

# Generator Compliance Program Proforma

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**PERFORMANCE STANDARD MONITORING PROGRAM**

(Based on Generator Performance Standards registered with NEMMCO)

Compliance Item	Monitoring Action	Test Frequency	Action	Comment
<b>3.1 Reactive Power Capability (NER S5.2.5.1)</b>				
The reactive power capability (generation and absorption) should be periodically tested at a time when system conditions are acceptable.	Test	3 Yearly	With the generating unit generating at or near full output, adjust reactive output to each specified level.	Testing will generally require other generating units to be operated in a way that compensates for the generating unit under test.
Reactive power consumption of auxiliary loads when not generating should be assessed by monitoring in-service performance if measurements are usually recorded, or a periodic test if special monitoring needs to be set up.	Monitor	Yearly	Monitor and record auxiliary load drawn from the power system while the unit is not generating, including when starting.	Only applies where there is a generator circuit breaker, allowing auxiliary supply to be drawn through the main connection point.
<b>3.2 Quality of Electricity Generated (NER S5.2.5.2)</b>				
The quality of electricity generated should be tested periodically or following return to service from major outages.	Test	When required	With the generating unit generating at or near full output, measure harmonics, balance and fluctuations in accordance with relevant standard.	If significant modifications to the unit's magnetic path, electrical path, rotor winding configuration or the excitation system were made, testing would be required.

	Test	3 Yearly	Open circuit test using high speed recorders. The results of these recordings are to be compared with the original and previously test results for consistency and identifying occurring trends in performance.	Test will depend on whether standard is the plant standard (AS 1359) or network standard (AS/NZS 61000.3.6:2001).
<b>3.3 Response to Disturbances (NER S5.2.5.3)</b>				
Response to frequency and voltage disturbances and to faults should be assessed by monitoring in-service performance and by periodically testing any relevant protection systems. Whenever the generating unit trips, an assessment of compliance with these requirements should be made.	monitor	Following frequency disturbances  or  after trips	Measure response of the unit to frequency disturbances and investigate whether the frequency or voltage deviation caused the trip.	
Response to faults should also be tested periodically by interrupting auxiliary supplies for the specified period. The testing could be done by an auxiliary supply changeover with time delay introduced if necessary. To manage risk, the test may be possible during an outage or just before or just after.	Test	3 Yearly	With unit shut down, interrupt auxiliary supplies for specified time and check that auxiliaries keep running.	Such test have been shown to be valuable in identifying the most sensitive auxiliary equipment.

<b>3.4 Partial Load Rejection (NER S5.2.5.4)</b>				
Partial load rejection should be assessed by monitoring in-service performance and by periodically testing any relevant protection systems. Whenever the generating unit trips, an assessment of compliance with this requirement should be made.	Monitor	When required following significant load reductions  and  after trips	Measure response of the unit to load reduction (over-frequency) disturbances and investigate whether the unit performed satisfactorily or the whether the load reduction caused the trip.	Significant load rejections usually only occur in incidents where regions separate, leaving one side with a large surplus of generation.
<b>3.5 Protection From Power System Disturbances (NER S5.2.5.8)</b>				
Performance should be assessed by monitoring in-service performance and by periodically testing any relevant protection systems. Protection systems should be tested by secondary injection at intervals consistent with good electricity industry practice (typically every three years).	Test	3 Yearly	Test the relevant protection systems of each unit by secondary injection.	
Whenever the generating unit trips, an assessment of compliance with this requirement should be made.	Monitor	After trips	Investigate whether an inappropriate protection operation caused or contributed to the trip.	

<b>3.6 Protection that impacts on Power System Security (NER S5.2.5.9)</b>				
Performance should be assessed by monitoring in-service performance and by periodically testing the protection systems. Protection systems should be tested by secondary injection at intervals consistent with good electricity industry practice (typically every three years).	Test	3 Yearly	Test the relevant protection systems of each unit by secondary injection.	
Each primary <i>protection system</i> has sufficient redundancy to ensure that a faulted element within its protection zone is disconnected from the <i>power system</i> within the applicable <i>fault clearance time</i> with any single protection element (including any communications facility upon which that <i>protection system</i> depends) out of service.	Test	3 yearly	Check the redundancy during tests of the relevant protection systems.	
<i>Breaker fail protection systems</i> are provided to clear faults that are not cleared by the circuit breakers controlled by the primary <i>protection system</i> , within the following <i>fault clearance times</i> :	Test	Yearly	Test whether the trip signal issued by the breaker fail protection systems is fast enough to ensure that the backup protection operate correctly.	

Whenever the generating unit trips, an assessment of compliance with this requirement should be made.	Monitor	After trips	Investigate unit trips due to faults on the generating unit side of the connection point to check whether the protection system had operated correctly.  Investigate unit trips due to faults on the generating unit side of the connection point to check whether the redundancy was effective.	
<b>3.7 Asynchronous Operation (NER S5.2.5.10)</b>				
Performance should be assessed by monitoring in-service performance and by periodically testing any relevant protection systems.	Test	3 Yearly	Test the relevant protection systems of each unit by secondary injection.	
Whenever the generating unit trips, an assessment of compliance with this requirement should be made.	Monitor	After trips	Investigate whether the pole slip protection operated as required.	
If the generating unit is permitted to operate asynchronously, an assessment of compliance is required if asynchronous operation occurs.	Monitor	After asynchronous operation	Investigate whether quality of supply criteria were satisfied.	

<b>3.8 Frequency Control (NER S5.2.5.11)</b>				
Performance should be assessed by monitoring in-service performance and by periodically performing a step response test of the governor control system at a time when system conditions are acceptable. Test results should be compared with the results of the previous test to assess any unexpected change in performance.	Test	3 Yearly  or  when the unit is returned to service from maintenance	Governor step response tests to confirm droop characteristics and damping performance.	This will usually apply to scheduled generating units that operate in the frequency control ancillary service market.
Generating units that are registered for frequency control ancillary services should carry out the test in accordance with the Market Ancillary Service Specification standard frequency ramp and measuring the services delivered.	Monitor	After major disturbances.	Check whether expected frequency control ancillary service was delivered.	
<b>3.9 Stability (NER S5.2.5.12)</b>				
Performance should be assessed by periodically by monitoring in-service performance and by performing a transfer function test or step response test of any power system stabiliser at a time when system conditions are acceptable.	Test	When required	Short-circuit ratio test if the unit parameters have altered significantly.	Only if short circuit ratio is part of performance standard.

<p>Test results should be compared with the results of the previous test to assess any unexpected change in performance.</p>	<p>Test</p>	<p>3 Yearly or after changes to generating unit parameter values</p>	<p>Verify settings for AVR and PSS (if any) if modifications to the machines caused changes to their parameter values</p> <p>The result of these tests will become the standard against which subsequent test results will be compared with.</p>	
	<p>Test</p>	<p>3 Yearly or when the unit is returned to service from maintenance</p>	<p>Step response test on the AVR with and without the PSS in service to check whether the PSS improves system damping</p> <p>Compare results with previous tests to detect any drift in PSS performance.</p>	<p>NEMMCO will also check results against models that are used to assess power system security and transfer capability.</p>



<b>3.10 Excitation Control System (NER S5.2.5.13)</b>				
Performance should be assessed by monitoring in-service performance and by periodically performing a step response test of the excitation control system at a time when system conditions are acceptable. Tests need to include steps into limiter operation (attempt to move operating point beyond a limit imposed by a limiter) to assess the stability of limiter operation.	Test	3 Yearly  or  when the unit is returned to service from maintenance	Transfer function measurements and step response tests with the unit unsynchronised and at full load.  The on-load tests should include steps into the excitation limiters from within the operating region to validate the operation of the limiter.  Compare results with previous tests to detect any drift in performance.	NEMMCO will also check results against models that are used to assess power system security and transfer capability.
<b>3.11 Remote Monitoring (NER S5.2.6.1)</b>				
Performance should be assessed by monitoring in-service performance.	Test	3 Yearly	Calibration of transducers and verification of transmitted results to NEMMCO.	
<b>3.12 Auxiliary Transformers (NER S5.2.5.8)</b>				

<p>Reactive power consumption should be assessed by monitoring in-service performance if measurements are usually recorded, or a periodic test if special monitoring needs to be set up.</p> <p>Quality of supply tests should be done in conjunction with tests under "quality of electricity generated".</p>			<p>This section does not apply if auxiliary supplies are only taken from the same connection point as used for generation output to the power system.</p>	
	<p align="center">Test</p>	<p align="center">3 Yearly</p>	<p>Test the relevant protection systems.</p>	
<p><b>3.13 Fault Level (NER S5.2.9)</b></p>				
<p>Performance should be assessed by monitoring in-service performance during faults near the connection point. When faults are not near the connection point, the performance should be assessed by computer simulation of the fault and comparison with measured fault current. Performance should be re-assessed after any measurement of relevant generating unit parameters or modifications that could change them.</p>	<p align="center">Calculations</p>	<p align="center">When required</p>	<p>Recalculate fault levels if significant modifications or equipment replacements were made to the electrical system elements.</p>	
	<p align="center">Monitor</p>	<p align="center">After close faults</p>	<p>Measure actual current contribution during close faults and compare with expected value.</p>	