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Ms Sophie Cazabon
Australian Energy Market Commission
Level 5
201 Elizabeth Street
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6 March 2012

SKM Letter to AEMC 06Mar2012.docx
QHIN113.01

Dear Sophie,

AEMC Generator Compliance Program Template Review - SKM Submission

Although not an NEM Participant, SKM provides technical consultancy services to a number of registered Generators in the areas of generator registration and compliance.

Based on experience gained in these roles, SKM wishes to submit for consideration the enclosed marked up version of its proposed changes to the compliance program template for consideration during the present review.

The marked up changes relate to the extension of the testing frequency from the present “every 3 years” to “major inspection interval, or every 5 years (whichever occurs sooner)”.

The reasons for the proposed change in testing frequency are detailed as follows:

- Generating unit availability to the NEM should be kept to a maximum by making use of the scheduled major inspection intervals for generator compliance testing rather than requiring the generating unit to be made unavailable to the NEM solely for compliance testing at the fixed interval of every 3 years, as stated in the current compliance program template.
- Good Electricity Industry Practice (GEIP) for Gas Turbine (GT) generating units has advanced to the extent that major inspection intervals for typical advanced GT generating units (e.g. F, G and H class) are ranging from 24000 to 40000 operating hours. Thus, typical GT generating units may take longer than 3 years to accumulate these operating hours before the next major inspection is due. This is particularly the case for peaking duty and strategic standby generating units which do not normally operate under base load conditions.
- New microprocessor digital IED generator protection relays, digital AVRs and digital governors do not drift in accuracy, as might have been the case for earlier analogue (rotating induction disc type) protection relays. SKM considers that the current 3 year



testing interval for digital protection AVR and governor systems in the existing compliance program template could be safely extended to each major inspection interval, or every 5 years (whichever occurs sooner).

SKM would be happy to enter discussions and to provide evidence to support its case for the proposed change to the current template, should this be requested.

Yours faithfully,

Alan Peiniger

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2.9 Table to assist development of generator compliance programs

Performance Standard/Rules/Code Provision	Suitable testing and monitoring methodology	Frequency	Notes	Basis for compliance assessment
Reactive Power Capability (as required under S5.2.5.1 in versions 1-30 of the Rules, the initial Code, and all amended versions of the Code) ⁸	Method 1: At rated power output, adjust the reactive power capability to specified levels	Every 3 years <u>Major Inspection interval or every 5 years (whichever occurs sooner)</u> and after <u>plant change</u>	Directly Measurable. Applies to synchronous and conventional plant.	Achieve reactive power requirements of the performance standard
	Method 2: Exercise the over and under excitation limits at as close to rated power output as practical	Every 3 years <u>Major Inspection interval or every 5 years (whichever occurs sooner)</u> -and after <u>plant change</u>	Directly Measurable. Applies to synchronous and conventional plant.	Achieve reactive power requirements of the performance standard
	Method 3:			

⁸ 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	Frequency	Notes	Basis for compliance assessment
	Step testing of AVR limiters	Every Major Inspection interval or every 5 years (whichever occurs sooner) 3 years and after <u>plant change</u>	Applies to conventional plant	Achieve reactive power requirements of the performance standard
	Method 4: (a) Capability will be tested by component (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> Annual review of a selection of events	Applies to wind farms plant	Achieve performance standard Consistency with plant characteristics
	Method 5: Routine testing of <u>relevant sub-systems</u>	As appropriate to the technology of the <u>relevant sub-system</u>	Applicable to a wide range of generating plant and systems	Consistency with plant characteristics
Power Factor Requirements (as required under S5.3.5 in versions 1-30 of the Rules, the	Direct measurement and calculation of power factor when not generating	Every Major Inspection interval or every 5 years	Only applies where there is a generator circuit breaker,	Actual capability directly demonstrated

Performance Standard/Rules/Code Provision	Suitable testing and monitoring methodology	Frequency	Notes	Basis for compliance assessment
initial Code, and all amended versions of the Code)		<u>(whichever occurs sooner)</u> 3 years and following <u>plant change</u>	allowing auxiliary supply to be drawn through the main connection point	
Quality of Electricity Generated (as required under S5.2.5.2 in versions 1-30 of the Rules, the initial Code, and all amended versions of the Code) ⁹	Method 1: (a) Direct measurements using power quality meters to derive: i. voltage fluctuation levels ii. voltage balance iii. harmonics, flicker and negative phase sequence voltage prior to synchronisation (b) Routine testing of any <u>relevant sub-systems</u>	Following <u>plant change</u> As appropriate to the technology of the <u>relevant sub-system</u>	Performance of generator and its contribution to power quality needs to be separated from the contribution of others. Important when power quality at the connection point is dependent on	Achieve performance standard or demonstrate consistency with plant characteristics used in determining original compliance

⁹ 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	Frequency	Notes	Basis for compliance assessment
			ancillary plant of power electronic control systems.	
	<p>Method 2:</p> <p>(a) Monitoring in-service performance through use of Power Quality Monitors</p> <p>(b) Testing of any <u>relevant sub-systems</u></p>	<p>Routine monitoring</p> <p>Specific review every <u>Major-Inspection interval or every 5 years (whichever occurs sooner)</u>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>Response to Frequency Disturbances</p> <p>(as required under S5.2.5.3 in</p>	<p>Method 1:</p> <p>(a) Investigating <u>plant trips</u> that occur during significant</p>	<p>On every event</p>		<p>Achieve performance standard</p>

Performance Standard/Rules/Code Provision	Suitable testing and monitoring methodology	Frequency	Notes	Basis for compliance assessment
versions 1-30 of the Rules, the initial Code, and all amended versions of the Code) ¹⁰	<p>frequency disturbances</p> <p>(b) Routine testing of <u>relevant sub-systems</u> including:</p> <ul style="list-style-type: none"> i. testing of control system response to disturbances by the injection of simulated frequency / speed control signals ii. Routine tests of electrical / mechanical over speed devices 	As appropriate to the technology of the <u>relevant sub-system</u>		
	<p>Method 2:</p> <p>(a) Investigating system performance using high speed data recorders</p>	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

¹⁰ 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	Frequency	Notes	Basis for compliance assessment
	<p>(b) Routine testing of <u>relevant sub-systems</u> including:</p> <ul style="list-style-type: none"> i. testing of control system response to disturbances by the injection of simulated frequency / speed control signals ii. Routine tests of electrical / mechanical over speed devices 	<p>As appropriate to the technology of the <u>relevant sub-system</u></p>		<p>the models are not available</p>
	<p>Method 3:</p> <ul style="list-style-type: none"> (a) Verify the modelled performance of a sample of turbines (b) Verify the performance at the connection point by testing response to an introduced disturbance 	<p>Following <u>plant change</u></p> <p><u>Type testing</u> and verification every 10 years</p>	<p>Only applicable to small asynchronous generators with digital controls that are aggregated.</p> <p>Each unit is not material and performance slippage is unlikely.</p>	<p>Operation over the frequency range specified and agreed in the Generator Performance Standard</p>

Performance Standard/Rules/Code Provision	Suitable testing and monitoring methodology	Frequency	Notes	Basis for compliance assessment
	<p>(c) Continuous monitoring (high speed) of performance at the connection point</p> <p>(d) Routine testing of <u>relevant sub-systems</u> including:</p> <ul style="list-style-type: none"> i. testing of control system response to disturbances by the injection of simulated frequency / speed control signals ii. Routine tests of electrical / mechanical over speed devices 	As appropriate to the technology of the <u>relevant sub-system</u>	Appropriate to use where high speed monitors are available and models have been used in establishing compliance.	
	<p>Method 4:</p> <p>(a) Performance of <u>relevant sub-systems</u> will be monitored using the following systems under normal machine operation:</p>	Every <u>3 years Major Inspection interval or every 5 years (whichever occurs</u>		Achieve performance standard

Performance Standard/Rules/Code Provision	Suitable testing and monitoring methodology	Frequency	Notes	Basis for compliance assessment
	<p>digital protection relays; other data-logging equipment as required</p> <p>(b) Routine testing and validation of <u>relevant sub-system</u> performance including:</p> <ul style="list-style-type: none"> i. electrical protection; and ii. turbine protection 	<p>sooner)</p> <p>As appropriate to the technology of the <u>relevant sub-system</u></p>		
<p>Response to Voltage Disturbances (as required under: S5.2.5.3 in versions 1-12 of the Rules, and S5.2.5.4 in versions 13-30 of the Rules; and S5.2.5.3 in the initial Code, and all</p>	<p>Method 1:</p> <ul style="list-style-type: none"> (a) Investigating <u>plant trips</u> that occur during significant voltage disturbances (b) Routine testing of <u>relevant sub-systems</u> including: 	<p>On every event</p> <p>As appropriate to the technology of the <u>relevant sub-system</u></p>		<p>Consistency with plant characteristics</p>

Performance Standard/Rules/Code Provision	Suitable testing and monitoring methodology	Frequency	Notes	Basis for compliance assessment
amended versions of the Code) ¹¹	<ul style="list-style-type: none"> i. AVR systems ii. Auxiliary power systems iii. Protection relays 			
	<p>Method 2:</p> <ul style="list-style-type: none"> (a) Continuous high speed monitoring (b) Routine testing of <u>relevant sub-systems</u> including: <ul style="list-style-type: none"> i. AVR systems ii. Auxiliary power systems 	<p>On every event where the <u>plant trips</u> or on at least one major voltage disturbance every <u>3 years Major Inspection interval or every 5 years (whichever occurs sooner)</u></p> <p>As appropriate to the technology of the <u>relevant sub-system</u></p>	<p>Appropriate to use where high speed monitors are available and models have been used in establishing compliance.</p> <p>Where possible, testing of auxiliary power systems should include simulated</p>	<p>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</p>

¹¹ 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	Frequency	Notes	Basis for compliance assessment
	iii. Protection relays		disturbance testing.	
	<p>Method 3:</p> <p>(a) With the generator out of service, test the ability of nominated 415 V drives to sustain a specified voltage interruption</p> <p>(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</p>	<p>Every <u>4 years Major Inspection interval or every 5 years (whichever occurs sooner)</u></p> <p>On every event</p>	<p>Applies only to 415 V drives.</p> <p>This type of monitoring will be acceptable only if high speed monitoring is not available.</p>	<p>Successful ride through of system voltage disturbances, as per the agreed performance standard</p>
<p>Response to Disturbances following Contingency Events</p> <p>(as required under S5.2.5.5 in versions 13-30 of the Rules)¹²</p>	<p>Method 1:</p> <p>Direct testing by instigating a network trip</p>	<p>Following <u>plant changes</u></p>	<p>Preferred method where possible and where risks can be managed</p>	<p>Achieve performance standard</p>

¹² This provision was amended in version 13 of the Rules.

Performance Standard/Rules/Code Provision	Suitable testing and monitoring methodology	Frequency	Notes	Basis for compliance assessment
	Method 2: (a) Investigate <u>plant trips</u> that occur during or immediately following major system events (b) Routine monitoring and testing of <u>relevant sub-systems</u> including suitable testing to confirm circuit breaker operating times	On every event As appropriate to the technology of the <u>relevant sub-system</u>		Achieve performance standard
	Method 3: (a) Continuous monitoring using high speed recorders (b) Routine monitoring and testing of <u>relevant sub-</u>	On disturbances when the <u>plant trips</u> or at least one major event every 3 years <u>Major-Inspection interval or every 5 years (whichever occurs sooner)</u> As appropriate to the technology of the	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

Performance Standard/Rules/Code Provision	Suitable testing and monitoring methodology	Frequency	Notes	Basis for compliance assessment
	(c) Routine monitoring and testing of any <u>relevant sub-systems</u>	As appropriate to the technology of the <u>relevant sub-system</u>		
	Method 2: Monitoring in-service performance using appropriate metering	On disturbances when the plant trips including at least one major event every <u>3 years Major Inspection interval or every 5 years (whichever occurs sooner)</u>	Appropriate to use where suitable metering is available	Consistency of operation with plant performance specifications
Partial Load Rejection (as required under: S5.2.5.4 in versions 1-12 of the Rules, and S5.2.5.7 in versions 13-30 of the Rules; and S5.2.5.4 of the initial Code, and all	Method 1: (a) Measure response of the generator to system over-frequency and analyse the unit performance (b) Investigation of <u>plant trips</u>	On every event	Directly measurable	Achieve performance standard

Performance Standard/Rules/Code Provision	Suitable testing and monitoring methodology	Frequency	Notes	Basis for compliance assessment
amended versions of the Code) ¹⁴				
	<p>Method 2:</p> <p>(a) Routine testing of <u>relevant sub-systems including</u>:</p> <p>i. Analytical simulation of generator, auxiliary systems and critical protections</p> <p>ii. Secondary injection testing of critical protection systems</p> <p>(b) Assess any <u>plant trip</u> for relationship to load rejection event</p>	<p>As appropriate to the technology of the <u>relevant sub-system</u></p> <p>On every event</p>	<p><u>Type Test</u> permissible where multiple units are involved</p>	<p>Simulation demonstrates ride through of load rejection event specified in Performance Standard.</p> <p>Operation over the conditions specified and agreed in the Generator Performance Standard.</p>
	<p>Method 3:</p> <p>(a) Response to partial load rejection to be assessed by</p>			<p>Achieve performance</p>

¹⁴ 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	Frequency	Notes	Basis for compliance assessment
	<p>in-service performance</p> <p>(b) Test for correct operation of turbine overspeed trips</p>	<p>Every <u>4-years Major Inspection interval or every 5 years (whichever occurs sooner)</u></p>	<p>Overspeed protection checked off-line after major overhauls</p>	<p>standard.</p> <p>That turbine trip operates to within acceptable tolerance of nominal trip setting for overspeed protection.</p>
<p>Protection from Power System Disturbances</p> <p>(as required under S5.2.5.8 in versions 1-30 of the Rules, the initial Code, and all amended versions of the Code)¹⁵</p>	<p>Method 1:</p> <p>(a) Continuous monitoring using high speed recorders</p> <p>(b) Routine testing of <u>relevant sub-systems</u> including applicable protection relays</p>	<p>As appropriate to the technology of the <u>relevant sub-system</u></p>	<p>Appropriate to use where high speed monitors are available and models have been used in establishing compliance</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> <p>That protection system operated in accordance with design and the</p>

¹⁵ 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	Frequency	Notes	Basis for compliance assessment
	(c) Investigate unit electrical protection trips	On every event		Performance Standard.
	Method 2: (a) Routine testing of <u>relevant sub-systems including:</u> i. Injection of simulated signals (secondary injection) to demonstrate correct operation of the protection ii. Repair or recalibrate protection relays as required (b) Investigate <u>plant trips</u>	As appropriate to the technology of the <u>relevant sub-system</u> On every event		Achieve performance standard
	Method 3: (a) Performance is monitored, in-service	At each major overhaul; and/or every 5 years <u>Major Inspection interval or every 5 years</u>	Applicable for wind farms. Changes to turbine control parameters will be controlled	Performance is confirmed by the generating system remaining synchronised during power system

Performance Standard/Rules/Code Provision	Suitable testing and monitoring methodology	Frequency	Notes	Basis for compliance assessment
	(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	<p>(<u>whichever occurs sooner</u>) by routine functional testing of unit electrical protection systems and verification of database registered protection settings to occur annually</p> <p>As appropriate to the technology of the <u>relevant sub-system</u></p>	<p>such that the performance of the generating system and generating units is not compromised in relation to the generator performance standard.</p> <p>Appropriate to use where data is available.</p>	<p>disturbance conditions where required under a provision of the Rules.</p> <p>Performance will be assessed against the performance standard requirements.</p>
<p>Protection Systems that Impact on Power System Security (as required under S5.2.5.9 in</p>	<p>Method 1:</p> <p>(a) Routine testing of protection systems including:</p> <p>i. CB opening times;</p>	<p>As appropriate to the technology of the protection system</p>	<p>Directly measurable</p>	<p>Achieve performance standard</p>

Performance Standard/Rules/Code Provision	Suitable testing and monitoring methodology	Frequency	Notes	Basis for compliance assessment
versions 1-30 of the Rules, the initial Code, and all amended versions of the Code) ¹⁶	<ul style="list-style-type: none"> ii. Protection relay injection testing. <p>(b) Confirmation from fault recorder records of actual performance</p>	Every <u>plant trip</u>		
	<p>Method 2:</p> <p>(a) Routine testing of <u>relevant sub-systems</u> including:</p> <ul style="list-style-type: none"> i. protection system testing by secondary injection ii. checking of circuit breaker opening times iii. redundancy of primary protection systems iv. timing of trip signal issued by the breaker fail 	<p>As appropriate to the technology of the <u>relevant sub-system</u></p> <p>On every event</p>		That all protection relays operate satisfactorily and to within design tolerance of setting value.

¹⁶ 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	Frequency	Notes	Basis for compliance assessment
	<p>protection system</p> <p>(b) Assessment of protection system performance in the event of protection system operation</p>			<p>That protection system is operated in accordance with design and the Performance Standard.</p>
	<p>Method 3:</p> <p>(a) Performance is monitored, in-service, where data is available.</p> <p>(b) Relevant testing of any <u>relevant sub-systems</u></p>	<p>At each major overhaul; and/or every 5 years <u>Major Inspection interval or every 5 years (whichever occurs sooner)</u> by routine functional testing of unit electrical protection systems and verification of database registered protection settings to occur annually</p> <p>As appropriate to the technology of the</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>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.</p> <p>Performance will be assessed against the</p>

Performance Standard/Rules/Code Provision	Suitable testing and monitoring methodology	Frequency	Notes	Basis for compliance assessment
	<p>including protection system relays shall be tested by secondary injection</p> <p>(c) Verification of database registered protection settings to occur in conjunction with injection testing</p>	<u>relevant sub-system</u>		performance standard requirements following a unit trip as a result of a relevant system event in which the unit should have remained synchronised.
<p>Asynchronous Operation of Synchronous Generating Units / Protection to Trip Plant for Unstable Operation (as required under S5.2.5.10 in versions 1-30 of the Rules, the initial Code, and all amended versions of the Code)¹⁷</p>	<p>Method 1:</p> <p>(a) Routine testing of <u>relevant sub-systems</u> including protection system testing by secondary injection</p> <p>(b) Assessment of protection system performance in the</p>	<p>As appropriate to the technology of the <u>relevant sub-system</u></p> <p>On every event</p>		<p>That all protection relays operate satisfactorily and to within design tolerance of setting value.</p> <p>That protection system is operated in</p>

¹⁷ 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	Frequency	Notes	Basis for compliance assessment
	event of protection system operation or of asynchronous operation			accordance with design and the Performance Standard.
Frequency Control / Frequency Responsiveness and/or Governor Stability and Governor System (as required under: S5.2.5.11 in versions 1-30 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) ¹⁸	Method 1: Monitor in-service performance using high speed frequency data		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
	Method 2: 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

¹⁸ 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	Frequency	Notes	Basis for compliance assessment
	Method 3: (a) Analytical simulation of turbine and governor systems (b) Assess generator response to disturbances using high speed recording data	Type Test permissible where multiple units are involved 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: (a) Step response test of the governor to test damping and droop characteristics	Every 4 years <u>Major Inspection interval or every 5 years (whichever occurs sooner)</u>		Plant performance complies with the Generator Performance Standard

Performance Standard/Rules/Code Provision	Suitable testing and monitoring methodology	Frequency	Notes	Basis for compliance assessment
	(b) Routine calibration tests	Every <u>4 years Major Inspection interval</u> or every 5 years (whichever occurs sooner)		
Stability / Impact on Network Capability (as required under S5.2.5.12 in versions 1-30 of the Rules, and all amended versions of the Code from 27 March 2003 onwards) ¹⁹	Method 1: (a) Monitor in-service performance for relevant performance characteristics not otherwise tested (b) Routine monitoring and testing of <u>relevant sub-systems</u> including suitable testing to confirm power system stabiliser	Following <u>plant changes</u> As appropriate to the technology of the <u>relevant sub-system</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

¹⁹ This provision was amended in the Code on 27 March 2003, and in version 13 of the Rules.

Performance Standard/Rules/Code Provision	Suitable testing and monitoring methodology	Frequency	Notes	Basis for compliance assessment
	performance (if relevant)			
Excitation Control System/ Voltage and Reactive Power Control (as required under: S5.2.5.13 in versions 1-30 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) ²⁰	Method 1: (a) Transfer function measurements and step response tests with the unit unsynchronised and at full load (b) Assess the stability of limiter operation (c) Monitoring in-service performance or undertake transfer function measurements	Every 4 years <u>Major Inspection interval or every 5 years (whichever occurs sooner)</u>		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
	Method 2: (a) AVR step response tests	Every 4 years <u>Major</u>		Consistency of

²⁰ This provision was amended in the Code on 27 March 2003, and in version 13 of the Rules.

Performance Standard/Rules/Code Provision	Suitable testing and monitoring methodology	Frequency	Notes	Basis for compliance assessment
	<p>(b) AVR step response test of OEL and UEL operation</p> <p>(c) AVR and PSS transfer function measurements over required frequency range</p>	<p>Inspection interval or every 5 years (whichever occurs sooner)</p>		<p>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>
	<p>Method 3:</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</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</p>

Performance Standard/Rules/Code Provision	Suitable testing and monitoring methodology	Frequency	Notes	Basis for compliance assessment
			and generating units is not compromised in relation to the Generator Performance Standard.	models are not available
Active Power Control (as required under S5.2.5.14 in versions 13-30 of the Rules) ²¹	Method 1: One-off installation	Following <u>plant change</u>		Achieve performance standard
	Method 2: Monitor non-compliance with dispatch market systems			Achieve performance standard
Remote Monitoring (as required under S5.2.6.1 in versions 1-30 of the Rules, the initial Code, and all amended	Method 1: (a) Calibration of Transducers	Following <u>plant change</u> and every <u>5 years Major Inspection interval</u>		Confirmation at each end of the communications system by both parties

²¹ This provision was amended in version 13 of the Rules.

Performance Standard/Rules/Code Provision	Suitable testing and monitoring methodology	Frequency	Notes	Basis for compliance assessment
versions of the Code) ²²	(b) Verification of the accuracy of transmitted data	<u>or every 5 years (whichever occurs sooner)</u>		
	<p>Method 2:</p> <p>(a) SCADA monitored values and farm panel metering will be routinely checked</p> <p>(b) The calibration of transducers and Wind Farm panel metering will be checked</p>	<p>Every 5 years <u>Major Inspection interval or every 5 years (whichever occurs sooner)</u></p> <p>At each major outage or once every 5 years <u>Major-Inspection interval or every 5 years (whichever occurs sooner)</u></p>	Applicable for Wind Farms	Achieve performance standard
Communications Equipment	Method 1:			

²² This provision was amended in the Code on 27 March 2003, and in version 13 of the Rules.

Performance Standard/Rules/Code Provision	Suitable testing and monitoring methodology	Frequency	Notes	Basis for compliance assessment
(as required under: S5.2.6.3 in versions 1-12 of the Rules, and S5.2.6.2 in versions 13-30 of the Rules; and S5.2.6.3 of the initial Code, and all amended versions of the Code) ²³	<p>(a) Confirmation of the availability of communication links, including any backup links with AEMO</p> <p>(b) Testing of <u>relevant sub-systems</u> including any power backup or UPS system</p>	<p>Annual</p> <p>As appropriate to the technology of the <u>relevant sub-system</u></p>		Achieve performance standard
<p>Power Station Auxiliary Transformers / Supplies</p> <p>(as required under: S5.2.8 in versions 1-12 of the Rules, and S5.2.7 in versions 13-30 of the Rules; and S5.2.8 of the initial Code, and all amended versions of the Code)²⁴</p>	<p>Method 1:</p> <p>(a) Metering of active and reactive power at the auxiliary supply connection point</p>	<p>Every 4 years Major Inspection interval or every 5 years (whichever occurs sooner)</p>	<p>Only applicable when auxiliary supplies are taken from some other point different to generator connection point.</p> <p>Access Standards must be established</p>	<p>Power factor, quality of supply and protection and control requirements within allowable range / specification</p>

²³ This provision was amended in version 13 of the Rules.

²⁴ This provision was amended in the Code on 27 March 2003, and in version 13 of the Rules.

Performance Standard/Rules/Code Provision	Suitable testing and monitoring methodology	Frequency	Notes	Basis for compliance assessment
	(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>	under clause S5.3.5.	Performance to specification
	Method 2: Performance will be monitored as part of condition monitoring and maintenance routines		This standard only applies to generating systems that takes auxiliary supplies from a separate supply. Unit auxiliary supplies on wind farms are taken from within connection point when units are on-line. Very small wind farm station service auxiliary load requirements are considered negligible under NEM CMP requirements.	Achieve performance standard

Performance Standard/Rules/Code Provision	Suitable testing and monitoring methodology	Frequency	Notes	Basis for compliance assessment
Fault Level / Current (as required under: S5.2.9 in versions 1-12 of the Rules, and S5.2.8 in versions 13-30 of the Rules; and S5.2.9 in all amended versions of the Code from 27 March 2003 onwards) ²⁵	Method 1: (a) Monitoring in-service performance during faults near the connection point (b) Review and recalculation of fault levels (c) Routine testing of any <u>relevant sub-systems</u>	Review following any event Following <u>plant change</u> As appropriate to the technology of the <u>relevant sub-system</u>		Calculation confirms current fault current contribution
	Method 2: (a) Modelling and simulation of plant characteristics to make sure the plant is capable of meeting agreed standards (b) Monitoring of generator contribution on fault event	Following <u>plant change</u> Review following any event		Calculation confirms current fault current contribution
	Method 3:			

²⁵ This provision was amended in the Code on 27 March 2003, and in version 13 of the Rules.

Performance Standard/Rules/Code Provision	Suitable testing and monitoring methodology	Frequency	Notes	Basis for compliance assessment
	<p>(a) 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>(b) Where recorded data is available, comparison to be made of measured fault currents and computer simulations</p> <p>(c) Review and recalculation of fault levels</p>	<p>As appropriate to the technology of the <u>relevant sub-system</u></p> <p>Following a fault</p> <p>Following <u>plant change</u></p>		<p>Achieve 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>