

Reliability Panel AEMC

TEMPLATE FOR GENERATOR COMPLIANCE PROGRAMS

27 June 2012

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About the AEMC

The Council of Australian Governments, through its Ministerial Council on Energy (MCE), established the Australian Energy Market Commission (AEMC) in July 2005. The AEMC has two principal functions. We make and amend the national electricity and gas rules, and we conduct independent reviews of the energy markets for the MCE.

About the AEMC Reliability Panel (Panel)

The Panel is a specialist body within 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.

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Notes to this document

Compliance with technical standards is crucial to ensuring power system security in the National Electricity Market (NEM). Ensuring high levels of compliance with effective standards is fundamental to the safe and reliable operation of the power system within the power system's technical envelope. If this were not the case, the risk of a major power system incident would materially increase.^a

Clause 8.8.1(a)(2b) of the National Electricity Rules (Rules) includes requirements for the Reliability Panel (Panel) to develop a template for generator compliance programs (template) based on a public consultation process. The template seeks to define "good electricity industry practice" in the management of generator plant performance and adherence to standards (but does not of itself fully define nor guarantee good electricity industry practice), and hence provides certainty for Generators as to what is required of their compliance programs. Generators must develop and maintain compliance programs in line with the template.

Clause 8.8.3(ba) of the Rules also provides an ongoing role for the Panel including an obligation to review the template at least every three years or as the AEMC directs. The regular reviews of the template will ensure its consistency with the Rules and provide a continual improvement focus.

The Panel undertook an extensive consultation process in developing the initial template.^b This process included:

- forming an ad-hoc Working Group under the direction of Panel to assist in the development of the template. The Working Group was chaired by a member of the Panel and had representation from the National Generators Forum (NGF), the Clean Energy Council, Transmission Network Service Providers, the Australian Energy Regulator (AER) and the Australian Energy Market Operator (AEMO). Members of the Working Group have contributed their extensive experience to the development task;
- giving notice to all Registered Participants of the Panel's review to develop the template in accordance to clause 8.8.3(d) of the Rules and publishing an Issues Paper on 22 January 2009. Submissions closed on 6 March 2009;
- publishing a Draft Report on 8 May 2009. Submissions closed on 19 June 2009; and
- holding a meeting which was open to all Registered Participants on its draft template at the office of the AEMC on 12 June 2009.

On 31 July 2009, the Panel submitted to the AEMC its Final Report on the template for generator compliance programs for publication in accordance with clause 8.8.3(j)

^a Final Report of the AEMC Review of Enforcement of and Compliance with Technical Standards (dated 1 September 2006), p.4.

^b In November 2008, the Commission provided terms of reference to the Panel requiring it to conduct this review as required under clause 8.8.3 of the Rules.

of the Rules. The Panel, for the reasons as set out in Chapter 2 of the Final Report, has determined that the template consist of the table of compliance measures and explanatory material set out in Chapters 3 and 4 of the Final Report. These chapters of the Final Report have therefore had minor reformatting and renumbering to constitute this template. For further details on the Panel's development and determination of the initial template, refer to the Final Report.

In September 2011, the AEMC provided terms of reference to the Panel to undertake the first of the three-yearly reviews of the template. The review process included consultation with stakeholders on an issues paper and a draft report. A public meeting was held on 16 May 2012 via teleconference where participants discussed the template and potential amendments. The review did not identify material issues with the template. Minor amendments were made to clarify existing provisions in the template and to make minor improvements to the template's ease of use. Details of the Panel's considerations are set out in the final report on this review.^c

Generators are required to institute and maintain a compliance program consistent with this template (and other relevant requirements under the Rules).^d Such a program must be instituted as soon as reasonably practicable but, in accordance with clause 4.15(b) of the Rules, no later than:

- (1) 6 months after the day that AEMO gives notice to the Registered Participant of registration of the performance standard under rule 4.14(n); or
- (2) 6 months after the day on which the relevant plant commences operation.

Participants are required to modify their compliance programs in accordance with the Panel's amended template by no later than six months after the amendments are published.^e The nature of the amendments is minor and the Panel considers the amendments will not have significant operational impacts on participants.

All enquiries on this template should be addressed to the Reliability Panel Secretariat on (02) 8296 7800.

^c AEMC Reliability Panel, Final Report, Review of the template for generator compliance programs, 27 June 2012.

^d Refer to clause 4.15(c) of the Rules.

^e Clause 4.15(c)(3) of the rules provides a default timeframe of 6 months, but also enables the Panel to establish an alternative timeframe for participants to implement changes to the template. The Panel did not propose alternative timing for implementation due to the minor nature of the amendments.

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1 Principles and guidelines for compliance programs

1.1 Introduction

This chapter outlines the principles the AEMC Reliability Panel (Panel) adopted in developing the template for generator compliance programs (template). The documenting of these principles should be a guide to future revision and development of the template. In addition, generators should consider these principles in applying the template to their compliance programs.

The chapter also provides guidance to assist Generators develop their own compliance programs. Compliance programs must be consistent with the template and include procedures to monitor the performance of plant in a manner that is consistent with good electricity industry practice. The Panel considered that good practice requires Generators to refine the template within an appropriate compliance management setting to their specific plant characteristics.

1.2 Compliance principles

The Panel used the following compliance principles in developing its template. These are recommended to be used as a guide in future reviews of the 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 electrical 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 TNSP.
- Principle 10: Compliance programs should be reviewed and updated periodically.

1.3 The nature of the template and its application

A clear objective of the template is to provide clarity to all parties as to what constitutes good electricity industry practice with respect to technical standards compliance. The work of the Panel in developing the template and most submissions on the Panel's development of the template, however, highlight the difficulty of establishing a single template for the diverse range of plant in the NEM. The submission by PacificHydro reinforces this point stating that:⁶

"The requirement to develop and mandate a template creates a significant challenge. Such a template must be broad enough to cover the various technologies; allow for different types of connection points; and avoid being overly prescriptive, as this in itself could design in compliance failure for generators."

Considering the principles under which the template is to be developed and in light of:

- the variety of technology of generating plant in the NEM;
- the different ages and sizes of that plant;
- the plant specific attributes of the generating plant and its potential impacts on the network; and

⁶ PacificHydro submission on the Issues Paper (AEMC Reliability Panel 2009, Template for Generator Compliance Programs, Issues Paper, 22 January 2009, Sydney), 9 March 2009, p.1.

- the differing technical standards (or registered performance standards) to which they must comply,

the Panel recognised that the template cannot be a prescriptive list of compliance choices. Such an approach would not be efficient nor 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. This is consistent with the NGF submission which envisioned a role for the template within a “quality assurance framework”.⁷

It is also broadly consistent with the proposals by PacificHydro. PacificHydro suggested that the Australian Standard for Compliance Programs (AS 3806-2006) should be used as a starting point and it should be assumed that companies are using AS 3806 already in their compliance systems.⁸ PacificHydro argued that the specific technical principles should not be contrary to, nor overwrite, any of the principles contained in AS 3806.⁹

The following section outlines the nature of such a framework and the following chapter provides a table to assist Generators in developing their compliance programs.

1.4 The framework for the development of a compliance program

The Panel recognised that the Rules requires Generators to implement compliance programs that are consistent with the template but not a carbon copy of the template. The template is not an exhaustive document and is intended to assist Generators to design its own compliance programs. It is recognised that as each Generator may have its own particular requirements for their plant, the Generator is responsible for developing its own compliance program. The development of the compliance program and its ongoing application must, however, be within an appropriate framework.

In its submission¹⁰, AEMO (formerly NEMMCO) proposed that the framework for compliance programs be further clarified in the form of a “multi-faceted approach”.

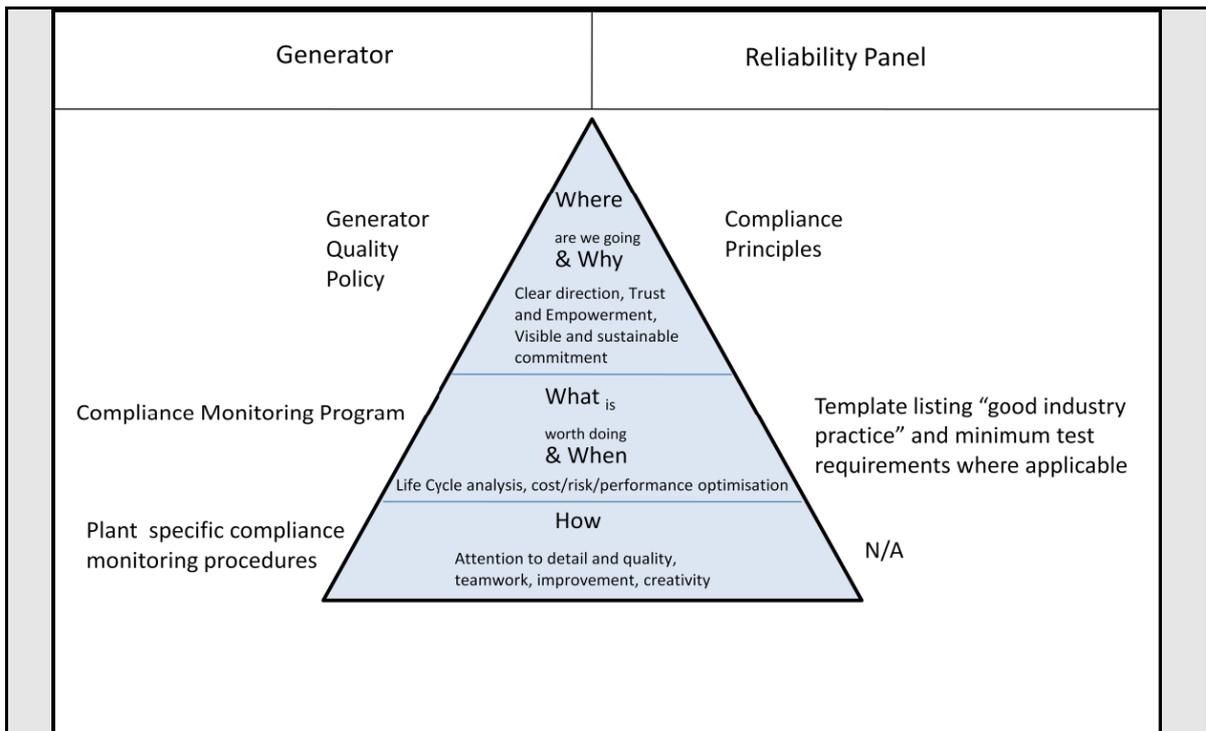
The figure below summarises AEMO’s proposed approach and the following extract from their submission¹¹ describes the proposal in more detail.

⁷ NGF submission on the Issues Paper (AEMC Reliability Panel 2009, Template for Generator Compliance Programs, Issues Paper, 22 January 2009, Sydney), 6 March 2009, p.1.

⁸ PacificHydro submission on the Issues Paper (AEMC Reliability Panel 2009, Template for Generator Compliance Programs, Issues Paper, 22 January 2009, Sydney), 9 March 2009, Pp.1-2.

⁹ PacificHydro submission on the Issues Paper (AEMC Reliability Panel 2009, Template for Generator Compliance Programs, Issues Paper, 22 January 2009, Sydney), 9 March 2009, Pp.1-2.

¹⁰ AEMO submission on the Issues Paper (AEMC Reliability Panel 2009, Template for Generator Compliance Programs, Issues Paper, 22 January 2009, Sydney), 6 March 2009, p.5.



“The figure indicates a tiered approach. Documentation to be put in place by the Reliability Panel is indicated on the right hand side of the triangle, while the documentation the generators will need to have in place in response to this is indicated to the left.

The compliance principles that the Panel now asks the generators to follow will be based on internationally recognised quality management system principles such as can be found in the ISO9000, 9001 and 9004 set of standards. This set of compliance principles will need to be followed in the establishment, implementation and maintenance of the Generator Compliance Program. The concept of the suitability of testing and monitoring regimes for each performance standard as per Rule 4.15(ca) is therefore taken to a higher level. Generators will have to show that their processes are well managed and that there are sufficient supporting systems in place with regards to resourcing for, execution and review of all the processes supporting the achievement of performance standard targets.

At the next level the Reliability Panel will be responsible for putting a more detailed template in place. This template will indicate which tests and monitoring techniques constitute good electricity industry practice for each performance standard area for different technologies.

At the top tier on the generator side there is a quality management policy that will have to show:

- the processes needed for the establishment, implementation and maintenance of the Generator Compliance Program

11 AEMO submission on the Issues Paper (AEMC Reliability Panel 2009, Template for Generator Compliance Programs, Issues Paper, 22 January 2009, Sydney), 6 March 2009, Pp.5-6.

- the sequence and interaction of these processes,
- the determination of criteria and methods needed to ensure that both the operation and control of these processes are effective,
- the availability of resources and information necessary to support the operation and monitoring of these processes,
- that these processes are monitored, measured and analysed, and
- actions necessary to achieve planned results and continual improvement of these processes are implemented.

The resulting Generator Performance Standard Compliance Plan will then consist of a document detailing the systems and processes in place to ensure the generators ability to consistently meet regulatory requirements. The compliance program should stipulate how the processes are managed in terms of issues such as records and document control, handling of non-conformances and management review. The design and implementation of a generator’s specific compliance program will be influenced by varying needs, particular technologies, the products provided, the processes employed and be manageable irrespective of the size and structure of the organisation. The plan should also include an assessment plan that stipulates the specified monitoring and test procedures including required frequency of testing. At the bottom of the tier on the generator side there should be a set of compliance monitoring procedures for each test the compliance program prescribes. These will include step by step instructions including the following:

- input and output requirements (for example specifications, resources and records to be kept),
- activities within the processes,
- verification and validation of processes and products,
- analysis of the process including dependability,
- identification, assessment and mitigation of risk,
- corrective and preventive actions,
- opportunities and actions for process improvement, and
- control of changes to processes and products.”

The Panel decided not to mandate a particular management approach or standard, knowing that different organisations have their own approaches or are certified to various standards. However, in the context of developing the template, the Panel considered that AEMO’s general proposal in clarifying the compliance program framework will assist it in determining the scope of the template and avoid duplicating other processes within the framework.

1.5 The need for documentation within the overall compliance arrangements

While the Panel did not intend to mandate a particular management approach, any appropriate management would have a number of characteristics. One of those would be to record and document decisions. In addition to being necessary for proper management control, documentation will be necessary within the broader NEM compliance arrangements.

The overall compliance arrangements in the Rules and the NEL rely on participation of Generators, AEMO and the AER. For the framework of compliance programs to function effectively, in addition to the Panel's role in developing and reviewing the template, it was anticipated by the AEMC in its final Rule determination that:¹²

- Registered Participants (Generators) will institute and maintain generator compliance programs based on the template;
- the AER will regularly conduct spot audits of selected Generators' compliance programs as part of its compliance monitoring activities; and
- Generators will engage with external auditors to independently audit their compliance programs to determine whether they are required to amend their compliance programs and amend if required.

¹² AEMC 2008, Performance Standard Compliance of Generators, Rule Determination (23 October 2008, Sydney), p.v.

2 Table for developing generator compliance programs

2.1 Introduction

A table to assist Generators to develop their own compliance programs ('the table') is provided at the end of this chapter. 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 2.8 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

Table 2.9 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 ten 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, the testing and monitoring is, in some cases, based on the need to maintain compliance.

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 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 and Code, clause numbering and title in some places. At the time that this template was last updated, version 49 of the Rules was the latest version. Reference to version 49 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 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, there is a column titled "Suggested frequency of testing". This column 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;²⁰ and
- 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.²¹ 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 Basis for compliance assessment

In the table, there is a column titled “Basis for compliance assessment”. 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. This column indicates the type of measure required as the benchmark for a particular method.

2.9 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*. 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*.

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,

²⁰ This could include considering any specific requirements related to the minimum number of operational hours required prior to undertaking ‘major inspections’.

²¹ 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.

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.

Table 2.9 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. Generators should consider the ten compliance principles set out in Chapter 1 of the template when applying this table. Chapters 1 and 2 of the template provide important context for the application of this table and emphasize 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 ¹⁵	Suggested frequency of testing ¹⁶	Notes	Basis for compliance assessment
Reactive Power Capability (as required under S5.2.5.1 in versions 1-49 of the Rules, the initial Code, and all amended versions of the Code) ¹⁷	Method 1 (of 5): At rated power output, adjust the reactive power at the connection point to specified levels	Every 3 years and after <u>plant change</u>	Directly Measurable. Applies to synchronous and conventional plant, and entire wind farms	Be capable of achieving reactive power requirements of the performance standard
	Method 2 (of 5): Exercise the over and under excitation limits at as close to rated power output as practical	Every 3 years and after <u>plant change</u>	Directly Measurable. Applies to synchronous and conventional plant	Be capable of achieving reactive power requirements of the performance standard

¹⁵ Where there is more than one method provided, only **one** method is required to be used.

¹⁶ See section 2.7 of the template for more information on the factors to be considered when determining the actual frequency.

¹⁷ 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 ¹⁵	Suggested frequency of testing ¹⁶	Notes	Basis for compliance assessment
	Method 3 (of 5): Step testing of AVR limiters	Every 3 years and after <u>plant change</u>	Applies to conventional plant	Be capable of achieving reactive power requirements of the performance standard
Reactive Power Capability (as required under S5.2.5.1 in versions 1-49 of the Rules, the initial Code, and all amended versions of the Code) ¹⁸	Method 4 (of 5): (a) Capability will be tested by component: and	Testing of ancillary plant and <u>type testing</u> of sample turbines following <u>plant change</u>	Applies to wind farms plant	Be capable of achieving performance standard
	(b) Capability will be monitored using SCADA under normal wind farm operation.	Annual review of a selection of events		Consistency with plant characteristics
	Method 5 (of 5): Routine testing of <u>relevant sub-systems</u>	As appropriate to the technology of the <u>relevant sub-system</u>	Applicable to a wide range of generating plant and systems	Consistency with plant characteristics

¹⁸ 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 methodology¹⁵	Suggested frequency of testing¹⁶	Notes	Basis for compliance assessment
Power Factor Requirements (as required under S5.3.5 in versions 1-49 of the Rules, the initial Code, and all amended versions of the Code)	Method 1 (of 1): Direct measurement and calculation of power factor when not generating	Every 3 years and following <u>plant change</u>	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 (as required under S5.2.5.2 in versions 1-49 of the Rules, the initial Code, and all amended versions of the Code) ¹⁹	Method 1 (of 2): (a) Direct measurements using power quality meters to derive: <ul style="list-style-type: none"> i. voltage fluctuation levels; ii. voltage balance; and iii. harmonics, flicker and negative phase sequence voltage; and 	Following <u>plant change</u>	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

¹⁹ 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 ¹⁵	Suggested frequency of testing ¹⁶	Notes	Basis for compliance assessment
Quality of Electricity Generated (as required under S5.2.5.2 in versions 1-49 of the Rules, the initial Code, and all amended versions of the Code) ²⁰	(b) Routine testing of any <u>relevant sub-systems</u> .	As appropriate to the technology of the <u>relevant sub-system</u>	Important when power quality at the connection point is dependent on ancillary plant of power electronic control systems	As above
	Method 2 (of 2): (a) Monitoring in-service performance through use of Power Quality Monitors; and	Routine monitoring Specific review every 3 years and following <u>plant change</u>		Monitors set against the performance standard are not raising alarms. Consistency with plant characteristics (no deterioration).
	(b) Testing and/or calibration of any <u>relevant sub-systems</u> .	As appropriate to the technology of the <u>relevant sub-system</u>	Important when power quality at the connection point is dependent on ancillary plant of power electronic control systems	Consistency with plant characteristics.

²⁰ 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 ¹⁵	Suggested frequency of testing ¹⁶	Notes	Basis for compliance assessment
Response to Frequency Disturbances (as required under S5.2.5.3 in versions 1-49 of the Rules, the initial Code, and all amended versions of the Code) ²¹	Method 1 (of 4): (a) Investigating <u>plant trips</u> that occur during significant frequency disturbances; and	On every event		Achieve performance standard
	(b) Routine testing and/or calibration of <u>relevant sub-systems</u> including: <ul style="list-style-type: none"> i. testing of control system and/or protection system response to disturbances by the injection of simulated frequency / speed control signals; and ii. Routine tests of electrical / mechanical over speed devices. 	As appropriate to the technology of the <u>relevant sub-system</u>		As above

²¹ 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 ¹⁵	Suggested frequency of testing ¹⁶	Notes	Basis for compliance assessment
Response to Frequency Disturbances (as required under S5.2.5.3 in versions 1-49 of the Rules, the initial Code, and all amended versions of the Code) ²²	Method 2 (of 4): (a) Investigating system performance using high speed data recorders; and	Every event where the <u>plant trips</u> and disturbances where the frequency moves out of the <i>operational frequency tolerance band</i>	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 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 <u>relevant sub-systems</u> including: i. testing of control system and/or protection system response to disturbances by the injection of simulated frequency / speed control signals; and ii. Routine tests of electrical / mechanical over speed	As appropriate to the technology of the <u>relevant sub-system</u>		As above

²² 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 ¹⁵	Suggested frequency of testing ¹⁶	Notes	Basis for compliance assessment
Response to Frequency Disturbances (as required under S5.2.5.3 in versions 1-49 of the Rules, the initial Code, and all amended versions of the Code) ²³	devices.			
	Method 3 (of 4): (a) Verify the modelled performance of a sample of turbines;	Following <u>plant change</u> , 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;	<u>Type testing</u> 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 used in establishing compliance	Operation over the frequency range specified and agreed in the Generator Performance Standard

²³ 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 ¹⁵	Suggested frequency of testing ¹⁶	Notes	Basis for compliance assessment
Response to Frequency Disturbances (as required under S5.2.5.3 in versions 1-49 of the Rules, the initial Code, and all amended versions of the Code) ²⁴	(d) Routine testing and/or calibration of <u>relevant sub-systems</u> including: <ul style="list-style-type: none"> i. testing of control system response to disturbances by the injection of simulated frequency / speed control signals; and ii. Routine tests of electrical / mechanical over speed devices. 	As appropriate to the technology of the <u>relevant sub-system</u>		As above
	Method 4 (of 4): <ul style="list-style-type: none"> (a) Performance of <u>relevant sub-systems</u> will be monitored using the following systems under normal machine operation: digital protection relays; other data-logging equipment as required; and 	Every 3 years		Achieve performance standard
	(b) Routine testing and/or	As appropriate to the technology of the		As above

²⁴ 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 ¹⁵	Suggested frequency of testing ¹⁶	Notes	Basis for compliance assessment
	calibration and validation of <u>relevant sub-system</u> performance including: <ul style="list-style-type: none"> i. electrical protection; and ii. turbine protection. 	<u>relevant sub-system</u>		
Response to Voltage Disturbances (as required under: S5.2.5.4 in versions 13-49 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) ²⁵	Method 1 (of 3): (a) Investigating <u>plant trips</u> that occur during significant voltage disturbances; and	On every event		Achieve performance standard
	(b) Routine testing and/or calibration of <u>relevant sub-systems</u> including: <ul style="list-style-type: none"> i. AVR systems; ii. Auxiliary power systems; and iii. Protection relays. 	As appropriate to the technology of the <u>relevant sub-system</u>		Consistency with plant characteristics

²⁵ 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 ¹⁵	Suggested frequency of testing ¹⁶	Notes	Basis for compliance assessment
Response to Voltage Disturbances (as required under: S5.2.5.4 in versions 13-49 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) ²⁶	Method 2 (of 3): (a) Continuous high speed monitoring; and	On every event where the <u>plant trips</u> 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 if the models are available; OR consistency with past performance only if the models are not available
	(b) Routine testing and/or calibration of <u>relevant sub-systems</u> including: i. AVR systems; ii. Auxiliary power systems; and iii. Protection relays.	As appropriate to the technology of the <u>relevant sub-system</u>	Where possible, testing of auxiliary power systems should include simulated disturbance testing	As above
	Method 3 (of 3): (a) With the generator out of service, test the ability of	Every 4 years	Applies only to 415 V drives	Successful ride through of system voltage

²⁶ 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 ¹⁵	Suggested frequency of testing ¹⁶	Notes	Basis for compliance assessment
	nominated 415 V drives to sustain a specified voltage interruption; and			disturbances, as per the agreed performance standard
	(b) In-service monitoring and investigation of any occurrence of a <u>plant trip</u> which may have been associated with a system 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 (as required under S5.2.5.5 in versions 13-49 of the Rules) ²⁷	Method 1 (of 3): Direct testing by instigating a network trip	Following <u>plant changes</u>	Preferred method where possible and where risks can be managed	Achieve performance standard
	Method 2 (of 3): (a) Investigate <u>plant trips</u> that occur during or immediately following major system events; and	On every event		Achieve performance standard

²⁷ This provision was amended in version 13 of the Rules.

Performance Standard/Rules/Code Provision	Suitable testing and monitoring methodology ¹⁵	Suggested frequency of testing ¹⁶	Notes	Basis for compliance assessment
Response to Disturbances following Contingency Events (as required under S5.2.5.5 in versions 13-49 of the Rules) ²⁸	(b) Routine monitoring and testing and/or calibration of <u>relevant sub-systems</u> including suitable testing to confirm circuit breaker operating times.	As appropriate to the technology of the <u>relevant sub-system</u>		As above
	Method 3 (of 3): (a) Continuous monitoring using high speed recorders; and	On disturbances when the <u>plant trips</u> or at least one major event 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 if the models are available; OR consistency with past performance only if the models are not available
	(b) Routine monitoring and testing and/or calibration of <u>relevant sub-systems</u> .	As appropriate to the technology of the <u>relevant sub-system</u>		As above

²⁸ This provision was amended in version 13 of the Rules.

Performance Standard/Rules/Code Provision	Suitable testing and monitoring methodology ¹⁵	Suggested frequency of testing ¹⁶	Notes	Basis for compliance assessment
Quality of Electricity Generated and Continuous Uninterrupted Operation (as required under S5.2.5.6 in versions 13-49 of the Rules) ²⁹	Method 1 (of 2): (a) Direct measurements using power quality meters to test: i. voltage fluctuation levels; ii. voltage balance ; and iii. harmonics, flicker and negative phase sequence voltage prior to synchronisation and to ensure protection settings align to the performance standard;	Following <u>plant changes</u>		Achieve performance standard and ensure protection settings are consistent with the performance standard.
	(b) Investigating <u>plant trips</u> 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 <u>relevant sub-systems</u> .	As appropriate to the technology of the <u>relevant sub-system</u>		As above

²⁹ This provision was amended in version 13 of the Rules.

Performance Standard/Rules/Code Provision	Suitable testing and monitoring methodology ¹⁵	Suggested frequency of testing ¹⁶	Notes	Basis for compliance assessment
Quality of Electricity Generated and Continuous Uninterrupted Operation (as required under S5.2.5.6 in versions 13-49 of the Rules) ³⁰	Method 2 (of 2): Monitoring in-service performance using appropriate metering	On 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
Partial Load Rejection (as required under: S5.2.5.7 in versions 13-49 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) ³¹	Method 1 (of 3): (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)	Directly measurable	Achieve performance standard
	(b) Investigation of <u>plant trips</u> .	On every event		As above

³⁰ This provision was amended in version 13 of the Rules.

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 ¹⁵	Suggested frequency of testing ¹⁶	Notes	Basis for compliance assessment
Partial Load Rejection (as required under: S5.2.5.7 in versions 13-49 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) ³²	Method 2 (of 3): (a) Routine testing and/or calibration of <u>relevant sub-systems including</u> : i. Analytical simulation of generator, auxiliary systems and critical protections; and ii. Secondary injection testing of critical protection systems; and	As appropriate to the technology of the <u>relevant sub-system</u>		Simulation demonstrates ride through of load rejection event specified in Performance Standard.
	(b) Assess any <u>plant trip</u> for relationship to load rejection event.	On every event	<u>Type Test</u> permissible where multiple units are involved	Operation over the conditions specified and agreed in the Generator Performance Standard.
	Method 3 (of 3): (a) Response to partial load rejection to be assessed by in-service performance; and	On every event or every 10 years (whichever is more frequent)		Achieve performance standard.

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 ¹⁵	Suggested frequency of testing ¹⁶	Notes	Basis for compliance assessment
	(b) Test for correct operation of turbine overspeed trips.	Every 4 years	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 (as required under S5.2.5.8 in versions 1-49 of the Rules, the initial Code, and all amended versions of the Code) ³³	Method 1 (of 3): (a) Continuous monitoring using high speed recorders;		Appropriate to use where high speed monitors are available and models have been used in establishing compliance This may not be relevant where alarms are incorporated into the design of the recorder	Consistency of operation with plant models used to establish initial compliance if the models are available; OR consistency with past performance if the models are not available.
	(b) Routine testing and/or calibration of <u>relevant sub-systems</u> including applicable protection relays; and	As appropriate to the technology of the <u>relevant sub-system</u>		That protection system operated in accordance with design and the Performance Standard.

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 ¹⁵	Suggested frequency of testing ¹⁶	Notes	Basis for compliance assessment
Protection from Power System Disturbances (as required under S5.2.5.8 in versions 1-49 of the Rules, the initial Code, and all amended versions of the Code) ³⁴	(c) Investigate unit electrical protection trips.	On every event		As above
	Method 2 (of 3): (a) Routine testing and/or calibration of <u>relevant sub-systems including:</u> i. Injection of simulated signals (secondary injection) to demonstrate correct operation of the protection; and ii. Repair or recalibrate protection relays as required; and	As appropriate to the technology of the <u>relevant sub-system</u>		Achieve performance standard
	(b) Investigate <u>plant trips</u> .	On every event		As above

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 ¹⁵	Suggested frequency of testing ¹⁶	Notes	Basis for compliance assessment
<p>Protection from Power System Disturbances (as required under S5.2.5.8 in versions 1-49 of the Rules, the initial Code, and all amended versions of the Code)³⁵</p>	<p>Method 3 (of 3):</p> <p>(a) Performance is monitored, in-service; and</p>	<p>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</p>	<p>Applicable for wind farms</p> <p>Changes to turbine 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</p> <p>Appropriate to use where data is available</p>	<p>Performance is confirmed by the generating system remaining synchronised during power system disturbance conditions where required under a provision of the Rules.</p>
	<p>(b) Routine testing and/or calibration of <u>relevant sub-systems</u> including testing by secondary injection all protection system relays,</p>	<p>As appropriate to the technology of the <u>relevant sub-system</u></p>		<p>Performance will be assessed against the performance standard requirements.</p>

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 ¹⁵	Suggested frequency of testing ¹⁶	Notes	Basis for compliance assessment
	between the generating unit terminals but within the generating system.			
Protection Systems that Impact on Power System Security (as required under S5.2.5.9 in versions 1-49 of the Rules, the initial Code, and all amended versions of the Code) ³⁶	Method 1 (of 3): (a) Routine testing and/or calibration of protection systems including: i. CB opening times; and ii. Protection relay injection testing; and	As appropriate to the technology of the protection system	Directly measurable	Achieve performance standard
	(b) Confirmation from fault recorder records of actual performance.	Every <u>plant trip</u>		As above
	Method 2 (of 3): (a) Routine testing and/or calibration of <u>relevant sub-systems</u> including: i. protection system testing	As appropriate to the technology of the <u>relevant sub-system</u>		That all protection relays operate satisfactorily and to within design tolerance of setting

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 ¹⁵	Suggested frequency of testing ¹⁶	Notes	Basis for compliance assessment
Protection Systems that Impact on Power System Security (as required under S5.2.5.9 in versions 1-49 of the Rules, the initial Code, and all amended versions of the Code) ³⁷	by secondary injection; ii. checking of circuit breaker opening times; iii. redundancy of primary protection systems; and iv. timing of trip signal issued by the breaker fail protection system; and	On every event		value.
	(b) 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.
	Method 3 (of 3): (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	Changes to turbine control parameters will be controlled such that the performance of the generating system and generating units is not compromised in relation to the	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

³⁷ 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 ¹⁵	Suggested frequency of testing ¹⁶	Notes	Basis for compliance assessment
Protection Systems that Impact on Power System Security (as required under S5.2.5.9 in versions 1-49 of the Rules, the initial Code, and all amended versions of the Code) ³⁸		protection settings to occur annually	Generator Performance Standard	unit stator and the connection point.
	(b) Relevant testing and or/calibration of any <u>relevant sub-systems</u> including protection system relays shall be tested by secondary injection; and	As appropriate to the technology of the <u>relevant sub-system</u>		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 have remained synchronised.
	(c) Verification of database registered protection settings to occur in conjunction with injection testing.	Every 5 years		As above

³⁸ 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 ¹⁵	Suggested frequency of testing ¹⁶	Notes	Basis for compliance assessment
Asynchronous Operation of Synchronous Generating Units / Protection to Trip Plant for Unstable Operation (as required under S5.2.5.10 in versions 1-49 of the Rules, the initial Code, and all amended versions of the Code) ³⁹	Method 1 (of 1): (a) Routine testing and/or calibration of <u>relevant sub-systems</u> including protection system testing by secondary injection; and	As appropriate to the technology of the <u>relevant sub-system</u>		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 operation or of asynchronous operation.	On every event		That protection system is operated in accordance 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 1-49 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	Method 1 (of 4): Monitor in-service performance using high speed frequency data	After every major frequency excursion	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	Consistency of operation with plant models used to establish initial compliance if the models are available; OR consistency with past performance only if the models are not available

³⁹ 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 ¹⁵	Suggested frequency of testing ¹⁶	Notes	Basis for compliance assessment
March 2003; and S5.2.5.11 of all amended versions of the Code from 27 March 2003 onwards) ⁴⁰			ie asynchronous machines	
	Method 2 (of 4): Assessment of governor system performance during events involving significant variation to system frequency	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
	Method 3 (of 4): (a) Analytical simulation of turbine and governor systems; and	<u>Type Test</u> 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		Consistency of operation with plant models used to establish initial compliance if the models are available; OR consistency with past performance only if the models are not available

⁴⁰ 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 methodology¹⁵	Suggested frequency of testing¹⁶	Notes	Basis for compliance assessment
Frequency Control / Frequency Responsiveness and/or Governor Stability and Governor System (as required under: S5.2.5.11 in versions 1-49 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) ⁴¹	Method 4 (of 4): (a) Step response test of the governor to test damping and droop characteristics; and	Every 4 years		Plant performance complies with the Generator Performance Standard
	(b) Routine calibration tests.	Every 4 years		As above
Stability / Impact on Network Capability (as required under S5.2.5.12 in versions 1-49 of the Rules, and all amended versions of the	Method 1 (of 1): (a) Monitor in-service performance for relevant performance characteristics not otherwise tested; and	Following <u>plant changes</u>	Generator can only be held responsible for ensuring the performance of their	Consistency of operation with plant models used to establish initial compliance if the models

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 ¹⁵	Suggested frequency of testing ¹⁶	Notes	Basis for compliance assessment
Code from 27 March 2003 onwards) ⁴²			generating system as it contributes to meeting this standard	are available; OR consistency with past performance if the models are not available
	(b) Routine monitoring and testing and/or calibration of <u>relevant sub-systems</u> including suitable testing to confirm power system stabiliser performance (if relevant).	As appropriate to the technology of the <u>relevant sub-system</u>		As above
Voltage and Reactive Power Control / Excitation Control System (as required under: S5.2.5.13 in versions 1-49 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	Method 1 (of 3): (a) Transfer function measurements and step response tests with the unit unsynchronised and at full load; and	Every 4 years		Consistency of operation with plant models used to establish initial compliance if the models are available; OR consistency with past performance if the models are not available

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 methodology¹⁵	Suggested frequency of testing¹⁶	Notes	Basis for compliance assessment
Voltage and Reactive Power Control / Excitation Control System (as required under: S5.2.5.13 in versions 1-49 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) ⁴⁴	(b) Assess the stability of limiter operation; and	Every 4 years		As above
	(c) Monitoring in-service performance or undertake transfer function measurements.	On every event or every 4 years		As above
	Method 2 (of 3): (a) AVR step response tests; and	Every 4 years		Consistency of operation with plant models used to establish initial compliance if the models are available; OR consistency with past performance if the models are not available
	(b) AVR step response test of OEL and UEL operation; and	Every 4 years		As above
	(c) AVR and PSS transfer function measurements over	Every 4 years		As above

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

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 ¹⁵	Suggested frequency of testing ¹⁶	Notes	Basis for compliance assessment
Voltage and Reactive Power Control / Excitation Control System (as required under: S5.2.5.13 in versions 1-49 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) ⁴⁵	required frequency range.			
	Method 3 (of 3): Performance of <u>relevant sub-systems</u> will be monitored using the following systems: digital protection relays; other data-logging equipment as required	As appropriate to the technology of the <u>relevant sub-system</u>	Applicable for Wind Farms Changes to turbine 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	Consistency of operation with plant models used to establish initial compliance if the models are available; OR consistency with past performance if the models are not available

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 methodology¹⁵	Suggested frequency of testing¹⁶	Notes	Basis for compliance assessment
Active Power Control (as required under S5.2.5.14 in versions 13- of the Rules) ⁴⁶	Method 1 (of 2): One-off installation	Following <u>plant change</u>		Achieve performance standard
	Method 2 (of 2): Monitor non-compliance with dispatch market systems	After major event		Achieve performance standard
Remote Monitoring (as required under S5.2.6.1 in versions 1-49 of the Rules, the initial Code, and all amended versions of the Code) ⁴⁷	Method 1 (of 2): (a) Calibration of Transducers; and	Following <u>plant change</u> and every 5 years		Confirmation at each end of the communications system by both parties
	(b) Verification of the accuracy of transmitted data.	Following <u>plant change</u> and every 5 years		As above
	Method 2 (of 2): (a) SCADA monitored values and farm panel metering will be routinely checked; and	Every 5 years	Applicable for Wind Farms	Achieve performance standard

⁴⁶ This provision was amended in version 13 of the Rules.

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 methodology¹⁵	Suggested frequency of testing¹⁶	Notes	Basis for compliance assessment
	(b) The calibration of transducers and Wind Farm panel metering will be checked.	At each major outage or once every 5 years		As above
Communications Equipment (as required under: S5.2.6.2 in versions 13-49 and S5.2.6.3 in versions 1-12 of the Rules ; and S5.2.6.3 of the initial Code, and all amended versions of the Code) ⁴⁸	Method 1 (of 1): (a) Confirmation of the availability of communication links, including any backup links with AEMO; and	Annual		Achieve performance standard
	(b) Testing of <u>relevant sub-systems</u> including any power backup or UPS system.	As appropriate to the technology of the <u>relevant sub-system</u>		As above
Power Station Auxiliary Transformers / Supplies (as required under: S5.2.7 in versions 13-49 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) ⁴⁹	Method 1 (of 2): (a) Metering of active and reactive power at the auxiliary supply connection point; and	Every 4 years	Only applicable when auxiliary supplies are taken from some other point different to generator connection point Access Standards	Power factor, quality of supply and protection and control requirements within allowable range / specification

⁴⁸ This provision was amended in version 13 of the Rules.

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 ¹⁵	Suggested frequency of testing ¹⁶	Notes	Basis for compliance assessment
Power Station Auxiliary Transformers / Supplies (as required under: S5.2.7 in versions 13-49 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) ⁵⁰			must be established under clause S5.3.5	
	(b) Testing and/or calibration of any <u>relevant sub-systems</u> including capacitor banks and circuit breakers.	As appropriate to the technology of the <u>relevant sub-system</u>		Performance to specification
	Method 2 (of 2): 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. 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	Achieve performance standard

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 ¹⁵	Suggested frequency of testing ¹⁶	Notes	Basis for compliance assessment
			considered negligible under NEM CMP requirements.	
Fault Level / Current (as required under: S5.2.8 in versions 13-49 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) ⁵¹	Method 1 (of 3): (a) Monitoring in-service performance during faults near the connection point; and	Review following any event		Calculation confirms current fault current contribution
	(b) Review and recalculation of fault levels; and	Following <u>plant change</u>		As above
	(c) Routine testing of any <u>relevant sub-systems</u> .	As appropriate to the technology of the <u>relevant sub-system</u>		As above
	Method 2 (of 3): (a) Modelling and simulation of plant characteristics to make sure the plant is capable of meeting agreed standards; and	Following <u>plant change</u>		Calculation confirms current fault current contribution
	(b) Monitoring of generator	Review following		As above

⁵¹ 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 ¹⁵	Suggested frequency of testing ¹⁶	Notes	Basis for compliance assessment
Fault Level / Current (as required under: S5.2.8 in versions 13-49 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) ⁵²	contribution on fault event.	any event		
	Method 3 (of 3): (a) Performance of <u>relevant sub-systems</u> will be monitored using the following systems: digital protection relays; other data-logging equipment as required; and	As appropriate to the technology of the <u>relevant sub-system</u>		Achieve performance standard.
	(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 if the models are available; OR consistency with past performance if the models are not available.
	(c) Review and recalculation of fault levels.	Following <u>plant change</u>		As above

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