

Reliability Panel AEMC

## DRAFT REPORT

# Template for Generator Compliance Programs

28 March 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 Reliability 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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## Foreword

I am pleased to present the Reliability Panel's (Panel's) draft report on the Review of the Template for Generator Compliance Programs.

In preparing this draft report, the Panel has taken into consideration comments from stakeholders and whether there have been changes to the electricity market which may have affected the application and efficiency of the template for generator compliance programs.

The Panel notes that the template was initially developed after extensive consultation with stakeholders and considers that it has worked well to date. The Panel proposes that the template should remain largely unchanged with some minor amendments to improve the clarity of the template.

I would like to thank the stakeholders that have made submissions to this review process. Stakeholders' views and comments have assisted us with our consideration and assessments.

I look forward to engaging with you further at the public meeting to be held in Sydney at the AEMC office on 16 May 2012.

Neville Henderson  
Chairman, AEMC Reliability Panel  
Commissioner, AEMC

## **Reliability Panel members**

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# 1 Introduction

In accordance with the requirements under the National Electricity Rules (rules) the Reliability Panel (Panel) has undertaken this review to assess, and update if necessary, the Template for Generator Compliance Programs (the template).

## 1.1 Background

In 2006, as directed by the Ministerial Council on Energy (MCE), the Australian Energy Market Commission (AEMC or Commission) undertook a review of the enforcement of, and compliance with, technical standards.<sup>1</sup>

Following from the review and the subsequent rule change request raised by the National Generators Forum (NGF), the AEMC made a rule to require the Panel to develop a 'compliance template'. The purpose of the compliance template is to assist generators with developing compliance programs and to facilitate the enforcement and monitoring of compliance with technical standards. The Panel undertook the requirement to establish the template. The review involved extensive consultation with stakeholders and was completed in July 2009. The template was implemented at that time.

## 1.2 Requirement for this review

The rules require the Panel to undertake a review of the template at least once every three years from the date the template is determined.<sup>2</sup> As the template was established in July 2009, the Panel must complete the first review by July 2012.

The template refers to specific provisions under the rules to which generators must comply with, as well as suitable testing and monitoring methodologies. Hence the review requirement recognises that ongoing review would ensure consistency of the template with the rules and other market developments. In addition, a periodic review would allow any experiences gained from the practical implementation of the template to be recognised and used to improve the template.

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<sup>1</sup> As noted in the technical standards review, the term technical standards is not defined in the rules but for the purposes of the development of the template, it was characterised as:

- the performance standards for Generators, Market Customers and market network service providers (MNSPs) specified under clauses 4.13, 4.14 and 5.3.4A(g) that are prepared to be registered with AEMO (NEMMCO at the time);
- the automatic access standards, minimum access standards and performance criteria required for the connection of network service providers (NSPs), Generators, Market Customers and MNSPs set out in schedules of 5.1, 5.2, 5.3, and 5.3a under the rules respectively, which in the case of Generators, Market Customers and MNSPs, form the basis for specific performance standards to be registered with AEMO; and
- the obligations of NSPs, Generators and Market Customers under clauses 5.2.3, 5.2.4 and 5.2.5 of the rules.

<sup>2</sup> Clause 8.8.3(ba) of the rules.

In November 2011 the AEMC provided the Panel with terms of reference for this review.<sup>3</sup>

### **1.3 The Reliability Panel's powers in relation to the template**

The rules provide that following the Panel's review of the template, the Panel may amend the template in accordance with its final report to the AEMC.<sup>4</sup> This draft report and the draft template (published with this report) sets out the Panel's proposed amendments. Subject to the Panel's consideration of any stakeholder comments on these draft provisions, the Panel will submit the final report to the AEMC in June 2012.

Participants will be required to modify their compliance programs in accordance with the amended template by no later than six months after the amendments are published (or by a date determined by the Panel).<sup>5</sup> At this stage the Panel does not propose to determine a specific implementation date, in which case the six month timeframe applies. However, as the nature of the amendments are minor (as discussed below in section 1.4 and in Chapters 2 and 3), the Panel considers the amendments to the template will not have significant operational impacts on participants.

### **1.4 Proposed amendments to the template**

The Panel proposes that a number of amendments be made to the template. These amendments are set out in the draft template published with this draft report. Details of the Panel's considerations are set out in Chapter 2 and Chapter 3. The proposed amendments are summarised as follows:

- clarification that generators have some discretion to determine the frequency with which compliance tests are to be carried out;
- some minor clarifications on whether tests apply to synchronous or asynchronous generation; and
- other minor 'typographical' clarifications to improve ease of application of the template.

### **1.5 The review process and consultation**

The Panel is required to undertake consultation as a part of this review.<sup>6</sup> The Panel has engaged stakeholders during the review process by providing the opportunity to make submissions on the issues paper and now this draft report (see section 1.6 on making a submission on this report). Five submissions were received on the issues paper from:

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<sup>3</sup> The terms of reference are published on the AEMC Reliability Panel website.

<sup>4</sup> Clause 8.8.3(ba) of the rules.

<sup>5</sup> Clause 4.15(c)(3) of the rules.

<sup>6</sup> Clause 8.8.3 of the rules and in accordance with the terms of reference.

the Australian Energy Market Operator (AEMO), AGL Energy, International Power GDF Suez Australia, Sinclair Knight Merz (SKM) and TRUenergy.

The Panel will also hold a public meeting.<sup>7</sup>

The key dates for the remainder of the review are set out as follows.

### Key dates

| Date          | Milestone   |
|---------------|---|
| 28 March 2012 | Publish draft report  |
| 2 May 2012    | Close of submissions on draft report                            |
| 16 May 2012   | Public meeting  |
| 27 June 2012  | Submit final report to the AEMC and publication of final report |

## 1.6 Submissions on the draft report

The Panel invites comments from interested parties on this draft report by 2 May 2012.

Electronic submissions must be lodged online through the AEMC website [www.aemc.gov.au](http://www.aemc.gov.au) using the "lodge a submission" function and reference code **REL0047**. The submission must be on letterhead (if submitted on behalf of an organisation), signed and dated.

Upon receipt of the electronic submission, the AEMC website will issue a confirmation email. If this confirmation email is not received within three business days, it is the submitter's responsibility to ensure the submission has been delivered successfully.

Or, if choosing to make a submission by mail, the submission must be on letterhead (if submitted on behalf of an organisation), signed and dated. The submission may be posted to:

The Reliability Panel  
Australian Energy Market Commission  
PO Box A2449  
SYDNEY SOUTH NSW 1235

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<sup>7</sup> The notice of the public meeting was published on the AEMC Reliability Panel website on 21 March 2012. Registration on line through the AEMC Reliability Panel website is required to attend the public meeting.

## 1.7 Structure of the paper

The remainder of this draft report is structured as follows:

**Chapter 2 - Factors taken into consideration** - sets out the factors that the Panel considered in preparing this draft report and draft template;

**Chapter 3 - Issues raised** - sets out the Panel's considerations of specific issues including those raised in submissions;

**Appendix A** - sets out a summary of issues raised in submissions;

**Appendix B** - sets out some of the specific provisions under the rules that relate to the template; and

**Appendix C** - sets out the compliance principles.

## 2 Factors taken into consideration

This chapter sets out the factors that the Panel considered in preparing this draft report and draft template. Specific issues raised, and the Panel's response to these issues, are discussed in Chapter 3.

### 2.1 Role and purpose of the template

The template provides clarity to generators by defining an appropriate compliance framework to assist them with developing and designing their compliance programs to meet the relevant technical requirements. The template also assists the Australian Energy Regulator (AER) with the enforcement and monitoring of the generators' compliance with the technical requirements under the rules.

The design of the template supports a flexible application with appropriate controls. It is not an exhaustive document. It was designed on the basis that it forms part of a generator's overall compliance management framework. During the development of the template, the Panel recognised that the document cannot be a prescriptive list of compliance choices, as to do so would not be representative of good electricity industry practice. This is because there are different generation technologies, and each plant may have unique attributes, such that some flexibility in the compliance process would be needed to accommodate these varying requirements.

The Panel has taken the overall role and purpose into consideration in undertaking this review and considers the proposed amendments clarify how the provisions in the template should be applied. The Panel notes that the template is applied to a broad range of generation plant and consequently it provides a basis for generators to develop compliance programs that are suited to their facilities. The application of the template will also depend on external audits that generators independently conduct.

### 2.2 Compliance Principles

As outlined in the issues paper, the Panel considered nine compliance principles in developing the initial template, which the Panel has also taken into consideration in preparing this draft report.<sup>8</sup> As the proposed amendments are to clarify the existing provisions, the Panel considers that they are consistent with the compliance principles.

### 2.3 Provisions in the rules which relate to the template

There are several clauses in the rules which relate to the technical standards, which the template reflects. These provisions include the specific scope of the template, which is to cover all performance standards and to define suitable testing and monitoring regimes.<sup>9</sup> The Panel notes that when the original template was established, each of

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<sup>8</sup> The compliance principles are set out in Appendix C.

<sup>9</sup> These specific provisions under the rules are outlined in Appendix B.

these rule provisions were considered in detail. The Panel considers that the proposed amendments do not impact how these provisions are captured by the template.

## **2.4 The National Electricity Objective**

The Panel has considered whether any amendments to the template would contribute to the national electricity objective (NEO), which is:

"to promote efficient investment in, and efficient operation and use of, electricity services for the long term interests of consumers of electricity with respect to -

- price, quality, safety, reliability and security of supply of electricity; and
- the reliability, safety and security of the national electricity system."

The Panel considers that the proposed amendments to the template will, or are likely to contribute to the development of the NEO. This is because the proposed amendments provide clarity to how specific aspects of the template should be applied, which would contribute to improving the efficiency with which compliance requirements are carried out by the AER and generators. This would promote the efficient operation of electricity services.

### **3 Amendments to the template**

This chapter sets out the Panel's consideration of specific issues including those raised in stakeholder submissions.

#### **3.1 Changes to the rules or performance standards**

One of the specific objectives of this review process is to consider whether any changes to the rules, or changes to the performance standards, impact the content or operation of the template.

##### **Stakeholder submissions**

Submissions on the issues paper did not raise any specific issues on rule changes that have been implemented or any changes to performance standards.

##### **Panel's considerations**

Since July 2009 (when the template was first implemented) to March 2012, the AEMC completed 35 electricity rule changes. Although some of the rule changes resulted in changes to Chapters 4 and 5 of the rules, where the provisions relating to generator compliance requirements are set out, the changes related to other aspects of the rules (such as changes associated with network support and control ancillary services). There were no other changes that impacted the technical provisions considered under the template. For these reasons, the Panel considers that no rule changes have affected the content or operation of the template.

The Panel also notes that there have not been any changes to the performance standards that affect the template.

#### **3.2 Frequency of tests**

One of the main parts of the template is a table that sets out the details of specific compliance requirements and tests. This table includes a column entitled 'Frequency', which outlines the frequency with which each suggested compliance test could be completed.

##### **Stakeholder submissions**

AEMO considers that the frequency of testing could be linked to the hours of operation for example "generators which only operate for a few hours a year may be required to implement a testing and compliance program that is potentially more frequent".<sup>10</sup>

SKM suggests that some of the testing frequency that currently specify three years should be amended to "every major inspection interval, or every 5 years (whichever

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<sup>10</sup> AEMO, submission on the issues paper, 29 February 2012, p. 1.

occurs sooner)".<sup>11</sup> SKM submits that its proposal would ensure that unit availability of generators would be kept at a maximum and that good electricity industry practice specifies major inspection intervals that could be different to 'three years'.<sup>12</sup>

AGL also submits that some provisions should be included in the template to allow some tests to be conducted once every five years rather than three years.<sup>13</sup>

### **Panel's considerations**

The Panel agrees that there should be flexibility in the frequency with which compliance testing is conducted and acknowledges the issues raised in stakeholder submissions. The Panel notes that the frequency values set out in the table in the template are the 'suggested' frequency values. The template was designed to support a flexible application and, as such, there is a degree of discretion on the frequency of testing. Section 2.6 of the template discusses that in determining the appropriate frequency the generator should consider the broader compliance framework and take into account all relevant factors including:<sup>14</sup>

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

Given the existing provisions of the template, the Panel does not consider extensive amendments to the template are required to address the frequency requirement. The Panel proposes that the column entitled 'Frequency' in the table in the template be amended to 'Suggested frequency of tests' to emphasise that these are not fixed values and that the explanation in section 2.6 of the template be updated to capture the issues raised by stakeholders.

### **3.3 Different generation technologies**

As noted above, the template is a single document that is to be applied to various types of generation technology. Consideration is given as to whether specific provisions or clarifications would be required (e.g. to more directly address requirements for wind generators).

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<sup>11</sup> SKM, submission on the issues paper, 6 March 2012, p. 1.

<sup>12</sup> *ibid*

<sup>13</sup> AGL Energy, submission on the issues paper, 8 February 2012, p. 2.

<sup>14</sup> AEMC Reliability Panel, Template for Generator Compliance Programs, 31 July 2009, p. 8.

## Stakeholder submissions

AGL notes that the majority of provisions in the template apply to synchronous generators rather than asynchronous generators. AGL suggests minor amendments to clarify the applicability of the tests.<sup>15</sup>

TRUenergy notes that "some consideration to the emergence of large scale solar may be warranted in due course".<sup>16</sup>

AEMO also noted the template should be updated to reflect new technologies.<sup>17</sup>

International Power notes that as wind generation was operational at the time the templates were first established, it would assume that any technological requirements for wind generation would already be considered.<sup>18</sup> Further, International Power notes that it is "not aware of any substantial new technology that has become established in the national electricity market since 2009" and that should large scale solar generation become a reality then this should be examined.<sup>19</sup>

## Panel's consideration

The Panel considers that the amendments proposed by AGL to clarify provisions for synchronous and asynchronous generation should be adopted. The amendments do not change the intention of the requirements and allow clearer understanding of the tests.

The Panel agrees that should the requirement arise in the future, additional consideration for the provisions of large scale solar installations would be needed. The Panel does not consider it would be efficient to consider any specific amendments to the template at this time for large scale solar installations as there are no committed projects on which to test and measure the potential requirements.

The Panel notes that the current template includes specific provisions and references to wind generation and, as noted by International Power, some consideration was given to the requirements for different technologies at the time the template was first established. Given that stakeholders did not identify any specific problems with the template in relation to provisions for wind generation, the Panel does not propose to make any further amendments associated with different technologies.

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<sup>15</sup> AGL, submission on the issues paper, 8 February 2012, p. 1.

<sup>16</sup> TRUenergy, submission on the issues paper, 6 January 2012, p. 1.

<sup>17</sup> AEMO, submission on the issues paper, 29 February 2012, p. 2.

<sup>18</sup> International Power, submission on the issues paper, 8 February 2012, p. 1.

<sup>19</sup> *ibid*

### **3.4 Timing to implement compliance programs**

The rules require that a participant must institute a compliance program as soon as reasonably practicable but no later than:<sup>20</sup>

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

#### **Stakeholder submissions**

AEMO submits that:<sup>21</sup>

“Clause 5.7.3 of the Rules requires generators to demonstrate that they comply with the performance standards in the time specified in clause 4.15. This is generally 6 months after commissioning. However it is believed that the intention of this clause is that compliance be demonstrated at the time of commissioning, as may be required under clause 5.8.1(b).”

AEMO considers the timing of the compliance requirements should be clarified.

#### **Panel's considerations**

The Panel notes that section 5.7 of the rules is on the 'Inspection and Testing' requirements, whereas section 5.8 of the rules is on 'Commissioning'. The timing provisions under clause 4.15(b) of the rules relate to the establishment of a 'compliance program' for demonstrating on-going compliance and compliance monitoring, in which case the existing timeframes under 4.15(b) seem appropriate. The Panel considers the requirement for an on-going compliance program is different from, and separate to, the requirements for commissioning a plant. However, the Panel welcomes any comments on this issue and, if there is a demonstrated problem with the commissioning process, would encourage AEMO to propose a rule change on this matter. In any case, the Panel does not consider this issue impacts on the actual content of the template.

### **3.5 Other minor amendments**

To improve the overall clarity of the template, other minor amendments are considered.

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<sup>20</sup> Clause 4.15(b) of the rules.

<sup>21</sup> AEMO, submission on the issues paper, 29 February 2012, p. 1.

## **Stakeholder submissions**

TRUenergy suggests some minor amendments to improve the clarity of the template:<sup>22</sup>

- where testing methods contain parts (a) and (b), "; and" should be inserted to ensure that both parts are used; and
- where rule provisions and their precedents are quoted, they should be listed in reverse chronological order to improve clarity.

## **Panel's considerations**

The Panel agrees the minor amendments suggested by TRUenergy will improve the clarity of the template. These amendments have been incorporated into the draft template.

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<sup>22</sup> TRUenergy, submission on the issues paper, p. 1.

## Abbreviations

|            |                                     |
|------------|-------------------------------------|
| AEMC       | Australian Energy Market Commission |
| AEMO       | Australian Energy Market Operator   |
| AER        | Australian Energy Regulator         |
| Commission | See AEMC                            |
| MCE        | Ministerial Council on Energy       |
| MNSP       | market network service provider     |
| NEO        | national electricity objective      |
| NGF        | National Generators Forum           |
| NSP        | network service provider            |
| Panel      | Reliability Panel                   |
| rules      | National Electricity Rules          |
| SKM        | Sinclair Knight Merz                |

## A Summary of submissions

Issues raised in submissions on the issues paper are summarised below. Submissions are published on the AEMC Reliability Panel website.

| Issue                   | Stakeholder              | Detail   | Panel Response   |
|-------------------------|--------------------------|--|--|
| Frequency of testing    | AEMO, AGL, SKM           | <p>AEMO submitted that the application of the compliance template to generators that do not operate often should be reviewed.</p> <p>AGL noted that where testing is required, some consideration should be given to the relevant technologies of the control and protection devices. This should include the ability to test full digital protection relays, AVRs and governors up to a period of every five years. This period should be decreased as best practice for lower technology devices, i.e. three years for electro-mechanical relays and electronic AVRs.</p> <p>SKM suggested that the frequency testing should be extended to "major inspection interval, or every 5 years (whichever occurs sooner)".</p> | This issue is considered and discussed in section 3.2. |
| Asynchronous generation | AGL, International Power | <p>International Power noted wind generation had been in operation at the time of development of the template and assume that all technology requirements were considered at that time.</p> <p>AGL noted that the majority of testing methods outlined in the template apply to synchronous generators only, which is not relevant to asynchronous generators, such as wind. AGL provides a mark-up of one section of the template which would clarify the application of the testing requirements.</p>  | This issue is considered and discussed in section 3.3. |

| Issue                                   | Stakeholder                          | Detail   | Panel Response   |
|---|--------------------------------------|--|--|
| Minor suggestions to improve clarity    | TRUenergy                            | <p>TRUenergy suggested minor amendments to the template to improve clarity, such as the insertion of "; and" between part (a) and part (b) of a testing method to ensure that both parts of the testing method are used.</p> <p>TRUenergy also suggested that references to Rule provisions and their precedents are listed in reverse chronological order to further improve clarity.</p>   | This issue is considered and discussed in section 3.5. |
| Large scale solar generation            | TRUenergy, International Power, AEMO | <p>TRUenergy suggested that some consideration to large scale solar installations may be warranted in due course.</p> <p>AEMO considered that the template should be updated to reflect new technologies such as solar.</p> <p>International Power was of the view that if the large scale solar generation projects proposed by the federal government were implemented, the template should be amended to accommodate this emergence of large scale solar installations.</p> | This issue is considered and discussed in section 3.3. |
| Timing to implement compliance programs | AEMO                                 | AEMO noted that compliance needs to be demonstrated by generators at the time of commissioning and hence questioned the timing of the establishment of compliance programs.  | This issue is considered and discussed in section 3.4. |

## **B Provisions under the rules that relate to the technical standards**

There are several clauses in the rules which relate to the technical standards that Generators must adhere to. Clause 4.15(ca) outlines that the template for generator compliance programs must:

- (a) cover all performance standards; and
- (b) define suitable testing and monitoring regimes for each performance standard so that a Registered Participant can select a regime that complies with the obligations set out in rules 4.15(a), 4.15(b) and 4.15(c) for their particular plant.

Rule 4.15(a) requires that a Registered Participant must:

1. ensure that its plant meets or exceeds the performance standard applicable to its plant; and
2. ensure that its plant is not likely to cause a material adverse effect on power system security through its failure to comply with a performance standard; and
3. immediately ensure that its plant ceases to be likely to cause a material adverse effect on power system security through its failure to comply with a performance standard, if:
  - (a) the Registered Participant reasonably believes that by failing to comply with a performance standard, its plant is likely to cause a material adverse effect on power system security; or
  - (b) AEMO advises the Registered Participant that by failing to comply with a performance standard, the Registered Participant's plant is likely to cause a material adverse effect on power system security.

Rule 4.15(b) requires that a Registered Participant who engages in the activity of planning, owning, controlling or operating a plant to which a performance standard applies must institute and maintain a compliance program which complies with rule 4.15(c). The compliance program must be instituted, as soon as reasonably practicable, but 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 plant commences operation.

Rule 4.15(c) requires that a compliance program instituted and maintained under rule 4.15(b) must:

1. be consistent with the template for generator compliance programs;

2. include procedures to monitor the performance of the plant in a manner that is consistent with good electricity industry practice;
3. be modified to be consistent with any amendments made under clause 8.8.3(ba) to the template for generator compliance programs, by no later than 6 months after amendments to the template for generator compliance programs are published or by a date determined by the Reliability Panel; and
4. provide reasonable assurance of ongoing compliance with each applicable performance standard.

## C Compliance principles

As outlined in the issues paper, the Panel considered nine compliance principles in developing the initial template and in conducting this review. These principles are:<sup>23</sup>

- 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 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 Generators active use and implementation 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"<sup>24</sup>. The template should specify the objectives and outcomes to be achieved by the testing on 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 compliance to a performance standard cannot be directly tested, the compliance program should include a range of other compliance

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<sup>23</sup> AEMC Reliability Panel, *Template for Generator Compliance Programs*, Final Report, 31 July 2009, Sydney.

<sup>24</sup> Good electricity industry practice is defined in Chapter 10 of the rules as "The exercise of that degree of skill, diligence, prudence and foresight that reasonably would be expected from a significant proportion of operators of facilities forming part of the power system for the generation, transmission or supply of electricity under conditions comparable to those applicable to the relevant facility consistent with applicable regulatory instruments, reliability, safety and environmental protection. The determination of comparable conditions is to take into account factors such as the relative size, duty, age and technological status of the relevant facility and the applicable regulatory instruments."

testing methods to provide reasonable assurance that the performance standard continues to be met.

- Principle 8 - When developing a compliance program and operating under that program, a Generator can only be reasonably held accountable for the compliance for its plant to its registered performance standards and to equipment settings approved or provided by the Australian Energy Market Operator (AEMO) and or the Transmission Network Service Provider (TNSP).
- Principle 9 - Compliance programs should be reviewed and updated periodically.

Reliability Panel AEMC

# **[DRAFT] TEMPLATE FOR GENERATOR COMPLIANCE PROGRAMS**

[XX] May 2012

## **Inquiries**

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Reference: REL0047

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Reliability Panel Australian Energy Market Commission 2012, Template for Generator Compliance Programs, [XX] May 2012, Sydney

## **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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*[Please note: this document is change-marked to show the proposed changes to the current template.]*

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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.<sup>a</sup>

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 ~~Panel intends to regularly~~ reviews of the template ~~in order to will~~ ensure its consistency with the Rules and ~~to~~ provide a continual improvement focus.

~~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. A copy of the Terms of Reference is provided in Appendix A of this Final Report.~~

The Panel has ds undertaken an extensive consultation process in developing the initial template.<sup>b</sup> 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

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

<sup>b</sup> 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.

- 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) 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 eChapters 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 also held.) The review did not identify material issues with the template and minor amendments were made to clarify that generators have some discretion on determining the appropriate frequency with which compliance tests should be conducted. Other minor ‘typographical’ amendments were also made. Details of the Panel’s considerations are set out in the final report on this review.<sup>c</sup>

Generators are required to institute and maintain a compliance program consistent with this template (and other relevant requirements under the Rules).<sup>d</sup> 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.

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

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<sup>c</sup> [AEMC Reliability Panel, Review of the template for generator compliance programs, XX May 2012.]

<sup>d</sup> Refer to clause 4.15(c) of the Rules.

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# 1 Principles for the development of the template for generator compliance programs and guidelines for its application to compliance programs

## 1.1 Introduction

This ~~Chapter first~~ outlines the principles the AEMC Reliability Panel (Panel) adopted in developing the template for generator compliance programs (template). In addition to providing background to the process of developing this template, the documenting of these principles should be a guide to future revision and development of the template.

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.

- 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 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 8: 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 9: 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:<sup>1</sup>

"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

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<sup>1</sup> 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”.<sup>2</sup>

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.<sup>3</sup> PacificHydro argued that the specific technical principles should not be contrary to, nor overwrite, any of the principles contained in AS 3806.<sup>4</sup>

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 submission<sup>5</sup>, AEMO (formerly NEMMCO) proposed that the framework for compliance programs be further clarified in the form of a “multi-faceted approach”.

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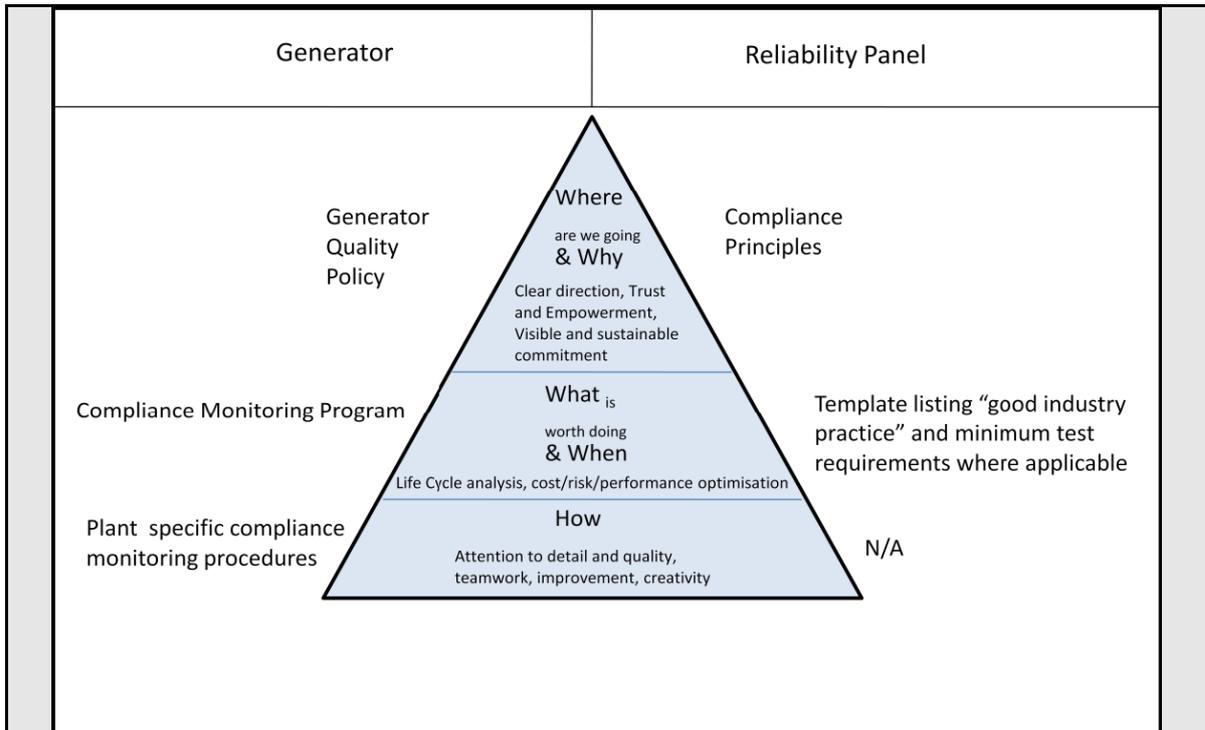
<sup>2</sup> NGF submission on the Issues Paper (AEMC Reliability Panel 2009, Template for Generator Compliance Programs, Issues Paper, 22 January 2009, Sydney), 6 March 2009, p.1.

<sup>3</sup> 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.

<sup>4</sup> 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.

<sup>5</sup> 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 below summarises AEMO’s proposed approach and the following extract from their submission<sup>6</sup> describes the proposal in more detail.



“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

<sup>6</sup> 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.

have to show:

- the processes needed for the establishment, implementation and maintenance of the Generator Compliance Program
- 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:<sup>7</sup>

- 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.

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<sup>7</sup> 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. 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 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.

### **2.3 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.

### **2.4 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 written, version 30 of the Rules was the latest version. Reference to version 30 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.

## 2.5 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.

## 2.6 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;<sup>8</sup> 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.<sup>9</sup> The actual frequency of testing may be described in terms of the:

- elapsed time;
- plant operating hours;

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<sup>8</sup> This could include considering any specific requirements related to the minimum number of operational hours required prior to undertaking 'major inspections'.

<sup>9</sup> 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.

- MWhrs generated; or
- number of plant starts

between testing.

## 2.7 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.

## 2.8 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, 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.

**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.

## 2.9 Table to assist development of generator compliance programs

| Performance Standard/Rules/Code Provision  | Suitable testing and monitoring methodology <sup>1</sup>   | <u>Suggested frequency of testing</u> <sup>2</sup> | Notes   | Basis for compliance assessment                                 |
|--|--|--|---|---|
| <b>Reactive Power Capability</b><br>(as required under S5.2.5.1 in versions 1- <del>30-47</del> of the Rules, the initial Code, and all amended versions of the Code) <sup>3</sup> | Method 1 <u>(of 5)</u> :<br>At rated power output, adjust the reactive power <u>at the connection point capability</u> to specified levels | Every 3 years and after <u>plant change</u>        | Directly Measurable.<br>Applies to synchronous and conventional plant, <u>and entire windfarms.</u> | Achieve reactive power requirements of the performance standard |
|  | Method 2 <u>(of 5)</u> :<br>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.<br>Applies to synchronous and conventional plant.                              | Achieve reactive power requirements of the performance standard |
|  | Method 3 <u>(of 5)</u> :<br>Step testing of AVR limiters   | Every 3 years and after <u>plant change</u>        | Applies to conventional plant   | Achieve reactive power requirements of the performance standard |

<sup>1</sup> Where there is more than one method provided, only one method is required to be used.

<sup>2</sup> See section 2.6 of the template for more information on the factors to be considered when determining the actual frequency.

<sup>3</sup> 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 <sup>1</sup>   | <u>Suggested frequency of testing</u> <sup>2</sup>  | Notes  | Basis for compliance assessment  |
|---|--|---|--|--|
| <u>Reactive Power Capability</u><br>(as required under S5.2.5.1 in versions 1-47 of the Rules, the initial Code, and all amended versions of the Code) <sup>4</sup> | Method 4 (of 5):<br>(a) Capability will be tested by component: <u>and</u><br>(b) Capability will be monitored using SCADA under normal wind farm operation. | Testing of ancillary plant and <u>type testing</u> of sample turbines following <u>plant change</u><br>Annual review of a selection of events | Applies to wind farms plant  | Achieve performance standard<br>Consistency with plant characteristics |
|   | Method 5 (of 5):<br>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                                 |
| <b>Power Factor Requirements</b><br>(as required under S5.3.5 in versions 1- <del>30</del> 47 of the Rules, the initial Code, and all amended versions of the Code) | 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 | Actual capability directly demonstrated                                |

<sup>4</sup> 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 <sup>1</sup>  | <u>Suggested frequency of testing</u> <sup>2</sup>   | Notes  | Basis for compliance assessment   |
|---|---|--|--|---|
| <p><b><u>Quality of Electricity Generated</u></b><br/>           (as required under S5.2.5.2 in versions 1-47 of the Rules, the initial Code, and all amended versions of the Code)<sup>6</sup></p> | <p>Method 2 <u>(of 2)</u>:</p> <p>(a) Monitoring in-service performance through use of Power Quality Monitors; <u>and</u></p> <p>(b) Testing of any <u>relevant sub-systems</u>.</p>      | <p>Routine monitoring</p> <p>Specific review every 3 years and following <u>plant change</u></p> <p>As appropriate to the technology of the <u>relevant sub-system</u></p> | <p>Important when power quality at the connection point is dependent on ancillary plant of power electronic control systems.</p> | <p>Monitors set against the performance standard are not raising alarms.</p> <p>Consistency with plant characteristics (no deterioration).</p> <p>Consistency with plant characteristics.</p> |
| <p><b>Response to Frequency Disturbances</b><br/>           (as required under S5.2.5.3 in versions 1-<del>30-47</del> of the Rules, the initial Code, and all</p>                                  | <p>Method 1 <u>(of 4)</u>:</p> <p>(a) Investigating <u>plant trips</u> that occur during significant frequency disturbances; <u>and</u></p> <p>(b) Routine testing of <u>relevant</u></p> | <p>On every event</p> <p>As appropriate to the</p>   |  | <p>Achieve performance standard</p>   |

<sup>6</sup> 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 <sup>1</sup>  | <u>Suggested frequency of testing<sup>2</sup></u>  | Notes   | Basis for compliance assessment  |
|--|---|--|---|--|
| amended versions of the Code) <sup>7</sup> | <u>sub-systems</u> including: <ul style="list-style-type: none"> <li>i. testing of control system response to disturbances by the injection of simulated frequency / speed control signals;<br/><u>and</u></li> <li>ii. Routine tests of electrical / mechanical over speed devices.</li> </ul> | <u>technology of the relevant sub-system</u>   |   |  |
|  | Method 2 <u>(of 4)</u> : <ul style="list-style-type: none"> <li>(a) Investigating system performance using high speed data recorders;<br/><u>and</u></li> </ul>   | 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 |

<sup>7</sup> 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 <sup>1</sup>   | <u>Suggested frequency of testing</u> <sup>2</sup>                        | Notes  | Basis for compliance assessment  |
|--|--|---|--|--|
| <p><b><u>Response to Frequency Disturbances</u></b><br/> <u>(as required under S5.2.5.3 in versions 1-47 of the Rules, the initial Code, and all amended versions of the Code)</u><sup>8</sup></p> | <p>(b) Routine testing of <u>relevant sub-systems</u> including:</p> <ul style="list-style-type: none"> <li>i. testing of control system response to disturbances by the injection of simulated frequency / speed control signals;<br/><u>and</u></li> <li>ii. Routine tests of electrical / mechanical over speed devices.</li> </ul> | <p>As appropriate to the technology of the <u>relevant sub-system</u></p> |  |  |
|  | <p>Method 3 <u>(of 4)</u>:</p> <p>(a) Verify the modelled performance of a sample of turbines;</p>   | <p>Following <u>plant change</u></p>                                      | <p>Only applicable to small asynchronous generators with digital controls that are aggregated.</p> | <p>Operation over the frequency range specified and agreed in the Generator Performance Standard</p> |

<sup>8</sup> 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 <sup>1</sup>  | <u>Suggested frequency of testing</u> <sup>2</sup>                 | Notes  | Basis for compliance assessment |
|--|---|--|--|---------------------------------|
| <u>Response to Frequency Disturbances</u><br>(as required under S5.2.5.3 in versions 1-47 of the Rules, the initial Code, and all amended versions of the Code) <sup>9</sup> | (b) Verify the performance at the connection point 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.  |                                 |
|  | (c) Continuous monitoring (high speed) of performance at the connection point; <u>and</u>   |  | Appropriate to use where high speed monitors are available and models have been used in establishing compliance. |                                 |
|  | (d) Routine testing of <u>relevant sub-systems</u> including: <ul style="list-style-type: none"> <li>i. testing of control system response to disturbances by the injection of simulated frequency / speed control signals; <u>and</u></li> <li>ii. Routine tests of electrical / mechanical over speed devices.</li> </ul> | As appropriate to the technology of the <u>relevant sub-system</u> |  |                                 |

<sup>9</sup> 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 <sup>1</sup>   | <u>Suggested frequency of testing<sup>2</sup></u>                         | Notes | Basis for compliance assessment     |
|---|--|---|-------|-------------------------------------|
| <p><b><u>Response to Frequency Disturbances</u></b><br/>           (as required under <u>S5.2.5.3 in versions 1-47 of the Rules, the initial Code, and all amended versions of the Code</u>)<sup>10</sup></p> | <p>Method 4 <u>(of 4)</u>:</p> <p>(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; <u>and</u></p> | <p>Every 3 years</p>  |       | <p>Achieve performance standard</p> |
|   | <p>(b) Routine testing and validation of <u>relevant sub-system</u> performance including:</p> <p>i. electrical protection; and</p> <p>ii. turbine protection.</p>   | <p>As appropriate to the technology of the <u>relevant sub-system</u></p> |       |                                     |
| <p><b>Response to Voltage Disturbances</b><br/>           (as required under: <u>S5.2.5.4 in versions 13-47 and S5.2.5.3 in versions 1-12 of the Rules, and S5.2.5.4 in versions 13-30 of</u></p>             | <p>Method 1 <u>(of 3)</u>:</p> <p>(a) Investigating <u>plant trips</u> that occur during significant voltage disturbances; <u>and</u></p>  | <p>On every event</p>   |       |                                     |

<sup>10</sup> 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 <sup>1</sup>  | <u>Suggested frequency of testing</u> <sup>2</sup>   | Notes  | Basis for compliance assessment  |
|--|---|--|--|--|
| <del>the Rules</del> ; and S5.2.5.3 in the initial Code, and all amended versions of the Code) <sup>11</sup> | (b) Routine testing of <u>relevant sub-systems</u> including: <ul style="list-style-type: none"> <li>i. AVR systems;</li> <li>ii. Auxiliary power systems; <u>and</u></li> <li>iii. Protection relays.</li> </ul> | As appropriate to the technology of the <u>relevant sub-system</u>                                     |  | Consistency with plant characteristics   |
|  | Method 2 <u>(of 3)</u> : <ul style="list-style-type: none"> <li>(a) Continuous high speed monitoring; <u>and</u></li> </ul>   | 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 of <u>relevant sub-systems</u> including: <ul style="list-style-type: none"> <li>i. AVR systems;</li> <li>ii. Auxiliary power systems;</li> </ul>   | As appropriate to the technology of the <u>relevant sub-system</u>                                     | Where possible, testing of auxiliary power systems should include simulated disturbance testing.                 |  |

<sup>11</sup> 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 <sup>1</sup>  | <u>Suggested frequency of testing</u> <sup>2</sup> | Notes  | Basis for compliance assessment  |
|---|---|--|--|--|
| <u>Response to Voltage Disturbances</u><br>(as required under: S5.2.5.4 in versions 13-47 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) <sup>12</sup> | <u>and</u><br>iii. Protection relays.   |  |  |  |
|   | Method 3 <u>(of 3)</u> :<br>(a) With the generator out of service, test the ability of nominated 415 V drives to sustain a specified voltage interruption; <u>and</u> | Every 4 years                                      | 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 <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. |  |

<sup>12</sup> 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 <sup>1</sup>  | <u>Suggested frequency of testing</u> <sup>2</sup>                 | Notes  | Basis for compliance assessment |
|---|---|--|--|---------------------------------|
| <b>Response to Disturbances following Contingency Events</b><br>(as required under S5.2.5.5 in versions 13- <del>30</del> <u>47</u> of the Rules) <sup>13</sup> | Method 1 <u>(of 3)</u> :<br>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 <u>(of 3)</u> :<br>(a) Investigate <u>plant trips</u> that occur during or immediately following major system events; <u>and</u> | On every event   |  | Achieve performance standard    |
|   | (b) Routine monitoring and testing 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> |  |                                 |

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<sup>13</sup> This provision was amended in version 13 of the Rules.

| Performance Standard/Rules/Code Provision  | Suitable testing and monitoring methodology <sup>1</sup>                                     | <u>Suggested frequency of testing</u> <sup>2</sup>                                    | Notes   | Basis for compliance assessment  |
|--|--|---|---|--|
| <u>Response to Disturbances following Contingency Events</u><br><u>(as required under S5.2.5.5 in versions 13-47 of the Rules)</u> <sup>14</sup> | Method 3 <u>(of 3)</u> :<br>(a) Continuous monitoring using high speed recorders; <u>and</u> | 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 of <u>relevant sub-systems</u> .                          | As appropriate to the technology of the <u>relevant sub-system</u>                    |   |  |

<sup>14</sup> This provision was amended in version 13 of the Rules.

| Performance Standard/Rules/Code Provision  | Suitable testing and monitoring methodology <sup>1</sup>  | <u>Suggested frequency of testing</u> <sup>2</sup>                 | Notes | Basis for compliance assessment   |
|--|---|--|-------|---|
| <b>Quality of Electricity Generated and Continuous Uninterrupted Operation</b><br>(as required under S5.2.5.6 in versions 13- <del>30</del> 47 of the Rules) <sup>15</sup> | Method 1 <u>(of 2)</u> :<br>(a) Direct measurements using power quality meters to test:<br>i. voltage fluctuation levels;<br>ii. voltage balance ; <u>and</u><br>iii. harmonics, flicker and negative phase sequence voltage prior to synchronisation<br>and to ensure protection settings align to the performance standard;<br> | 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); <u>and</u>  | Following each event   |       | Achieve performance standard.   |
|  | (c) Routine monitoring and testing of any <u>relevant sub-systems</u> .   | As appropriate to the technology of the <u>relevant sub-system</u> |       |   |

<sup>15</sup> This provision was amended in version 13 of the Rules.

| Performance Standard/Rules/Code Provision  | Suitable testing and monitoring methodology <sup>1</sup>   | <u>Suggested frequency of testing</u> <sup>2</sup>                                    | Notes   | Basis for compliance assessment                                |
|--|--|---|---|--|
| <u>Quality of Electricity Generated and Continuous Uninterrupted Operation</u><br>(as required under S5.2.5.6 in versions 13-30-47 of the Rules) <sup>16</sup>   | Method 2 (of 2):<br><br>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 |
| <b>Partial Load Rejection</b><br>(as required under: S5.2.5.7 in versions 13-47 and S5.2.5.4 in versions 1-12 of the Rules, <del>and S5.2.5.7 in versions 13-30 of the Rules</del> ; and S5.2.5.4 of the initial Code, and all amended versions of the Code) <sup>17</sup> | Method 1 (of 3):<br><br><u>(a)</u> Measure response of the generator to system over-frequency and analyse the unit performance; <u>and</u> |   | Directly measurable                                     | Achieve performance standard                                   |
|  | <del>(a)</del> (b) Investigation of <u>plant trips</u> .   | On every event  |   |  |

<sup>16</sup> This provision was amended in version 13 of the Rules.

<sup>17</sup> 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 <sup>1</sup>   | <u>Suggested frequency of testing<sup>2</sup></u>                  | Notes  | Basis for compliance assessment   |
|---|--|--|--|---|
| <u>Partial Load Rejection</u><br>(as required under: S5.2.5.7 in versions 13-47 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) <sup>18</sup> | Method 2 (of 3):<br>(a) Routine testing of <u>relevant sub-systems including:</u><br>i. Analytical simulation of generator, auxiliary systems and critical protections; <u>and</u><br>ii. Secondary injection testing of critical protection systems; <u>and</u> | 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.       |

<sup>18</sup> 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 <sup>1</sup>  | <u>Suggested frequency of testing<sup>2</sup></u> | Notes  | Basis for compliance assessment   |
|---|---|---|--|---|
| <p><b><u>Partial Load Rejection</u></b><br/> <u>(as required under: S5.2.5.7 in versions 13-47 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)<sup>19</sup></u></p> | <p>Method 3 <u>(of 3)</u>:</p> <p>(a) Response to partial load rejection to be assessed by in-service performance; <u>and</u></p> <p>(b) Test for correct operation of turbine overspeed trips.</p> | <p>Every 4 years</p>                              | <p>Overspeed protection checked off-line after major overhauls</p> | <p>Achieve performance standard.</p> <p>That turbine trip operates to within acceptable tolerance of nominal trip setting for overspeed protection.</p> |

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<sup>19</sup> 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 <sup>1</sup>  | <u>Suggested frequency of testing</u> <sup>2</sup>                 | Notes   | Basis for compliance assessment  |
|---|---|--|---|--|
| <b>Protection from Power System Disturbances</b><br>(as required under S5.2.5.8 in versions 1- <del>30-47</del> of the Rules, the initial Code, and all amended versions of the Code) <sup>20</sup> | Method 1 <u>(of 3)</u> :<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 | 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 of <u>relevant sub-systems</u> including applicable protection relays; <u>and</u> | As appropriate to the technology of the <u>relevant sub-system</u> |   | That protection system operated in accordance with design and the Performance Standard.  |
|   | (c) Investigate unit electrical protection trips.   | On every event   |   |  |

<sup>20</sup> 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 <sup>1</sup>  | <u>Suggested frequency of testing</u> <sup>2</sup>                        | Notes  | Basis for compliance assessment   |
|--|---|---|--|---|
| <p><b><u>Protection from Power System Disturbances</u></b><br/> <u>(as required under S5.2.5.8 in versions 1-47 of the Rules, the initial Code, and all amended versions of the Code)</u><sup>22</sup></p> |   | verification of database registered protection settings to occur annually | <p>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> | provision of the Rules.   |
|  | (b) Routine testing of <u>relevant sub-systems</u> 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 <u>relevant sub-system</u>        |  | Performance will be assessed against the performance standard requirements. |

<sup>22</sup> 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 <sup>1</sup>   | <u>Suggested frequency of testing</u> <sup>2</sup>                                       | Notes               | Basis for compliance assessment  |
|---|--|--|---------------------|--|
| <b>Protection Systems that Impact on Power System Security</b><br>(as required under S5.2.5.9 in versions 1- <del>30-47</del> of the Rules, the initial Code, and all amended versions of the Code) <sup>23</sup> | Method 1 <u>(of 3)</u> :<br>(a) Routine testing of protection systems including:<br>i. CB opening times; <u>and</u><br>ii. Protection relay injection testing; <u>and</u>  | 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>  |                     |  |
|   | Method 2 <u>(of 3)</u> :<br>(a) Routine testing of <u>relevant sub-systems</u> including:<br>i. protection system testing by secondary injection;<br>ii. checking of circuit breaker opening times;<br>iii. redundancy of primary protection systems; <u>and</u> | As appropriate to the technology of the <u>relevant sub-system</u><br><br>On every event |                     | That all protection relays operate satisfactorily and to within design tolerance of setting value. |

<sup>23</sup> 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 <sup>1</sup>  | <u>Suggested frequency of testing</u> <sup>2</sup>   | Notes   | Basis for compliance assessment   |
|---|---|--|---|---|
| <b>Protection Systems that Impact on Power System Security</b><br><br>(as required under S5.2.5.9 in versions 1- <del>30-47</del> of the Rules, the initial Code, and all amended versions of the Code) <sup>24</sup> | iv. timing of trip signal issued by the breaker fail protection system; <u>and</u>                              |  |   |   |
|   | (b) Assessment of protection system performance in the event of protection system operation.                    |  |   | That protection system is operated in accordance with design and the Performance Standard.  |
|   | Method 3 <u>(of 3)</u> :<br><br>(a) Performance is monitored, in-service, where data is available; <del>z</del> | 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 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. |

<sup>24</sup> 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 <sup>1</sup>   | <u>Suggested frequency of testing<sup>2</sup></u>                         | Notes | Basis for compliance assessment   |
|---|--|---|-------|---|
| <p><b><u>Protection Systems that Impact on Power System Security</u></b><br/> <u>(as required under S5.2.5.9 in versions 1-30-47 of the Rules, the initial Code, and all amended versions of the Code)<sup>25</sup></u></p> | <p>(b) Relevant testing of any <u>relevant sub-systems</u> including protection system relays shall be tested by secondary injection; <u>and</u></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 following a unit trip as a result of a relevant system event in which the unit should have remained synchronised.</p> |
|   | <p>(c) Verification of database registered protection settings to occur in conjunction with injection testing.</p>                                   |   |       |   |

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<sup>25</sup> 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 <sup>1</sup>   | <u>Suggested frequency of testing</u> <sup>2</sup>                 | Notes | Basis for compliance assessment  |
|---|--|--|-------|--|
| <b>Asynchronous Operation of Synchronous Generating Units / Protection to Trip Plant for Unstable Operation</b><br>(as required under S5.2.5.10 in versions 1- <del>30-47</del> of the Rules, the initial Code, and all amended versions of the Code) <sup>26</sup> | Method 1:<br>(a) Routine testing of <u>relevant sub-systems</u> including protection system testing by secondary injection; <u>and</u> | 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.         |

<sup>26</sup> 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 <sup>1</sup>  | <u>Suggested frequency of testing<sup>2</sup></u> | Notes  | Basis for compliance assessment  |
|---|---|---|--|--|
| <b>Frequency Control / Frequency Responsiveness and/or Governor Stability and Governor System</b><br>(as required under: S5.2.5.11 in versions 1- <del>30-47</del> 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) <sup>27</sup> | Method 1 <u>(of 4)</u> :<br><br>Monitor in-service performance using high speed frequency data  | <u>After every major frequency excursion</u>      | Appropriate to use where high speed monitors are available and models have been used in establishing compliance <u>or when plant has no capability of responding to frequency deviations ie asynchronous machines.</u> | 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 |
|   | Method 2 <u>(of 4)</u> :<br><br>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   |

<sup>27</sup> 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 <sup>1</sup>   | <u>Suggested frequency of testing</u> <sup>2</sup>             | Notes | Basis for compliance assessment  |
|---|--|--|-------|--|
| <p><b><u>Frequency Responsiveness and/or Governor Stability and Governor System</u></b><br/> <u>(as required under: S5.2.5.11 in versions 1-30-47 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)</u><sup>28</sup></p> | Method 3 <u>(of 4)</u> :<br>(a) Analytical simulation of turbine and governor systems; <u>and</u>                        | <u>Type Test</u> permissible where multiple units are involved |       |  |
|   | (b) Assess generator response to disturbances using high speed recording data.   | Ongoing  |       | 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 |
|   | Method 4 <u>(of 4)</u> :<br>(a) Step response test of the governor to test damping and droop characteristics; <u>and</u> | Every 4 years  |       | Plant performance complies with the Generator Performance Standard   |
|   | (b) Routine calibration tests.   | Every 4 years  |       |  |

<sup>28</sup> 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 <sup>1</sup>   | <u>Suggested frequency of testing</u> <sup>2</sup>                 | Notes   | Basis for compliance assessment   |
|--|--|--|---|---|
| <b>Stability / Impact on Network Capability</b><br>(as required under S5.2.5.12 in versions 1- <del>30-47</del> of the Rules, and all amended versions of the Code from 27 March 2003 onwards) <sup>29</sup> | Method 1 <u>(of 1)</u> :<br>(a) Monitor in-service performance for relevant performance characteristics not otherwise tested; <u>and</u>                   | Following <u>plant changes</u>                                     | 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 if the models are available; OR consistency with past performance if the models are not available |
|  | (b) Routine monitoring and testing 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> |   |   |

<sup>29</sup> 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 <sup>1</sup>   | <u>Suggested frequency of testing</u> <sup>2</sup> | Notes | Basis for compliance assessment   |
|---|--|--|-------|---|
| <b>Excitation Control System / Voltage and Reactive Power Control</b><br>(as required under: S5.2.5.13 in versions 1- <del>30-47</del> 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) <sup>30</sup> | Method 1 <u>(of 3)</u> :<br>(a) Transfer function measurements and step response tests with the unit unsynchronised and at full load; <u>and</u> | 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) Assess the stability of limiter operation; <u>and</u>  |  |       |   |
|   | (c) Monitoring in-service performance or undertake transfer function measurements.   |  |       |   |

<sup>30</sup> 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 <sup>1</sup>                             | <u>Suggested frequency of testing</u> <sup>2</sup> | Notes | Basis for compliance assessment   |
|---|--|--|-------|---|
| <b>Excitation Control System / Voltage and Reactive Power Control</b><br>(as required under: S5.2.5.13 in versions 1- <del>30-47</del> 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) <sup>31</sup> | Method 2 <u>(of 3)</u> :<br>(a) AVR step response tests;<br><u>and</u>               | 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;<br><u>and</u>                   |  |       |   |
|   | <u>(c)</u> AVR and PSS transfer function measurements over required frequency range. |  |       |   |

<sup>31</sup> 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 <sup>1</sup>  | <u>Suggested frequency of testing<sup>2</sup></u>                         | Notes   | Basis for compliance assessment  |
|---|---|---|---|--|
| <p><b><u>Excitation Control System / Voltage and Reactive Power Control</u></b></p> <p><u>(as required under: S5.2.5.13 in versions 1-30-47 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)<sup>32</sup></u></p> | <p>Method 3 <u>(of 3)</u>:</p> <p>Performance of <u>relevant sub-systems</u> will be monitored using the following systems: digital protection relays; other data-logging equipment as required</p> | <p>As appropriate to the technology of the <u>relevant sub-system</u></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>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</p> |

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<sup>32</sup> 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 <sup>1</sup>  | <u>Suggested frequency of testing<sup>2</sup></u> | Notes   | Basis for compliance assessment                                       |
|---|---|---|---|---|
| <b>Active Power Control</b><br>(as required under S5.2.5.14 in versions 13- <del>30-47</del> of the Rules) <sup>33</sup>  | Method 1 <u>(of 2)</u> :<br>One-off installation  |   | Following <u>plant change</u>                   | Achieve performance standard  |
|   | Method 2 <u>(of 2)</u> :<br>Monitor non-compliance with dispatch market systems   | <u>After major event</u>                          |   | Achieve performance standard  |
| <b>Remote Monitoring</b><br>(as required under S5.2.6.1 in versions 1- <del>30-47</del> of the Rules, the initial Code, and all amended versions of the Code) <sup>34</sup> | Method 1 <u>(of 2)</u> :<br>(a) Calibration of Transducers; <u>and</u><br>(b) Verification of the accuracy of transmitted data. |   | Following <u>plant change</u> and every 5 years | Confirmation at each end of the communications system by both parties |
|   | Method 2 <u>(of 2)</u> :<br><u>(a)</u> SCADA monitored values and farm panel metering will be routinely checked; <u>and</u>     | Every 5 years                                     | Applicable for Wind Farms                       | Achieve performance standard  |

<sup>33</sup> This provision was amended in version 13 of the Rules.

<sup>34</sup> 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 <sup>1</sup>  | <u>Suggested frequency of testing<sup>2</sup></u>                  | Notes | Basis for compliance assessment |
|---|---|--|-------|---------------------------------|
| <b>Remote Monitoring</b><br>(as required under S5.2.6.1 in versions 1- <del>30-47</del> of the Rules, the initial Code, and all amended versions of the Code) <sup>35</sup>   | <del>(a)</del> (b) The calibration of transducers and Wind Farm panel metering will be checked.   | At each major outage or once every 5 years                         |       |                                 |
| <b>Communications Equipment</b><br>(as required under: <u>S5.2.6.2 in versions 13-47 and</u> S5.2.6.3 in versions 1-12 of the Rules, <del>and S5.2.6.2 in versions 13-30 of the Rules</del> ; and S5.2.6.3 of the initial Code, and all amended versions of the Code) <sup>36</sup> | Method 1 <u>(of 1)</u> :<br>(a) Confirmation of the availability of communication links, including any backup links with AEMO; <u>and</u> | 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> |       |                                 |

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

<sup>36</sup> This provision was amended in version 13 of the Rules.

| Performance Standard/Rules/Code Provision   | Suitable testing and monitoring methodology <sup>1</sup>   | <u>Suggested frequency of testing<sup>2</sup></u>                  | Notes   | Basis for compliance assessment  |
|---|--|--|---|--|
| <b>Power Station Auxiliary Transformers / Supplies</b><br>(as required under: <a href="#">S5.2.7 in versions 13-47</a> and S5.2.8 in versions 1-12 of the Rules, <del>and <a href="#">S5.2.7 in versions 13-30 of the Rules</a></del> ; and S5.2.8 of the initial Code, and all amended versions of the Code) <sup>37</sup> | Method 1 <u>(of 2)</u> :<br><br>(a) Metering of active and reactive power at the auxiliary supply connection point; <u>and</u> | Every 4 years  | Only applicable when auxiliary supplies are taken from some other point different to generator connection point.<br><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 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 <u>(of 2)</u> :<br><br>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.  | Achieve performance standard   |

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<sup>37</sup> 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 <sup>1</sup>  | <u>Suggested frequency of testing</u> <sup>2</sup> | Notes   | Basis for compliance assessment                         |
|--|---|--|---|---|
| <b>Power Station Auxiliary Transformers / Supplies</b><br>(as required under: <u>S5.2.7 in versions 13-47</u> and S5.2.8 in versions 1-12 of the Rules, <del>and S5.2.7 in versions 13-30 of the Rules</del> ; and S5.2.8 of the initial Code, and all amended versions of the Code) <sup>38</sup> |   |  | 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. |   |
| <b>Fault Level / Current</b><br>(as required under: <u>S5.2.8 in versions 13-47</u> and S5.2.9 in versions 1-12 of the Rules, <del>and S5.2.8 in versions 13-30 of the Rules</del> ; and S5.2.9 in all amended versions of the Code from 27 March 2003 onwards) <sup>39</sup>                      | Method 1 <u>(of 3)</u> :<br>(a) Monitoring in-service performance during faults near the connection point; <u>and</u> | Review following any event                         |   | Calculation confirms current fault current contribution |
|  | (b) Review and recalculation of fault levels; <u>and</u>  | Following <u>plant change</u>                      |   |   |

<sup>38</sup> This provision was amended in the Code on 27 March 2003, and in version 13 of the Rules.

<sup>39</sup> 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 <sup>1</sup>  | <u>Suggested frequency of testing</u> <sup>2</sup>                 | Notes | Basis for compliance assessment                         |
|---|---|--|-------|---|
| <u>Fault Level / Current</u><br>(as required under: S5.2.8 in versions 13-47 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) <sup>40</sup> | (c) Routine testing of any <u>relevant sub-systems</u> .  | As appropriate to the technology of the <u>relevant sub-system</u> |       |   |
|   | Method 2 (of 3):<br>(a) Modelling and simulation of plant characteristics to make sure the plant is capable of meeting agreed standards; <u>and</u>   | Following <u>plant change</u>                                      |       | Calculation confirms current fault current contribution |
|   | (b) Monitoring of generator contribution on fault event.  | Review following any event   |       |   |
|   | Method 3 (of 3):<br>(a) Performance of <u>relevant sub-systems</u> will be monitored using the following systems: digital protection relays; other data-logging equipment as required; <u>and</u> | As appropriate to the technology of the <u>relevant sub-system</u> |       | Achieve performance standard.                           |

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<sup>40</sup> 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 <sup>1</sup>  | <u>Suggested frequency of testing</u> <sup>2</sup> | Notes | Basis for compliance assessment  |
|---|---|--|-------|--|
| <u>Fault Level / Current</u><br>(as required under: S5.2.8 in versions 13-47 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) <sup>41</sup> | (b) Where recorded data is available, comparison to be made of measured fault currents and computer simulations; <u>and</u> | 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>                      |       |  |

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