NATIONAL GENERATORS FORUM

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19 June 2009

Mr Ian Woodward
Chairman
Reliability Panel
The Australian Energy Market Commission
P O Box A2449
Sydney South NSW 1235

Dear Mr Woodward

TEMPLATE FOR GENERATOR COMPLIANCE PROGRAMMES (REL0032)

National Generator Forum ("NGF") appreciates the opportunity to provide the AEMC with a submission in response to the "Template for generator compliance programmes" consultancy.

The NGF was instrumental in developing the approach to generator compliance that includes the use of generator templates. This approach was chosen so that the compliance plan represents good electricity industry practice which allows:

- a generator to be confident that they are compliant with the Rules;
- the market to be confident that the requirements for compliance are clearly defined; and
- the AER to test compliance on an ongoing basis and in advance of issues developing.

The NGF supports the draft template but wishes to make some comments.

1. Compliance Principles

The NGF accepts the compliance principles used in developing the template and these principles can be used as a guide in future reviews of the template. The NGF recommends that these principles be part of the template package along with the Chapter 4 of the document. The template package must be published as a stand alone document.

2. Incorporating new testing regimes

The flexibility of the template in terms of the actual test method and frequency is very important as it is almost impossible to match every generator's test methodology with the template. The NGF acknowledges that the proposed template has these features to a large extent. There must, however, be an avenue for a new generator to propose a different testing methodology to those listed in the template. This option will take account of new generators that cannot perform some or all of the listed methods for technical or other reasons.

3. Management of Compliance Programmes

The Reliability Panel indicated that the template forms part of a generator's overall compliance management process. As such, the compliance programmes formulated can evolve to fit with the generator's overall compliance process. It is acknowledged that the compliance programmes are not subject to any approval process.

The NGF supports the AEMC's approach not to mandate a particular management approach or standard regarding the compliance programme and any associated procedures/policies that an individual generator may implement. It is appropriate that the generator is responsible for implementing this in a satisfactory and reasonable manner. It is acknowledged that generator compliance programmes are subject to audit by the AER. Further to this point, the NGF would like to propose that a consistent and clearly defined *framework* for such audits be developed covering areas including scope and frequency of audit. The NGF believes that this will directly assist generators and give other stakeholders, such as the Network Service Providers, confidence that the generators are being held to the appropriate review regimes.

4. Specific Comments on the draft compliance template

Appendix 1 contains number of comments made on the draft template document. They are not major and are self explanatory.

In summary, the NGF acknowledges that the draft template meets generator requirements to design compliance programmes. It is then up to the generator to determine how to manage the programme based on the generator's overall compliance management practices.

If you have any questions on the issues raised in this submission please contact Methsiri Aratchige on 02 8268 4235.

Yours sincerely

Alex Cruickshank
Chair, Market Working Group

Appendix 1

Draft Template for Generator Compliance Programs – WORKING DOCUMENT

Comment [T1]: The terminology throughout the document should be consistent.

Performance Standard/Rules Clause	Testing methodology	Frequency	Notes	Acceptance Criteria
Reactive Power Capability (as required under S5.2.5.1 in versions 1-26 of the Rules)	Method 1: At rated power output, adjust the reactive power capability to specified levels	At least every 3 years and after plant change	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	At least every 3 years and after plant change	Directly Measurable Applies to synchronous and conventional plant	Achieve reactive power requirements of the performance standard
	Method 3: Step testing of AVR limiters	At least every 3 years and after plant change	Applies to conventional plant	Achieve reactive power requirements of the performance standard

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Performance Standard/Rules Clause	Testing methodology	Frequency	Notes	Acceptance Criteria
	Method 4: (a) Capability will be tested (b) Capability will be monitored using SCADA under normal wind farm operation.	Following plant change Annual review of a selection of events	Applies to wind farms plant	Achieve performance standard Consistency with plant characteristics
	Method 5: Routine testing of relevant sub-systems	As appropriate to the technology of the relevant sub-system	Applicable to a wide range of generating plant and systems	Consistency with plant characteristics
Power Factor when not generating (clause and version of Rules: N/A)	Method 1: Direct measurement and calculation of power factor when not generating	At least every 3 years and following plant change	Only applies where there is a circuit breaker, allowing auxiliary supply to be drawn through the main connection point	Actual capability directly demonstrated.
Quality of Electricity Generated (as required under	Method 1: (a) Direct measurements using power quality	Following plant change	Important when power quality at the	Data analysis can demonstrate compliance

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Comment [EE4]: Do we need more details ??

Comment [T5]: This section is incomplete.

Comment [T6]: A reference must be provided if this is a NER performance requirement.

Performance Standard/Rules Clause	Testing methodology	Frequency	Notes	Acceptance Criteria
S5.2.5.2 in versions 1-26 of the Rules)	meters to derive: i. voltage fluctuation levels ii. voltage balance iii. harmonics, flicker and negative phase sequence voltage prior to synchronization (b) Routine testing of any relevant sub-systems	As appropriate to the technology of the relevant sub-system	connection point is dependent on ancillary plant of power electronic control systems	is met. Consistency with plant characteristics
	Method 2: (a) Capability will be monitored through use of Power Quality Monitors (b) Testing of any relevant sub-systems	Routine monitoring Specific review annually and following plant change As appropriate to the technology of the relevant sub-system	Important when power quality at the connection point is dependent on ancillary	Not raising alarms Consistency with plant characteristics (no deterioration) Consistency with plant characteristics

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Comment [T7]: The impact of harmonics already on the system needs to be addressed and generators can act as harmonic sinks.

Comment [T8]: This should be Performance not Capability

Comment [T9]: Annual review of this performance is onerous to the generator

Performance Standard/Rules Clause	Testing methodology	Frequency	Notes	Acceptance Criteria
			plant of power electronic control systems	
Response to Frequency Disturbances (as required under S5.2.5.3 in versions 1-26 of the Rules)	Method 1: (a) Investigating unit trips that occur during significant frequency disturbances (b) Routine testing of relevant sub-systems including: 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	On every event As appropriate to the technology of the relevant sub-system		Achieve performance standard

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Performance Standard/Rules Clause	Testing methodology	Frequency	Notes	Acceptance Criteria
	Method 2: (a) Investigating system performance using high speed data recorders (b) Routine testing of relevant sub-systems including: 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	On major events and minimum annual review As appropriate to the technology of the relevant sub-system	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; OR consistency with past performance
	Method 3: (a) Verify the modeled performance of a sample of turbines (say	Following plant change	Only applicable to small asynchronous generators with digital	Operation over the frequency range specified and agreed in the

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Comment [T10]: Three years would be more appropriate taking into account investigation at major events

Performance Standard/Rules Clause	Testing methodology	Frequency	Notes	Acceptance Criteria
	1-2%). (b) Verify the performance at the connection point by testing response to an introduced disturbance. (c) Continuous monitoring (high speed) of performance at the connection point.	Type testing and verification at least every 10 years	controls that are aggregated. Each unit is not material and performance slippage is unlikely. Appropriate to use where high speed monitors are available and models have been used in establishing compliance.	Generator Performance Standard.
	Method 4: (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	On major events and minimum annual review		Achieve performance standard

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Performance Standard/Rules Clause	Testing methodology	Frequency	Notes	Acceptance Criteria
	(b) Routine testing and validation of relevant sub-system performance including: i. electrical protection; and ii. turbine protection	As appropriate to the technology of the relevant sub-system		
Response to Voltage Disturbances (as required under S5.2.5.4 in versions 13-26 of the Rules)	Method 1: (a) Investigating unit trips that occur during significant voltage disturbances (b) Routine testing of relevant sub-systems including: i. AER systems ii. Auxiliary power systems iii. Protection relays	Event by event analysis As appropriate to the technology of the relevant sub-system		Consistency with plant characteristics

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Performance Standard/Rules Clause	Testing methodology	Frequency	Notes	Acceptance Criteria
	Method 2: (a) Continuous high speed monitoring. (b) Routine testing of relevant sub-systems including: i. AVR systems ii. Auxiliary power systems iii. protection relays	On major events and minimum annual review As appropriate to the technology of the relevant sub-system	Appropriate to use where high speed monitors are available and models have been used in establishing compliance. Where possible, testing of auxiliary power systems should include simulated disturbance testing	Consistency of operation with plant models used to establish initial compliance; OR consistency with past performance
	Method 3: (a) With the generator out of service, test the ability of nominated 415 V drives to sustain a specified voltage interruption. (b) Investigation of any	At least every 4 years	Applies only to 415 V drives	Successful ride through of system voltage disturbances, as per the agreed performance standard.

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Comment [T11]: Practically this may be very difficult to undertake and will be limited by the voltage range of the plant auxiliary tap changers

Performance Standard/Rules Clause	Testing methodology	Frequency	Notes	Acceptance Criteria
	occurrence of a unit trip which may have been associated with a system voltage disturbance.	Analysis of all events		
Generating Unit response to disturbances following contingency events (as required under S5.2.5.5 in versions 13-26 of the Rules)	Method 1: (a) Direct testing by instigating a network trip. (b) Continuous monitoring using high speed recorders (c) Routine monitoring and testing of relevant sub-systems	Following plant changes On major events and minimum annual review As appropriate to the technology of the relevant sub-system	Preferred method where possible and where risks can be managed Appropriate to use where high speed monitors are available and models have been used in establishing compliance.	Actual results will confirm compliance with standard. Consistency of operation with plant models used to establish initial compliance; OR consistency with past performance
	Method 2: (a) Investigate unit trips during major system events	On every event		

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Performance Standard/Rules Clause	Testing methodology	Frequency	Notes	Acceptance Criteria
	(b) Routine monitoring and testing of relevant sub-systems including suitable testing to confirm circuit breaker operating times	As appropriate to the technology of the relevant sub-system		Achieve performances standards
Quality of Electricity Generated and Continuous Uninterrupted Operation (as required under S5.2.5.6 in versions 13-26 of the Rules)	Method 1: (a) Investigating unit trips to ensure the cause of the trip is not voltage unbalanced conditions (b) Routine monitoring and testing of any relevant sub-systems	Following each event As appropriate to the technology of the relevant sub-system		
	Method 2: Monitoring in-service performance using high speed data recorders	Review performance at least annually	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; OR consistency with past performance

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Performance Standard/Rules Clause	Testing methodology	Frequency	Notes	Acceptance Criteria
Partial Load Rejection (as required under S5.2.5.4 in versions 1-12 of the Rules, and S5.2.5.7 in versions 13-26 of the Rules)	Method 1: (a) Measure response of the generator to system over-frequency and analyse the unit performance (b) Investigation of unit trips	On every event	Directly measurable	Achieve performance standards
	Method 2: (a) Routine testing of relevant sub-systems including: i. Analytical simulation of generator, auxiliary systems and critical protections ii. Secondary injection testing of critical protection systems (b) Assess any unit trip for relationship to load	Following plant changes As appropriate to the technology of the relevant sub-system	Type Test permissible where multiple units are involved	Simulation demonstrates ride through of load rejection event specified in Performance Standard Operation over the conditions specified and agreed in the Generator Performance Standard

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Performance Standard/Rules Clause	Testing methodology	Frequency	Notes	Acceptance Criteria
	rejection event	On every event		
	Method 3: (a) Response to partial load rejection to be assessed by in service performance (b) Test for correct operation of turbine overspeed trips	At least every 4 years	Overspeed protection checked off-line after major overhauls	That plant remained in service when required to do so. That turbine trip operates to within acceptable tolerance of nominal trip setting for overspeed protection.
Protection from Power System Disturbances (as required under S5.2.5.8 in versions 1-26 of the Rules)	Method 1: (a) Continuous monitoring using high speed recorders (b) Routine testing of relevant sub-systems including applicable protection relays (c) Investigate unit	As appropriate to the technology of the relevant sub-system On every event	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; OR consistency with past performance Relays are set correctly and any faults repaired at

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Performance Standard/Rules Clause	Testing methodology	Frequency	Notes	Acceptance Criteria
	electrical protection trips			time of testing.
	Method 2: (a) Routine testing of relevant sub-systems including: i. Injection of simulated signals (secondary injection) to demonstrate correct operation of the protection ii. Repair or recalibrate protection relays as required (b) Investigate unit trips	As appropriate to the technology of the relevant sub-system On every event		Plant performance complies with the clearance times in the Generator Performance Standard
	Method 3: (a) Performance is	At each major	Applicable for wind farms	Performance is confirmed

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Performance Standard/Rules Clause	Testing methodology	Frequency	Notes	Acceptance Criteria
	monitored, in-service, where data is available (b) Routine testing of relevant sub-systems including protection system relays, between the generating unit terminals but within the generating system shall be tested by secondary injection	overhaul; and/or at least every 5 years by routine functional testing of unit electrical protection systems and verification of database registered protection settings to occur annually. As appropriate to the technology of the relevant sub-system	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.	by the generating system remaining synchronised during power system disturbance conditions where required under a provision of the Rules 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
Protection systems that Impacts on Power System Security (as required under S5.2.5.9 in versions	Method 1: (a) Routine testing of protection systems including: i. CB opening times; ii. Protection relay	As appropriate to the technology of the protection system	Directly Measurable	Achieve performance standard

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Performance Standard/Rules Clause	Testing methodology	Frequency	Notes	Acceptance Criteria
1-26 of the Rules)	injection testing. (b) Confirmation from fault recorder records of actual performance	Every trip event		
	Method 2: (a) Routine testing of relevant sub-systems including: i. protection system testing by secondary injection ii. redundancy of primary protection systems iii. timing of trip signal issued by the breaker fail protection system (b) Assessment of protection system performance in the event of protection	As appropriate to the technology of the relevant sub-system On every event		That all protection relays operate satisfactorily and to within design tolerance of setting value. That protection system is operated in accordance with design and the Performance Standard.

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Performance Standard/Rules Clause	Testing methodology	Frequency	Notes	Acceptance Criteria
	system operation.			
	Method 3: (a) Performance is monitored, in-service, where data is available. If appropriate data is not currently available, additional on-line data logging facilities to be considered. (b) Relevant testing of any relevant sub-systems including protection system relays shall be tested by secondary injection (c) Verification of database registered protection settings to occur in	At each major overhaul; and/or at least every 5 years by routine functional testing of unit electrical protection systems and verification of database registered protection settings to occur annually. As appropriate to the technology of the relevant sub-system; OR C/B Fail protection tests shall be carried out at least every 2 years.	Applicable to Wind Farms Changes to turbine control parameters will be controlled such that the performance of the generating system and generating units is not compromised in relation to the GPS.	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. 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.

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Performance Standard/Rules Clause	Testing methodology	Frequency	Notes	Acceptance Criteria
	conjunction with injection testing.			
Asynchronous operation of synchronous generating units / Protection to Trip Plant for unstable operation (as required under S5.2.5.10 in versions 1-26 of the Rules)	Method 1: (a) Routine testing of relevant sub-systems including protection system testing by secondary injection (b) assessment of protection system performance in the event of protection system operation or of asynchronous operation.	As appropriate to the technology of the relevant sub-system On every event		That all protection relays operate satisfactorily and to within design tolerance of setting value. That protection system is operated in accordance with design and the Performance Standard.
Frequency Control (as required under S5.2.5.11 in versions 1-26 of the Rules)	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.	Achieve performance standard
	Method 2: Assessment of governor system performance during events involving	On every event	Assessment takes into account inertial response, overall	That governor system response is within the tolerance specified by the

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Performance Standard/Rules Clause	Testing methodology	Frequency	Notes	Acceptance Criteria
	significant variation to system frequency		governor droop setting etc.	Performance Standards.
	Method 3: (a) Analytical simulation of turbine and governor systems (b) Assess generator response to disturbances using high speed recording data	Following plant changes Type Test permissible where multiple units are involved Ongoing		Achieve performance standard or confirm modelled performance to actual
	Method 4: (a) Step response test of the governor to test damping and droop characteristics (b) Routine Calibration Tests	At least every 4 years At least every 4 years		Plant performance complies with the Generator Performance Standard
Stability / Impact on	Method 1:			

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Performance Standard/Rules Clause	Testing methodology	Frequency	Notes	Acceptance Criteria
Network Capability (as required under S5.2.5.12 in versions 1-26 of the Rules)	(a) Monitor in-service performance for relevant performance characteristics not otherwise tested (b) Routine monitoring and testing of relevant sub-systems including suitable testing to confirm power system stabilizer performance (if relevant).	Following plant changes As appropriate to the technology of the relevant sub-system	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; OR consistency with past performance
Excitation control system / Voltage and Reactive Power Control (as required under S5.2.5.13 in versions 1-26 of the Rules)	Method 1: (a) Monitoring in-service performance (b) Standard AVR testing – Step response	At least every 4 years		
	Method 2: (a) AER step response tests	At least every 4 years		

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Performance Standard/Rules Clause	Testing methodology	Frequency	Notes	Acceptance Criteria
	(b) AER step response test of OEL and UEL operation (c) AER and PSS transfer function measurements over required frequency range			
	Method 3: (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	At least every 4 years		

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Performance Standard/Rules Clause	Testing methodology	Frequency	Notes	Acceptance Criteria
	performance			
	Method 4: Performance of relevant sub-systems will be monitored using the following systems: digital protection relays; other data-logging equipment as required.	As appropriate to the technology of the relevant sub-system	Applicable for Wind Farms Changes to turbine control parameters will be controlled such that the performance of the generating system and generating units is not compromised in relation to the GPS.	
Active Power Control S5.2.5.14	One off installation	Assess when changes are made		
Remote Monitoring (as required under S5.2.6.1 in versions 1-26 of the Rules)	Method 1: (a) Calibration of Transducers (b) Verification of the accuracy of transmitted data	Following plant change and at least every 5 years		Confirmation at each end of the communications system by both parties.
	Method 2:		Applicable for Wind	

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Performance Standard/Rules Clause	Testing methodology	Frequency	Notes	Acceptance Criteria
	(a) SCADA monitored values and farm panel metering will be routinely checked (b) The calibration of transducers and Wind Farm panel metering will be checked.	At least every 5 years At each major outage or at least once every 5 years	Farms	
Communications Equipment (as required under S5.2.6.3 in versions 1-12 of the Rules, and S5.2.6.2 in versions 13-26 of the Rules)	One off installation	Assess when changes are made		Direct comparison with rules requirements
Power Station Auxiliary Transformers / Supplies (as required under S5.2.8 in versions 1-12 of the Rules, and	Method 1: (a) Metering of active and reactive power at the auxiliary supply connection point (b) Testing of any relevant	At least every 4 years	Only applicable when auxiliary supplies are taken from some other point different to generator connection	Power factor within allowable range Performance to

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Performance Standard/Rules Clause	Testing methodology	Frequency	Notes	Acceptance Criteria
S5.2.7 in versions 13-26 of the Rules)	sub-systems including capacitor banks and circuit breakers.	As appropriate to the technology of the sub-systems	point Access Standards must be established under clause S5.3.5	specification
	Method 2: (a) Performance will be monitored as part of condition monitoring and maintenance routines.		Applicable to Wind Farms 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.	
Fault Level / Current (as required under S5.2.9 in versions 1-12 of the Rules, and S5.2.8 in versions 13-26 of the Rules)	Method 1: (a) Monitoring in-service performance during faults near the connection point (b) Review and	Review following any event Following plant change		Calculation confirms current fault current contribution.

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Performance Standard/Rules Clause	Testing methodology	Frequency	Notes	Acceptance Criteria
	recalculation of fault levels. (c) Routine testing of any relevant sub-systems	As appropriate to the technology of the relevant sub-system		
	Method 2: (a) Modelling and simulation of plant characteristics to make sure the plant is capable of meeting agreed standards and (b) Monitoring of generator contribution on fault event.	Following plant change Review following any event		Calculation confirms current fault current contribution.
	Method 3: (a) Performance of relevant sub-systems will be monitored using	As appropriate to the technology of the relevant sub-system		Achieve performance standard

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Performance Standard/Rules Clause	Testing methodology	Frequency	Notes	Acceptance Criteria
	the following systems: digital protection relays; other data-logging equipment as required. (b) Where recorded data is available, comparison to be made of measured fault currents and computer simulations. (c) Review and recalculation of fault levels.	Following a fault Following plant change		Consistency of operation with plant models used to establish initial compliance; OR consistency with past performance

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