruption; and | Every 4 years and after plant change | Applies only to 415 V drives | Successful ride through of system voltage disturbances, as per the agreed performance standard |
| | (b) In-service monitoring and investigation of any occurrence of a plant trip which may have been associated with a ~~system~~ significant voltage disturbance. | On every event | This type of monitoring will be acceptable only if high speed monitoring is not available | As above |
| **Response to Disturbances following Contingency Events** | ~~Method 1 (of 3):~~<br>~~Direct testing by instigating a network trip~~ | ~~Following plant changes~~ | ~~Preferred method where possible and where risks can be managed~~ | ~~Achieve performance standard~~ |

| Performance Standard/Rules/Code Provision | Suitable testing and monitoring methodology[25] | Suggested frequency of testing[26] | Notes | Basis for compliance assessment |
|---|---|---|---|---|
| (as required under S5.2.5.5 in versions 13-12971 of the Rules)[37] | | | | |
| | Method 2 1 (of 32):<br>(a) Investigate plant trips that occur during or immediately following major system events; and | On every event | | Achieve performance standard |
| **Response to Disturbances following Contingency Events** (as required under S5.2.5.5 in versions 13-12971 of the Rules)[38] | (b) 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 |
| | Method 3 2 (of 32):<br>(a) Continuous monitoring using high speed recorders; and | On disturbances when When the plant trips during or immediately following a significant voltage disturbance and or at | Appropriate to use where high speed monitors are available and models have been used in establishing compliance | Consistency of operation with plant models used to establish initial compliance the latest plant model provided in accordance with clause S5.2.4 if the models are |

37 This provision was amended in version 13 of the Rules.

38 This provision was amended in version 13 of the Rules.

| Performance Standard/Rules/Code Provision | Suitable testing and monitoring methodology[25] | Suggested frequency of testing[26] | Notes | Basis for compliance assessment |
|---|---|---|---|---|
| | | least one major event every 3 years where the generating system maintains *continuous uninterrupted operation*. | | available; OR consistency with past performance only if the models are not available |
| | (b) Routine monitoring and testing and/or calibration of relevant sub-systems. | As appropriate to the technology of the relevant sub-system | | As above |
| **Quality of Electricity Generated and Continuous Uninterrupted Operation** (as required under S5.2.5.6 in versions 13-129~~71~~ of the Rules)[39] | Method 1 (of 2): (a) Direct measurements using power quality meters supplied via measurement transformers and transducers with sufficient frequency bandwidth to test: i. voltage fluctuation levels; ii. voltage balance ; and | Following plant changes | | Achieve performance standard and ensure protection settings are consistent with the performance standard. |

39 This provision was amended in version 13 of the Rules.

| Performance Standard/Rules/Code Provision | Suitable testing and monitoring methodology[25] | Suggested frequency of testing[26] | Notes | Basis for compliance assessment |
|---|---|---|---|---|
| | iii. harmonics, flicker and negative phase sequence voltage prior to synchronisation<br>and to ensure protection settings align to the performance standard; | | | |
| | (b) 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. |
| | (c) Routine monitoring and testing and/or calibration of any relevant sub-systems. | As appropriate to the technology of the relevant sub-system | | As above |
| **Quality of Electricity Generated and Continuous Uninterrupted Operation**<br>(as required under S5.2.5.6 in versions 13-12971 of the Rules)[40] | Method 2 (of 2):<br>Continuous m~~M~~onitoring in-service performance using ~~appropriate metering~~ power quality meters supplied via measurement transformers and | On significant disturbances when the plant trips including at least one major event every 3 years | Appropriate to use where suitable metering is available | Consistency of operation with plant performance specifications |

40 This provision was amended in version 13 of the Rules.

| Performance Standard/Rules/Code Provision | Suitable testing and monitoring methodology[25] | Suggested frequency of testing[26] | Notes | Basis for compliance assessment |
|---|---|---|---|---|
| | transducers with sufficient frequency bandwidth. | | | |
| **Partial Load Rejection**<br>(as required under: S5.2.5.7 in versions 13-12971 and S5.2.5.4 in versions 1-12 of the Rules ; and S5.2.5.4 of the initial Code, and all amended versions of the Code)[41] | Method 1 (of 3):<br>(a) Measure response of the generator to system over-frequency and analyse the unit performance; and | On every event where high frequency moves out of the operational frequency tolerance band or every five years (whichever is more frequent) and after plant change as appropriate to the technology of the relevant sub-system | Directly measurable | Achieve performance standard |
| | (b) Investigation of plant trips. | On every event | | As above |

41 This provision was amended in the Code on 27 March 2003, and in version 13 of the Rules.

| Performance Standard/Rules/Code Provision | Suitable testing and monitoring methodology[25] | Suggested frequency of testing[26] | Notes | Basis for compliance assessment |
|---|---|---|---|---|
| | | | | |
| **Partial Load Rejection**<br>(as required under: S5.2.5.7 in versions 13-12~~971~~ and S5.2.5.4 in versions 1-12 of the Rules; and S5.2.5.4 of the initial Code, and all amended versions of the Code)[42] | Method 2 (of 3):<br>(a) Routine testing and/or calibration of relevant sub-systems including:<br>i. Analytical simulation of generator, auxiliary systems and critical protections; and<br>ii. Secondary injection testing of critical protection systems; and | As appropriate to the technology of the relevant sub-system | | Simulation demonstrates ride through of load rejection event specified in Performance Standard. |
| | (b) Assess any plant trip for relationship to load rejection event. | On every event | Type Test permissible where multiple units are involved | Operation over the conditions specified and agreed in the Generator Performance Standard. |
| | Method 3 (of 3):<br>(a) Response to partial load rejection to be assessed by in-service performance; and | On every event ~~or every 10 years~~ where frequency moves above the operational | | Achieve performance standard. |

42 This provision was amended in the Code on 27 March 2003, and in version 13 of the Rules.

| Performance Standard/Rules/Code Provision | Suitable testing and monitoring methodology[25] | Suggested frequency of testing[26] | Notes | Basis for compliance assessment |
|---|---|---|---|---|
| | | frequency tolerance band or every 5 years (whichever is more frequent) as appropriate to the technology of the relevant sub-system | | |
| | (b) Test for correct operation of turbine overspeed trips. | Every 4 years and after plant change | Overspeed protection checked off-line after major overhauls | That turbine trip operates to within acceptable tolerance of nominal trip setting for overspeed protection. |
| **Protection from Power System Disturbances**<br>(as required under S5.2.5.8 in versions 1-129~~71~~ of the Rules, the initial Code, and all amended versions of the Code)[43] | Method 1 (of 3):<br>(a) Continuous monitoring using high speed recorders; | | Appropriate to use where high speed monitors are available and models have been used in establishing compliance<br>This may not be relevant where alarms are incorporated into | Consistency of operation with ~~plant models used to establish initial compliance~~ the latest plant model provided in accordance with clause S5.2.4 if the models are available; OR consistency with past |

43 This provision was amended in the Code on 27 March 2003, and in version 13 of the Rules.

| Performance Standard/Rules/Code Provision | Suitable testing and monitoring methodology[25] | Suggested frequency of testing[26] | Notes | Basis for compliance assessment |
|---|---|---|---|---|
| | | | the design of the recorder | performance if the models are not available. |
| | (b) Routine testing and/or calibration of relevant sub-systems including applicable protection relays; and | As appropriate to the technology of the relevant sub-system | | That protection system operated in accordance with design and the Performance Standard. |
| | (c) Investigate unit electrical protection trips. | On every event | | As above |
| **Protection from Power System Disturbances** (as required under S5.2.5.8 in versions 1-129~~71~~ of the Rules, the initial Code, and all amended versions of the Code)[44] | Method 2 (of 3): (a) Routine testing and/or calibration of relevant sub-systems including: i. Injection of simulated signals (secondary injection) to demonstrate correct operation of the protection; and | As appropriate to the technology of the relevant sub-system | | Achieve performance standard |

44 This provision was amended in the Code on 27 March 2003, and in version 13 of the Rules.

| Performance Standard/Rules/Code Provision | Suitable testing and monitoring methodology[25] | Suggested frequency of testing[26] | Notes | Basis for compliance assessment |
|---|---|---|---|---|
| | ii. Repair or recalibrate protection relays as required; and | | | |
| | (b) Investigate plant trips. | On every event | | As above |
| **Protection from Power System Disturbances**<br>(as required under S5.2.5.8 in versions 1-129~~71~~ of the Rules, the initial Code, and all amended versions of the Code)[45] | Method 3 (of 3):<br>(a) Performance is monitored, in-service; and | At each major overhaul; and/or every 5 years by routine functional testing of unit electrical protection systems and verification of database registered protection settings to occur annually | Applicable for ~~wind farms~~ generating systems with multiple generating units (solar and wind farms)<br>Changes to ~~turbine~~ generating unit control parameters will be controlled such that the performance of the generating system and generating units is not compromised in | Performance is confirmed by the generating system ~~remaining synchronised~~ maintaining *continuous uninterrupted operation* during power system disturbance conditions where required under a provision of the Rules. |

45 This provision was amended in the Code on 27 March 2003, and in version 13 of the Rules.

| Performance Standard/Rules/Code Provision | Suitable testing and monitoring methodology[25] | Suggested frequency of testing[26] | Notes | Basis for compliance assessment |
|---|---|---|---|---|
| | | | relation to the generator performance standard<br>Appropriate to use where data is available | |
| | (b) Routine testing and/or calibration of relevant sub-systems including testing by secondary injection all protection system relays, between the generating unit terminals but within the generating system. | As appropriate to the technology of the relevant sub-system | | Performance will be assessed against the performance standard requirements. |
| **Protection Systems that Impact on Power System Security**<br>(as required under S5.2.5.9 in versions 1-129~~71~~ of the Rules, the initial Code, and all amended versions of the Code)[46] | Method 1 (of 3):<br>(a) Routine testing and/or calibration of protection systems including:<br>i. CB opening times; and<br>ii. Protection relay injection testing; and | As appropriate to the technology of the protection system<br><br>At least every 5 years and after plant change | Directly measurable | Achieve performance standard |

46 This provision was amended in the Code on 27 March 2003, and in version 13 of the Rules.

| Performance Standard/Rules/Code Provision | Suitable testing and monitoring methodology[25] | Suggested frequency of testing[26] | Notes | Basis for compliance assessment |
|---|---|---|---|---|
| **Protection Systems that Impact on Power System Security**<br>(as required under S5.2.5.9 in versions 1-12971 of the Rules, the initial Code, and all amended versions of the Code)[47] | (b) Confirmation from fault recorder records of actual performance. | Every plant trip | | As above |
| | Method 2 (of 3):<br>(a) Routine testing and/or calibration of relevant sub-systems including:<br>i. protection system testing by secondary injection;<br>ii. checking of circuit breaker opening times;<br>iii. redundancy of primary protection systems; and<br>iv. timing of trip signal issued by the breaker fail protection system; and | As appropriate to the technology of the relevant sub-system<br><br>At least every 5 years and after plant change | | That all protection relays operate satisfactorily and to within design tolerance of setting value. |
| | (b) Assessment of protection system performance in the | On every event | | That protection system is operated in accordance |

47 This provision was amended in the Code on 27 March 2003, and in version 13 of the Rules.

| Performance Standard/Rules/Code Provision | Suitable testing and monitoring methodology[25] | Suggested frequency of testing[26] | Notes | Basis for compliance assessment |
|---|---|---|---|---|
| | event of protection system operation. | | | with design and the Performance Standard. |
| **Protection Systems that Impact on Power System Security**<br>(as required under S5.2.5.9 in versions 1-12971 of the Rules, the initial Code, and all amended versions of the Code)[48] | Method 3 (of 3):<br>(a) Performance is monitored, in-service, where data is available; | At each major overhaul; and/or every 5 years by routine functional testing of unit electrical protection systems and verification of database registered protection settings to occur annually | Changes to ~~turbine~~ generating unit control parameters will be controlled such that the performance of the generating system and generating units is not compromised in relation to the Generator Performance Standard | Performance is confirmed by assessing operation of protection systems against the requirements of the standard when a generating unit trips as a result of fault occurring between the generating unit stator and the connection point. |
| | (b) Relevant testing and or/calibration of any relevant sub-systems including protection system relays shall be tested by secondary injection; and | As appropriate to the technology of the relevant sub-system | | Performance will be assessed against the performance standard requirements following a unit trip as a result of a relevant system event in which the unit should |

48 This provision was amended in the Code on 27 March 2003, and in version 13 of the Rules.

| Performance Standard/Rules/Code Provision | Suitable testing and monitoring methodology[25] | Suggested frequency of testing[26] | Notes | Basis for compliance assessment |
|---|---|---|---|---|
| | | | | have remained synchronised. |
| | (c) Verification of database registered protection settings to occur in conjunction with injection testing. | Every 5 years | | As above |
| **Asynchronous Operation of Synchronous Generating Units / Protection to Trip Plant for Unstable Operation** (as required under S5.2.5.10 in versions 1-12971 of the Rules, the initial Code, and all amended versions of the Code)[49] | Method 1 (of 1): (a) 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<br><br>At least every 5 years and after plant change | | That all protection relays operate satisfactorily and to within design tolerance of setting value. |
| | (b) Assessment of protection system performance in the event of protection system | On every event | | That protection system is operated in accordance |

49 This provision was amended in the Code on 27 March 2003, and in version 13 of the Rules.

| Performance Standard/Rules/Code Provision | Suitable testing and monitoring methodology[25] | Suggested frequency of testing[26] | Notes | Basis for compliance assessment |
|---|---|---|---|---|
| | operation or of asynchronous operation. | | | with design and the Performance Standard. |
| **Frequency Control / Frequency Responsiveness and/or Governor Stability and Governor System** (as required under: S5.2.5.11 in versions 1-12971 of the Rules; S5.2.5.11 and S5.2.6.4 in the initial Code, and all amended versions of the Code before 27 March 2003; and S5.2.5.11 of all amended versions of the Code from 27 March 2003 onwards)[50] | Method 1 (of 4): Monitor in-service performance using high speed frequency data | After every major frequency excursion disturbance | Appropriate to use where high speed monitors are available and models have been used in establishing compliance or when plant has no capability of responding to frequency deviations ie asynchronous machines | Consistency of operation with plant models used to establish initial compliance 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 2 (of 4): Assessment of governor system performance, or the performance of other control systems designed to modulate the active power response to a frequency disturbance, during | On every event | Assessment takes into account inertial response, overall governor droop setting etc | That governor system response is within the tolerance specified by the Performance Standards |

50 This provision was amended in the Code on 27 March 2003, and in version 13 of the Rules.

| Performance Standard/Rules/Code Provision | Suitable testing and monitoring methodology[25] | Suggested frequency of testing[26] | Notes | Basis for compliance assessment |
|---|---|---|---|---|
| **Frequency Control / Frequency Responsiveness and/or Governor Stability and Governor System**<br>(as required under: S5.2.5.11 in versions 1-129~~71~~ of the Rules; S5.2.5.11 and S5.2.6.4 in the initial Code, and all amended versions of the Code before 27 March 2003; and S5.2.5.11 of all amended versions of the Code | events involving significant variation to system frequency | | | |
| | Method 3 (of 4):<br>(a) 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 |
| | (b) Assess generator response to disturbances using high speed recording data. | On every event where the frequency moves out of the operational tolerance band or at least every four years and after plant change | | Consistency of operation with ~~plant models used to establish initial compliance~~ 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 |

| **Performance Standard/Rules/Code Provision** | **Suitable testing and monitoring methodology[25]** | **Suggested frequency of testing[26]** | **Notes** | **Basis for compliance assessment** |
|---|---|---|---|---|
| from 27 March 2003 onwards)[51] | Method 4 (of 4):<br>(a) 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 4 years and after plant change | | Plant performance complies with the Generator Performance Standard |
| | (b) Routine calibration tests. | Every 4 years | | As above |
| **Stability / Impact on Network Capability**<br>(as required under S5.2.5.12 in versions 1-12971 of the Rules, and all amended versions of the Code from 27 March 2003 onwards)[52] | Method 1 (of 1):<br>(a) Monitor in-service performance for relevant performance characteristics not otherwise tested; and | Following plant changes | Generator can only be held responsible for ensuring the performance of their generating system as it contributes to meeting this standard | Consistency of operation ~~with plant models used to establish initial compliance~~ the latest plant model provided in accordance with clause S5.2.4 if the models are available; OR |

51 This provision was amended in the Code on 27 March 2003, and in version 13 of the Rules.

52 This provision was amended in the Code on 27 March 2003, and in version 13 of the Rules.

| Performance Standard/Rules/Code Provision | Suitable testing and monitoring methodology[25] | Suggested frequency of testing[26] | Notes | Basis for compliance assessment |
|---|---|---|---|---|
| | | | | consistency with past performance if the models are not available |
| | (b) 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 |
| **Voltage and Reactive Power Control / Excitation Control System**<br>(as required under: S5.2.5.13 in versions 1-129~~71~~ of the Rules; S5.2.5.13 and S5.2.6.5 in the initial Code, and all amended versions of the Code before 27 March 2003; and S5.2.5.13 of all amended versions of the Code from 27 March 2003 onwards)[53] | Method 1 (of 3):<br>(a) Transfer function measurements and step response tests with the unit unsynchronised and at full load; and | Every 4 years and after plant change. Testing frequency may be reduced for modes that are not routinely used to control the output of the generator | Tests should address all control modes specified in the generator performance standard as commissioned control modes. | Consistency of operation with ~~plant models used to establish initial compliance~~ 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 |

53 This provision was amended in the Code on 27 March 2003, and in version 13 of the Rules.

| Performance Standard/Rules/Code Provision | Suitable testing and monitoring methodology[25] | Suggested frequency of testing[26] | Notes | Basis for compliance assessment |
|---|---|---|---|---|
| **Voltage and Reactive Power Control / Excitation Control System**<br>(as required under: S5.2.5.13 in versions 1-129~~71~~ of the Rules; S5.2.5.13 and S5.2.6.5 in the initial Code, and all amended versions of the Code before 27 March 2003; and S5.2.5.13 of all amended versions of the Code from 27 March 2003 onwards)[54] | (b) Assess the stability of limiter operation; and | Every 4 years and after plant change for the primary commissioned control mode | | As above |
| | (c) Monitoring in-service performance or undertake transfer function measurements. | On every event or every 4 years for the primary commissioned control mode | | As above |
| **Voltage and Reactive Power Control / Excitation Control System** | Method 2 (of 3):<br>(a) AVR step response tests; and | Every 4 years and after plant change for the primary commissioned control mode | | Consistency of operation with ~~plant models used to establish initial compliance~~ the latest plant model provided in accordance with clause S5.2.4 if the models are available; OR consistency with past |

54 This provision was amended in the Code on 27 March 2003, and in version 13 of the Rules.

| Performance Standard/Rules/Code Provision | Suitable testing and monitoring methodology[25] | Suggested frequency of testing[26] | Notes | Basis for compliance assessment |
|---|---|---|---|---|
| (as required under: S5.2.5.13 in versions 1-12971 of the Rules; S5.2.5.13 and S5.2.6.5 in the initial Code, and all amended versions of the Code before 27 March 2003; and S5.2.5.13 of all amended versions of the Code from 27 March 2003 onwards)[55] | | | | performance if the models are not available |
| | (b) AVR step response test of OEL and UEL operation; and | Every 4 years and after plant change for the primary commissioned control mode | | As above |
| | (c) AVR and PSS transfer function measurements over required frequency range. | Every 4 years and after plant change for the primary commissioned control mode | | As above |
| | Method 3 (of 3):<br>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 | Applicable for synchronous generators, wind and solar farms with appropriate monitoring systems installed and models | Consistency of operation with ~~plant models used to establish initial compliance~~ the latest plant model provided in accordance with clause S5.2.4 if the models are |

55 This provision was amended in the Code on 27 March 2003, and in version 13 of the Rules.

| Performance Standard/Rules/Code Provision | Suitable testing and monitoring methodology[25] | Suggested frequency of testing[26] | Notes | Basis for compliance assessment |
|---|---|---|---|---|
| | | | have been used in establishing compliance.<br>Changes to ~~turbine~~ generating unit control parameters will be controlled such that the performance of the generating system and generating units is not compromised in relation to the Generator Performance Standard | available; OR consistency with past performance if the models are not available |
| **Active Power Control**<br>(as required under S5.2.5.14 in versions 13-129~~71~~ of the Rules)[56] | Method 1 (of 2):<br>One-off installation | Following plant change | | Achieve performance standard |
| | Method 2 (of 2):<br>Monitor non-compliance with dispatch market systems | After major event | | Achieve performance standard |

56 This provision was amended in version 13 of the Rules.

| Performance Standard/Rules/Code Provision | Suitable testing and monitoring methodology[25] | Suggested frequency of testing[26] | Notes | Basis for compliance assessment |
|---|---|---|---|---|
| **Remote Monitoring**<br>(as required under S5.2.6.1 in versions 1-12~~971~~ of the Rules, the initial Code, and all amended versions of the Code)[57] | Method 1 (of 2):<br>(a) Calibration of Transducers; and | Following plant change and every 5 years | | Confirmation at each end of the communications system by both parties |
| | (b) Verification of the accuracy of transmitted data. | Following plant change and every 5 years | | As above |
| | Method 2 (of 2):<br>(a) SCADA monitored values and farm panel metering will be routinely checked; and | Every 5 years | Applicable for Wind and Solar Farms | Achieve performance standard |
| | (b) The calibration of transducers and Wind and Solar Farms panel metering will be checked. | At each major outage or once every 5 years | | As above |
| **Communications Equipment**<br>(as required under: S5.2.6.2 in versions 13-12~~971~~ and S5.2.6.3 in versions 1-12 of the Rules ; | Method 1 (of 1):<br>(a) Confirmation of the availability of communication links, | Annual and after plant change | | Achieve performance standard |

57 This provision was amended in the Code on 27 March 2003, and in version 13 of the Rules.

| Performance Standard/Rules/Code Provision | Suitable testing and monitoring methodology[25] | Suggested frequency of testing[26] | Notes | Basis for compliance assessment |
|---|---|---|---|---|
| and S5.2.6.3 of the initial Code, and all amended versions of the Code)[58] | including any backup links with AEMO; and | | | |
| | (b) Testing of relevant sub-systems including any power backup or UPS system. | As appropriate to the technology of the relevant sub-system | | As above |
| **Power Station Auxiliary Transformers / Supplies** (as required under: S5.2.7 in versions 13-12971 and S5.2.8 in versions 1-12 of the Rules ; and S5.2.8 of the initial Code, and all amended versions of the Code)[59] **Power Station Auxiliary Transformers / Supplies** (as required under: S5.2.7 in versions 13-12971 and S5.2.8 in versions 1-12 of the Rules ; and S5.2.8 of the initial Code, and | Method 1 (of 2):<br>(a) Metering of active and reactive power at the auxiliary supply connection point; and | Every 4 years and after plant change | Only applicable when auxiliary supplies are taken from some other point different to generator connection point<br>Access Standards must be established under clause S5.3.5 | Power factor, quality of supply and protection and control requirements within allowable range / specification |
| | (b) 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 (of 2): | | | |

58 This provision was amended in version 13 of the Rules.

59 This provision was amended in the Code on 27 March 2003, and in version 13 of the Rules.

| Performance Standard/Rules/Code Provision | Suitable testing and monitoring methodology[25] | Suggested frequency of testing[26] | Notes | Basis for compliance assessment |
|---|---|---|---|---|
| all amended versions of the Code)[60] | Performance will be monitored as part of condition monitoring and maintenance routines | | This standard only applies to generating systems that takes auxiliary supplies from a separate supply.<br>Unit auxiliary supplies on wind farms are taken from within connection point when units are on-line. Very small wind farm station service auxiliary load requirements are considered negligible under NEM CMP requirements. | Achieve performance standard |
| **Fault Level / Current**<br>(as required under: S5.2.8 in versions 13-12~~971~~ and S5.2.9 in versions 1-12 of the Rules ; and S5.2.9 in all amended versions | Method 1 (of 3):<br>(a) Monitoring in-service performance during faults near the connection point; and | Review following any event | | Calculation confirms current fault current contribution |

60 This provision was amended in the Code on 27 March 2003, and in version 13 of the Rules.

| Performance Standard/Rules/Code Provision | Suitable testing and monitoring methodology[25] | Suggested frequency of testing[26] | Notes | Basis for compliance assessment |
|---|---|---|---|---|
| of the Code from 27 March 2003 onwards)[61] | (b) Review and recalculation of fault levels; and | Following plant change | | As above |
| | (c) Routine testing of any relevant sub-systems. | As appropriate to the technology of the relevant sub-system | | As above |
| **Fault Level / Current** (as required under: S5.2.8 in versions 13-129~~71~~ and S5.2.9 in versions 1-12 of the Rules; and S5.2.9 in all amended versions of the Code from 27 March 2003 onwards)[62] | Method 2 (of 3):<br>(a) Modelling and simulation of plant characteristics to make sure the plant is capable of meeting agreed standards; and | Following plant change | | Calculation confirms current fault current contribution |
| | (b) Monitoring of generator contribution on fault event. | Review following any event | | As above |
| | Method 3 (of 3):<br>(a) Performance of relevant sub-systems will be monitored using the following systems: digital protection relays; | As appropriate to the technology of the relevant sub-system | | Achieve performance standard. |

61 This provision was amended in the Code on 27 March 2003, and in version 13 of the Rules.

62 This provision was amended in the Code on 27 March 2003, and in version 13 of the Rules.

| Performance Standard/Rules/Code Provision | Suitable testing and monitoring methodology[25] | Suggested frequency of testing[26] | Notes | Basis for compliance assessment |
|---|---|---|---|---|
| | other data-logging equipment as required; and | | | |
| | (b) Where recorded data is available, comparison to be made of measured fault currents and computer simulations; and | Following a fault | | Consistency of operation with ~~plant models used to establish initial compliance~~ 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. |
| | (c) Review and recalculation of fault levels. | Following plant change | | As above |