



Primary Frequency Response Requirements

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Current version release details

Version	Effective date	Summary of changes
2.03.0	8-May-2023TBC	Final requirements following National Electricity Amendment (Clarifying mandatory primary frequency response obligations for bidirectional plant Primary frequency response incentive arrangements) Rule 20242

Note: There is a full version history at the end of this document.

1. Introduction

1.1. Purpose and scope

These are the *primary frequency response requirements (PFRR)* made under clause 4.4.2A(a) of the National Electricity Rules (**NER**).

The PFRR have effect only for the purposes set out in the NER. The NER and the *National Electricity Law* prevail over the PFRR to the extent of any inconsistency.

1.2. Definitions and interpretation

1.2.1. Glossary

Terms defined in the *National Electricity Law* and the NER have the same meanings in these PFRR unless otherwise specified.

Terms defined in the NER are intended to be identified in these PFRR by italicising them, but failure to italicise a defined term does not affect its meaning.

The words, phrases and abbreviations in the table below have the meanings set out opposite them when used in this document.

Term	Definition
Affected Generator Provider	A <i>Scheduled Generator</i> , or a a <i>Semi-Scheduled Generator</i> or a <i>Scheduled Integrated Resource Provider</i> .
Affected GSUnit	The <i>scheduled generating unit, semi-scheduled generating unit or scheduled bidirectional unit generating system</i> of an Affected ProviderGenerator.
Affected GSUnit's dDeadband	For an Affected-GS Affected Unit, the deadband within which it will be operated in accordance with AEMO's approval.
Contingency FCAS	<i>A term used to refer to very fast raise service, very fast lower services, fast raise service, fast lower service, slow raise service, slow lower service, delayed raise service and delayed lower service collectively.</i>
DCS	Distributed control systems.
Deadband	<i>The range of Local Frequency through which a frequency response will not be provided.</i>
Droop	As defined in NER S5.2.5.11(a).
LNSP	The <i>Local Network Service Provider</i> in respect of an Affected-GS Affected Unit
Local Frequency	<i>As defined in the MASS</i>
NER	National Electricity Rules. NER followed by a number indicates the corresponding rule or clause of the NER.
MASS	<i>market ancillary service specification.</i>
Maximum Operating Level	As defined in NER S5.2.5.11(a).
Minimum Operating Level	As defined in NER S5.2.5.11(a).
OEM	Original equipment manufacturer.
PFCB	<i>Primary frequency control band</i> (as at 8 May 2023, it is 49.985 Hz to 50.015 Hz).
PFR	<i>Primary frequency response.</i>
PFRP	<i>Primary frequency response parameters.</i>

Term	Definition
PFRR	Primary frequency response requirements.
PFR Settings	The <i>frequency response mode</i> characteristics (deadband, droop and response time) applicable to an Affected GS Affected Unit , as approved by AEMO.
P _{MAX}	As defined in section 3.3.
<u>Regulation FCAS</u>	<u>Regulation Raise Response and Regulation Lower Response as defined in the MASS</u>
RMS	Root mean square.
<u>IRP</u>	<u>Integrated Resource Provider</u>

1.2.2. Interpretation

The following principles of interpretation apply to these PFRR unless otherwise expressly indicated:

- These PFRR are subject to the principles of interpretation set out in Schedule 2 of the National Electricity Law.
- References to *frequency* should be read as referring to *frequency* as measured at an **Affected GS****Affected Unit**'s connection point.
- Units of measurement are in accordance with the International System of Units.
- A reference to a document or a provision of a document are to that document or provision as amended, replaced or novated from time to time.

1.3. Related documents

Title	Location
GPS Compliance Assessment And R2 Model Validation Test Plan Template For Conventional Synchronous Machines	https://www.aemo.com.au/-/media/Files/Electricity/NEM/Network_Connections/Transmission-and-Distribution/Generating-System-Test-Plan-Template-for-Conventional-Synchronous-Machines.pdf .
GPS Compliance Assessment And R2 Model Validation Test Plan Template For Power Electronic Interfaced Nonsynchronous Generation Technologies	https://aemo.com.au/-/media/files/electricity/nem/network_connections/transmission-and-distribution/generating-system-test-template-for-non-synchronous-generation.docx .
Market Ancillary Service Specification	https://aemo.com.au/energy-systems/electricity/national-electricity-market-nem/system-operations/ancillary-services/market-ancillary-services-specification-and-fcas-verification-tool .
SO_OP_3715 Power System Security Guidelines	https://aemo.com.au/en/energy-systems/electricity/national-electricity-market-nem/system-operations/power-system-operation/power-system-operating-procedures

2. Requirement to provide PFR

2.1. Basic requirement

Unless exempt under section 6.5 or exempted by AEMO under section 6.4.3, and subject to variation either under section 6.6 or as granted by AEMO under section 6.4.3, **Affected Generator****Affected Provider**s must commence providing PFR every time they receive a *dispatch*

instruction as specified in NER 4.4.2(c1) in respect of an ~~Affected GS~~Affected Unit, in accordance with its PFR Settings.

2.2. No stored energy to meet requirement

As indicated by NER 4.4.2A(c), there is no requirement for ~~Affected Generator~~Affected Providers to maintain headroom, footroom or stored energy in their ~~Affected GS~~Affected Units for the purpose of providing PFR.

2.3. Interaction between dispatch instructions and PFR Settings

2.3.1. Energy and Regulation FCAS

An Affected Unit's output is to be varied in accordance with the PFR Settings where an Affected Provider:

- (a) receives a NER 4.9.2 dispatch instruction in respect of the Affected Unit to generate a volume greater than 0 MW; or
- (b) from 8 June 2025, receives a NER 4.9.2 dispatch instruction in respect of the Affected Unit to consume electricity other than as an auxiliary load; or
- (c) from 8 June 2025, is a Scheduled Integrated Resource Provider (IRP) and receives a NER 4.9.3A dispatch instruction in respect of the Affected Unit for a quantity of Regulation FCAS.

If the dispatch instruction is received by AGC, the desired output should be the summation of the AGC setpoint and the PFR Settings as described in section 7.3 of the market ancillary service specification (MASS¹).

Prior to 8 June 2025, an Affected Unit is not obligated to provide PFR (but may choose to do so) in accordance with the PFR Settings, where an Affected Provider:

- (a) receives a NER 4.9.2 dispatch instruction in respect of the Affected Unit to consume electricity other than as an auxiliary load; or
- (b) is a Scheduled IRP and in respect of the same trading interval:
 - I. receives a NER 4.9.3A dispatch instruction in respect of the Affected Unit for a quantity of Regulation FCAS; and;
 - II. does not receive a NER 4.9.2 dispatch instruction in respect of that Affected Unit to generate a volume greater than 0 MW.

Where an Affected Generator receives a NER 4.9.2 dispatch instruction in respect of an Affected GS to generate a quantity of energy greater than 0 MW, the Affected GS' output is to be varied in accordance with the PFR Settings. If the dispatch instruction is received by AGC, the desired output should be the summation of the AGC setpoint and

¹ Version 8.1.

the PFR Settings as described in section 10.3 of the *market ancillary service specification (MASS²)*.

11.0.0. Regulation FCAS

- (c) — Where an Affected Generator receives a *NER 4.9.3A dispatch instruction* in respect of an Affected GS for a quantity of Regulation FCAS **and** a *NER 4.9.2 dispatch instruction to generate* a quantity of energy greater than 0 MW in a *trading interval*, the Affected GS' desired output should be the sum of the AGC setpoint and the PFR Settings as described in section 10.3 of the MASS.
- (c) — Where an Affected Generator receives a *NER 4.9.3A dispatch instruction* in respect of an Affected GS for a quantity of Regulation FCAS only (with no *NER 4.9.2 dispatch instruction to generate* in the same *trading interval*), the Affected GS' desired output is the AGC setpoint. The Affected GS may also provide PFR (but is not required to do so).

2.3.2. Contingency FCAS

Where an Affected Provider receives a *NER 4.9.3A dispatch instruction* in respect of an Affected Unit for a quantity of Contingency FCAS only (and no other *dispatch instruction* in that *trading interval* in respect of which the PFR Settings are to be applied), the Affected Unit may also provide PFR (but is not required to do so).

Where an Affected Generator receives a *NER 4.9.3A dispatch instruction* in respect of an Affected GS for a quantity of Contingency FCAS:

if it has not also received a *NER 4.9.2 dispatch instruction* in respect of the Affected GS to *generate* a quantity of energy greater than 0 MW in the same *trading interval*, the Affected GS may also provide PFR (but is not required to do so);³ and

in all cases, the Affected GS/Affected Unit must comply with the requirements for the relevant Contingency FCAS, as set out in the MASS.

2.3.4.2.3.3. Semi-Dispatch

Where an Affected GS/Affected Unit is operating in a *semi-dispatch interval* and a frequency deviation would cause an increase in output, where possible, the Affected GS' Affected Unit's output should be increased to provide PFR even if this might exceed the Affected GS' Affected Unit's *dispatch level* for that *semi-dispatch interval*³.

²Version 8.17.

³ Note that compliance with *dispatch instructions* in these circumstances is addressed in NER 4.9.8(a1).

2.4. Changes to PFR Settings

Once an ~~Affected GS~~Affected Unit's PFR Settings are approved by AEMO, the ~~Affected Generator~~Affected Provider:

- (a) must not adjust the PFR Settings of the ~~Affected GS~~Affected Unit without AEMO's prior approval, consistent with the requirement in NER 4.9.4(e);
- (b) may subsequently apply for an exemption from any of the PFRP for the ~~Affected GS~~Affected Unit in accordance with sections 6.2 and 6.4;
- (c) may subsequently apply for a variation (or a further variation as applicable) of any of the PFRP for the ~~Affected GS~~Affected Unit in accordance with sections 6.3 and 6.4; and
- (d) may subsequently agree with AEMO to vary any of the PFRP in accordance with section 6.8.

3. Primary frequency response parameters

3.1. General

Three PFRP are set out in section 3 – deadband, droop and response time.

The PFR Settings for an ~~Affected GS~~Affected Unit must be consistent with the PFRP, or a variation must be applied for, as outlined in section 6.

3.2. ~~Affected GS~~Affected Unit's deadband

3.2.1. ~~Affected GS~~Affected Unit's deadband

Subject to section 3.2.2 and any variation or exemption granted in accordance with these PFRP, an ~~Affected GS~~Affected Unit must be operated with a deadband equal to the PFCB.

For the avoidance of doubt, the ~~Affected GS~~Affected Unit's Deadband~~deadband~~ applies at the *connection point*.

3.2.2. Operating with narrower deadband acceptable

Provided AEMO agrees, an ~~Affected Generator~~Affected Provider may operate its ~~Affected GS~~Affected Unit with an ~~Affected GS~~Affected Unit's deadband that is narrower than the PFCB.

3.3. Droop

For all ~~Affected GS~~Affected Units, subject to any variation or exemption granted in accordance with these PFRP, ~~Droop~~droop at the *connection point* must be set to less than or equal to 5%.

The change in *frequency* is to be measured from the upper or lower limit (as applicable) of the ~~Affected GS~~Affected Unit ~~Deadband~~deadband, as shown in Equation 1.

Equation 1:

$$\mathbf{Droop} (\%) = 100 \times \frac{\Delta F/50}{\Delta P/P_{MAX}}$$

where:

ΔF is the frequency deviation beyond the limit of the **Affected GS'Affected Unit Deadband**, in Hz.

ΔP is *active power* change, in MW.

P_{MAX} is the Maximum Operating Level in MW⁴.

Droop may be asymmetrical for over- and under-*frequency* responses.

Droop may be different for different levels of *frequency* change.

The droop characteristic should not exhibit any step changes in MW as *frequency* changes.

3.4. Response time

Subject to any variation or exemption granted in accordance with these PFRR, an **Affected GS'Affected Unit** should be capable of achieving a 5% change in *active power* output within no more than 10 seconds, resulting from a sufficiently large positive or negative step change in *frequency* greater than the **Affected GS'Affected Unit's Deadband** and less than or equal to 0.5 Hz.

The response time is measured from when the *frequency* crosses the limit of the **Affected GS'Affected Unit's Deadband** until *active power* reaches a 5% change based on P_{MAX} . The sustained change in *active power* resulting from the *frequency* step, may be greater than 5%, in order to demonstrate this capability.

For the avoidance of doubt, a more rapid change in output in response to a change in *frequency* is acceptable, and *plant* should not be deliberately slow or reduce its response to match this minimum requirement.

An **Affected GS'Affected Unit's** control settings must ensure an *adequately damped* response to a change in *frequency*.

The change in an **Affected GS'Affected Unit's** *active power* output following a *frequency* deviation outside the **Affected GS'Affected Unit's Deadband** must commence with no delay beyond that inherent in the *plant* and *plant* controls.

4. Additional performance requirements

4.1. No withdrawal of response

Where it is safely and stably capable of doing so and considering *plant* load controllers or distributed control systems (**DCS**) and governor response, an **Affected GS'Affected Unit** should

⁴ Or the capacity of in-service *generating units* or *bidirectional units* where multiple *generating units* or *bidirectional units* are aggregated in a single **Affected GS'generating system** or **integrated resource system**.

continue to deliver PFR until *frequency* returns to be within the ~~Affected GS~~Affected Unit's Deadband.

PFR should not be deliberately withdrawn or defeated by a *plant* load controller to return an ~~Affected GS~~Affected Unit to a *market dispatch* target while *frequency* remains outside the ~~Affected GS~~Affected Unit's Deadband.

4.2. Range of response

The magnitude of an ~~Affected GS~~Affected Unit's *active power* change that results from *frequency* deviating from 50 Hz must not be unnecessarily limited.

Subject to section 6.6, an ~~Affected GS~~Affected Unit should not use load limiters or similar controls to limit or restrict the ~~Affected GS~~Affected Unit's response to a level below what could otherwise be safely and stably delivered, if that limiter were not in place.

4.3. Continuity of response

Subject to NER 4.4.2(c1), PFR must remain continuously enabled at the PFR Settings, unless agreed with AEMO, independent of *ancillary services enablement*.

NER 4.4.2(c1) permits, but does not require, the PFR Settings of ~~Affected GSs comprising battery energy storage systems~~scheduled bidirectional units to be disabled or changed while they are consuming *energy* other than as an auxiliary load or *enabled* to provide a *market ancillary service* without a concurrent *dispatch instruction* to generate *energy*.

From 8 June 2025, the PFR settings of Affected Units must not be disabled or changed while they are consuming energy other than as an auxiliary load or enabled to provide Regulation FCAS only without a concurrent dispatch instruction to generate or consume energy other than as an auxiliary load.

Relevant ~~Affected Generator~~Affected Providers wishing to apply different settings for an ~~Affected GS~~Affected Unit in these periods may do so if they have obtained AEMO's prior approval for the application of settings as required by NER 4.9.4(e) (and S5.2.2 where applicable), and included those settings in the *Power System Setting Data Sheet* for the ~~Affected GS~~Affected Unit.

4.4. Remote monitoring

NER S5.2.6.1(b)(8) permits AEMO to request that Affected Providers transmit the status of their frequency controller through existing communications equipment to improve AEMO's operational awareness of the frequency responsiveness of the system.

5. PFR settings to be addressed as part of connection application process

A *Connection Applicant* proposing to connect a ~~generating system that will comprise~~ scheduled generating units, or semi-scheduled generating units or scheduled bidirectional unit (or any combination of the ~~two~~three) must either:

- (a) agree with AEMO as part of its connection application the PFR Settings for that generating-system-Affected Unit, which must be within the PFRP; or
- (b) seek an exemption from, or variation to, the application of the PFRP in accordance with section 6.

6. Exemptions and variations

6.1. Principles

NER 4.4.2B(a) specifies the factors that AEMO must have regard to when considering whether to approve an application for exemption from, or variation to, any of the PFRP. The remainder of section 6.1 provides high-level guidance on the evidence AEMO may need from an Affected Generator/Affected Provider to demonstrate why an application for exemption or variation should be granted based on one or more of those factors.

6.1.1. Capability

If an Affected Generator/Affected Provider's application for exemption is on the basis that an Affected GS/Affected Unit is either inherently incapable of or is not designed with an underlying capability for operating in *frequency response mode*, the Affected Generator/Affected Provider must demonstrate this incapability.

This may be done by providing AEMO with copies of relevant original equipment manufacturer (OEM) specifications or test results from the OEM.

Where OEM information is not available, for example due to the age of the Affected GS/Affected Unit or the status of the OEM, the Affected Generator/Affected Provider will need to provide a recent assessment of *plant* capability from a suitably qualified and experienced consulting engineer, including any information about the risk to the safe or stable operation due to a requirement to provide PFR by reference to the Affected GS/Affected Unit's underlying design.

6.1.2. Stability

If an Affected Generator/Affected Provider's application for exemption or variation is on the basis that an Affected GS/Affected Unit will operate unstably in *frequency response mode*, the Affected Generator/Affected Provider must provide evidence of test results or other technical information, such as evidence from the OEM or a suitably experienced consulting engineer, to demonstrate the unstable operation.

AEMO may consider *power system security* issues when considering applications for variation or exemption. For instance, it may be necessary to vary an Affected GS/Affected Unit's PFR Settings to address interactions with other *generating systems*, integrated resource systems, or broader *power system* dynamics.

6.1.3. Physical characteristics

If an Affected Generator/Affected Provider's application for exemption or variation is based on other physical characteristics that affect the Affected GS/Affected Unit's ability to operate in

frequency response mode, the Affected Generator/Affected Provider will need to consider the type of evidence that will substantiate the claim. For example:

- (a) *Dispatch* inflexibilities – this is included in section 6.6 as a standing variation and no application is necessary where this is the only basis for an application for variation.
- (b) Energy constraints – this is included in section 6.6 as a standing variation and no application is necessary where this is the only basis for an application for variation.
- (c) Licensing or other conditions of operation – if a regulatory licence to operate restricts the operation of an Affected GS/Affected Unit to such an extent that it will not be able to operate in *frequency response mode* under certain conditions, the Affected Generator/Affected Provider will need to provide AEMO with a copy of the relevant licence and other relevant information about its enforceability and evidence of when the conditions are likely to occur.
- (d) Connection agreement – if there are any restrictions in an Affected Generator/Affected Provider's *connection agreement* with its LNSP that impact the Affected Generator/Affected Provider's ability to provide PFR in accordance with an Affected GS/Affected Unit's PFR Settings, the Affected Generator/Affected Provider will need to provide AEMO with a copy of the relevant parts of the *connection agreement* and any other information about its enforceability and evidence of when the restrictions are likely to apply.

6.1.4. Costs versus market turnover

If an Affected Generator/Affected Provider's application for exemption or variation is on the basis that the costs likely to be incurred in modifying an Affected GS/Affected Unit to operate in *frequency response mode* and the costs of operating the Affected GS/Affected Unit in *frequency response mode* relative to the *market* revenue derived during its expected operating hours are unreasonably onerous, the Affected Generator/Affected Provider must provide supporting documentation evidencing the expected capex and opex costs of modifying and operating the Affected GS/Affected Unit.

6.2. Application for exemption

Where an Affected Generator/Affected Provider seeks an exemption from the requirement to operate an Affected GS/Affected Unit in accordance with these PFRR, it must submit an application for exemption to AEMO in the form in Appendix A, detailing the grounds for seeking exemption, with reasons and supporting evidence.

For the avoidance of doubt, Affected Generator/Affected Providers do not need to submit an application for exemption where section 6.5 applies to the Affected GS/Affected Unit.

6.3. Application for variation

Where an Affected Generator/Affected Provider seeks a variation from the requirement to operate an Affected GS/Affected Unit in *frequency response mode* in accordance with one or more of the PFRP, it must submit an application for variation to AEMO in the form in Appendix B, detailing the Affected GS/Affected Unit's limitations, with reasons and supporting evidence.

For the avoidance of doubt, ~~Affected Generator~~~~Affected Provider~~s do not need to submit an application for variation where one or more of the conditions specified in section 6.6 may affect the ~~Affected GS~~~~Affected Unit~~'s ability to provide PFR.

6.4. Application process

6.4.1. Insufficient information

If AEMO considers that an ~~Affected Generator~~~~Affected Provider~~ has not provided enough information for AEMO to assess an ~~Affected Generator~~~~Affected Provider~~'s application for exemption or variation, a request specifying the further information required will be forwarded to the ~~Affected Generator~~~~Affected Provider~~ within 30 *business days* of receiving the ~~Affected Generator~~~~Affected Provider~~'s application for exemption.

The ~~Affected Generator~~~~Affected Provider~~ must provide the further information requested within 30 *business days* of receiving AEMO's request.

6.4.2. Extension of time

In its absolute discretion, if AEMO is satisfied that an ~~Affected Generator~~~~Affected Provider~~ cannot reasonably provide such further information within the required time, AEMO may grant the ~~Affected Generator~~~~Affected Provider~~ additional time to provide the further information requested under section 6.4.1.

6.4.3. AEMO response to application

AEMO will determine whether to grant an exemption or variation within 60 *business days* of receiving an ~~Affected Generator~~~~Affected Provider~~'s application, or provision of any further information requested under section 6.4.1, whichever is the later, in the form in Appendix C.

If AEMO rejects an application for exemption, AEMO may grant the ~~Affected Generator~~~~Affected Provider~~ a variation from one or more of the PFRP, instead.

AEMO may grant an exemption or variation with or without conditions, as appropriate.

6.5. Standing exemptions

6.5.1. Steam stage of combined cycle gas turbines

The steam turbine component of a combined cycle gas generator does not need to be frequency responsive.

6.6. Standing variations

The ability of an ~~Affected GS~~~~Affected Unit~~ to provide PFR will be affected from time to time by one or more of the factors or causes detailed below, in which case the ~~Affected GS~~~~Affected Unit~~ will not be required to provide PFR to the extent that its ability to do so is impacted by the relevant factor or cause:

- (a) to manage the safety or stability of the ~~Affected GS~~~~Affected Unit~~;

- (b) to maintain operation between the ~~Affected GS~~Affected Unit's Maximum Operating Level and Minimum Operating Level;
- (b)(c) to effect the start-up or shutdown of the ~~Affected GS~~Affected Unit, including following *plant* disturbances;
- (e)(d) to manage *self-commitment, synchronisation, decommitment or de-synchronisation* of the ~~Affected GS~~Affected Unit;
- (d)(e) to manage *plant* within pressure limits, operating temperature limits, state of charge limits or limits due to ambient environmental conditions;
- (e)(f) to avoid rough running ranges associated with the ~~Affected GS~~Affected Unit;
- (f)(g) while the ~~Affected GS~~Affected Unit is *inflexible*;
- (g)(h) to respond to primary energy availability, such as the availability of fuel or stored pressure for thermal *generation*, wind for wind *generation*, irradiance for solar *generation*, head level for hydro *generation* or number of in-service coal mills for coal *generation*;
- (h)(i) where the ~~Affected GS~~Affected Unit forms part of a generating system or integrated resource system is comprised of one or more hydro *generating units*, while they are being operated in tail-water depression mode;
- (i)(j) to maintain operation within the limit of the ~~Affected GS~~Affected Unit's obligations and capabilities, as expressed in its *performance standards* under NER S5.2.5.7 and S5.2.5.8;
- (j)(k) to conduct tests on the ~~Affected GS~~Affected Unit provided that the ~~Affected Generator~~Affected Provider notifies AEMO⁵ of the expected start and end times of testing where it is expected to take one hour or longer and confirms when testing is complete and normal *frequency* response has resumed. For the avoidance of doubt, no notification is required if the test is expected to take less than one hour; or
- (l) to comply with a request by the LNSP to change or limit the *frequency* response of the ~~Affected GS~~Affected Unit, provided that the ~~Affected Generator~~Affected Provider notifies AEMO⁶ of the expected duration of the change or limit where it is expected to take one hour or longer and confirms when the change or limit no longer applies and normal *frequency* response has resumed. For the avoidance of doubt, no notification is required if the change or limit is expected to be in effect for less than one hour;

6.7. Changes to ~~Affected GS~~Affected Unit after exemption or variation

The approval of an application for exemption or variation is granted using information on the status of the ~~Affected GS~~Affected Unit at the relevant time. If, after the grant of an exemption or variation, an ~~Affected Generator~~Affected Provider is proposing substantive changes to the configuration of an ~~Affected GS~~Affected Unit, the ~~Affected Generator~~Affected Provider must either:

⁵ Notifications must be made to AEMO's control room by telephone or email to the appropriate OPS mailbox.

⁶ Notifications must be made to AEMO's control room by telephone or email to the appropriate OPS mailbox.

- (a) if the ~~Affected Generator~~Affected Provider considers the ~~Affected GS~~Affected Unit is capable of meeting the PFRP without variation, advise AEMO of the proposed PFR Settings and how the ~~Affected Generator~~Affected Provider proposes to demonstrate *plant* stability; or
- (b) re-apply for exemption or variation (as applicable) in accordance with sections 6.2 to 6.4.

6.8. AEMO-initiated variation for power system security

6.8.1. Initiation by AEMO

If AEMO considers that a variation from the requirement to operate an ~~Affected GS~~Affected Unit in *frequency response mode* in accordance with one or more of the PFRP is likely to assist in improving *power system security*, AEMO may request the relevant ~~Affected Generator~~Affected Provider to consider and discuss the feasibility of proposed variations, either on a temporary (trial) or ongoing basis.

6.8.2. Finalisation of AEMO-initiated variation

If AEMO and an ~~Affected Generator~~Affected Provider agree on a variation following AEMO's contact under section 6.8.1, AEMO will confirm its approval of the variation in the form in Appendix D.

7. Demonstration of stability

7.1. General

Plant stability needs to be demonstrated following changes to a *control system* or primary plant to meet the PFRP. Section 7.27-2 outlines how this may be demonstrated.

Where material changes are made to governor or *plant* load controller deadbands or load limiters, or to the DCS only, modelling and testing beyond that described in section 7.2 will not be required by AEMO until expiry of the testing cycle detailed in an ~~Affected GS~~Affected Unit's compliance program under NER 4.15(b).

Material changes beyond DCS, governor or *plant* load controller deadbands, or load limiters will require the ~~Affected Generator~~Affected Provider to test its ~~Affected GS~~Affected Unit when these changes are made in accordance with the requirements of the GPS Compliance Assessment and R2 Model Validation Test Plan Templates⁷.

⁷ GPS Compliance Assessment And R2 Model Validation Test Plan Template For Conventional Synchronous Machines. AEMO, May 2016. Available at: https://www.aemo.com.au/-/media/Files/Electricity/NEM/Network_Connections/Transmission-and-Distribution/Generating-System-Test-Plan-Template-for-Conventional-Synchronous-Machines.pdf and GPS Compliance Assessment And R2 Model Validation Test Plan Template For Power Electronic Interfaced Nonsynchronous Generation Technologies. AEMO, September 2016. Available at: https://aemo.com.au/-/media/files/electricity/nem/network_connections/transmission-and-distribution/generating-system-test-template-for-non-synchronous-generation.docx.

7.2. Options for demonstrating stability

Once an ~~Affected-Generator~~Affected Unit meets the PFRP, its stability must be demonstrated.

It is preferred that ~~Affected-Generator~~Affected Providers conduct a *frequency* step response stability test as described in section 7.2.1. Other possible methods of demonstrating *plant* stability are detailed in the remainder of section 7.2.

Testing should confirm the ability of the ~~Affected-Generator~~Affected Unit to simultaneously respond to changes in *power system frequency* and changes in *dispatch level*, including both small ongoing changes in *frequency* and larger *frequency* disturbances.

7.2.1. Step response stability test

A test plan for a step response stability test must be submitted to AEMO a minimum of 10 *business days* prior to the proposed date for testing⁸. AEMO may agree to a shorter notice period in its absolute discretion.

A positive frequency step signal equivalent to create 5%, or greater, change in *active power* must be injected into the frequency controller summing junction. The response is to be recorded allowing at least 10 seconds pre-triggered recording and at least 60 seconds recording time after the response has settled at its steady-state value.

The tester must assess whether the recorded response is *adequately damped*, and if so, repeat the test with a negative frequency step signal of the same size.

The test is to be undertaken from a loading that will allow a full positive and negative 5% *active power* change to be achieved.

The *active power*, *reactive power* and RMS *voltage* must be recorded during the test. Values are to be provided to AEMO at a sample rate of no less than one sample per cycle, unless agreed otherwise by AEMO. Where practicable, the injected frequency signal is to be recorded while synchronised with the other measurements. Where available, existing recorders of the ~~Affected-Generator~~Affected Unit's LNSP may be used.

7.2.2. Actual response to power system disturbance

Where an ~~Affected-Generator~~Affected Provider cannot carry out the test described in section 7.2.1, for example, where it uses a mechanical governor, or where the injection to a sub-part of the overall control will not present a picture of the full response, and the ~~Affected-Generator~~Affected Unit is operating in accordance with its PFR Settings, the ~~Affected-Generator~~Affected Provider may submit records of the ~~Affected-Generator~~Affected Unit's performance following one or more *power system* disturbances to demonstrate stability.

The records required include *frequency*, *active power*, *reactive power* and RMS *voltage*. Values are to be provided to AEMO at a sample rate of no less than one sample per cycle, unless

⁸ See SO_OP_3715 section 6 - <https://aemo.com.au/en/energy-systems/electricity/national-electricity-market-nem/system-operations/power-system-operation/power-system-operating-procedures>.

agreed by AEMO that a different rate is acceptable. Where available, existing recorders of the Affected GS'Affected Unit's LNSP may be used.

7.2.3. Recent tests

Where an Affected GeneratorAffected Provider has completed tests in the last few years on its Affected GSAffected Unit and those tests are substantially similar to the tests contemplated by section 7.2.1, the results of those tests may be submitted to AEMO as evidence of stability provided that no changes to the Affected GSAffected Unit have been made since then that would reasonably be expected to have a material adverse effect on the test results.

7.2.4. Identical ~~generating~~ units within an a generating system or integrated resource system Affected GS

Where multiple identical *generating units* or bidirectional units that form an generating system or integrated resource system Affected GS have identical settings applied, the Affected GeneratorAffected Provider is only required to test or otherwise demonstrate stable response from one of these identical *generating units* or bidirectional units.

7.2.5. Recent operation with similar settings

Where:

- (a) an Affected GSAffected Unit has been operated in the last few years with settings substantially similar to the Affected GS'Affected Unit's PFR Settings; and
- (b) no other changes to the Affected GSAffected Unit in the intervening period would reasonably be expected to have a material adverse effect on its operation with those settings,

the Affected GeneratorAffected Provider may submit evidence of stable operation during the period of prior operation with those settings.

8. Compliance

8.1. No new compliance monitoring

There are no additional compliance monitoring requirements, beyond those in the NER, required from Affected GeneratorAffected Providers to demonstrate compliance with an Affected GS'Affected Unit's PFR Settings.

8.2. Non-compliance

Where AEMO considers an Affected GSAffected Unit is being operated contrary to its PFR Settings, or there is an unusually high number of instances where it is subject to one or more of the operating conditions specified in section 6.6, AEMO may require further information and data from the Affected GeneratorAffected Provider to assess the Affected GS'Affected Unit's compliance.

9. Publication of Primary Frequency Response outcomes

AEMO will publish and maintain on its website a list of ~~Affected-GS~~Affected Units and an indication of whether each ~~Affected-GS~~Affected Unit is:

- (a) required to maintain its PFR Settings;
- (b) exempt from the requirements of this PFRR; or
- (c) subject to a variation of one or more PFRP described in section 3, and if so, which parameters are varied⁹.

⁹ The varied PFRP will only be published ~~by-with~~ an ~~Affected-Generator~~Affected Provider's consent.

Appendix A. Primary ~~F~~requency ~~R~~esponse ~~R~~equirements Application for Exemption

Section 1: ~~Affected Generator~~Affected Provider/Connection Applicant (Applicant)

Name	
ABN	

Section 2: ~~Affected GS~~Affected Unit¹⁰ & Local Network Service Provider (LNSP)¹¹

Name	
DUID	
Connection Point	
LNSP	

The Applicant seeks exemption from the requirement to operating the ~~Affected GS~~Affected Unit in accordance with all PFRP on the following grounds:

Section 3: Grounds for exemption

Provide details of basis for exemption and attach any relevant evidence. See Section 6.1 for details.

Section 4: Supporting information

Attach supporting information. See Section 6.1 of the Primary Frequency Response Requirements and NER 4.4.2B for the relevant grounds and details of the type of information to be provided.

Section 5: Contacts for queries¹²

Name	
Title	
Phone	
Email	

¹⁰ As defined in the Primary Frequency Response Requirements.

¹¹ If more than one ~~Affected GS~~Affected Unit is affected by the same issues, you may copy and paste table for each ~~Affected GS~~Affected Unit.

¹² Copy and paste table to insert more names if more than one contact.

Section 6: Acknowledgement and consent to publication

By submitting this application, the Applicant acknowledges that AEMO will publish a list of *generating systems-units and bidirectional units* that are exempt from the Primary Frequency Response Requirements, as required by the National Electricity Rules.

If exemption is granted, the published exemption list may include a brief reason for the exemption, with the Applicant’s consent. The Applicant **consents/does not consent** to the publication of the reason for which any exemption was granted.

Section 7: Certification and signature

I, _____ (insert name)

_____ (insert title)

DECLARE that I am authorised by the Applicant to submit this Application on the Applicant’s behalf and CERTIFY that the contents of this Application and any attachments are true and correct.

Signature/...../20..... Date
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This form should be submitted to PFR@aemo.com.au.

Enquiries about this form should be submitted to PFR@aemo.com.au.

Appendix B. Primary Frequency Response Requirements Application For Variation

Section 1: ~~Affected Generator~~Affected Provider/Connection Applicant (Applicant)

Applicant	
ABN	

Section 2: ~~Affected GS~~Affected Unit¹³ & Local Network Service Provider (LNSP)¹⁴

Name	
DUID	
Connection Point	
LNSP	

The Applicant seeks a variation from one or more of the PFRP.

Section 3: Variations requested

Indicate which PFRP the ~~Affected Generator~~Affected Provider seeks AEMO to vary for each ~~Affected GS~~Affected Unit and on what basis.

PFRP	Reason
Deadband	
Droop	
Speed of Response	

Section 4: Supporting information

Attach supporting information for each variation requested. See section 6.1 of the Primary Frequency Response Requirements and NER 4.4.2B of the NER for the relevant grounds and details of the type of information to be provided.

Section 5: Applicant contacts for queries¹⁵

Name	
Title	
Phone	

¹³ As defined in the Primary Frequency Response Requirements.

¹⁴ If more than one ~~Affected GS~~Affected Unit is affected by the same issues, you may copy and paste table for each ~~Affected GS~~Affected Unit.

¹⁵ Copy and paste table to insert more names if more than one contact.

Name	
Email	

Section 6: Acknowledgement of publication of variation and reasons:

By submitting this application, the Applicant acknowledges that AEMO will publish a list of *generating systems-units and bidirectional units* that have been granted variations of one or more PFRP, as required by the National Electricity Rules. The published list will specify which parameters are varied for each relevant *generating unit and bidirectional unit/generating-system*.

If a variation is granted, the published list may include the varied PFR Settings as approved by AEMO, with the Applicant's consent. The Applicant **consents/does not consent** to the publication of the approved PFR Settings **for the Affected GS** and the reasons for the variation.

Section 7: Certification and signature

I, _____ (insert name)

_____ (insert title)

DECLARE that I am authorised by the Applicant to submit this Application on the Applicant's behalf and CERTIFY that the contents of this Application and any attachments are true and correct.

Signature/...../20..... Date
-----------	-----------------------------

This form should be submitted to PFR@aemo.com.au.

Enquiries about this form should be submitted to PFR@aemo.com.au.

Appendix C. Primary Frequency Response Requirements AEMO Response to Application for Exemption/Variation

[on AEMO letterhead]

[Name and address of ~~Affected Generator~~Affected Provider]

Dear [insert as appropriate],

Primary Frequency Response Requirements – Exemption/Variation [delete whichever is inapplicable] of [insert name of ~~Affected GS~~Affected Unit]

Further to your recent application for exemption/variation [delete as applicable] of [insert name of ~~Affected GS~~Affected Unit] from the requirements of the Primary Frequency Response Requirements (PFRR)¹⁶, AEMO has assessed the information provided by you and decided to grant/not grant [delete as applicable] your application for exemption/variation [delete as applicable] on the following grounds/conditions [delete as applicable]:

[insert grounds/conditions – adjust as necessary if no conditions]

[If granting variation to requirements, confirm PFR Settings as follows]

Therefore, the PFR Settings for [insert name of ~~Affected GS~~Affected Unit] are as follows:

PFRP		
Affected GS Affected Unit Deadbanddeadband		
Droop	Under-Frequency Response	
	Over-Frequency Response	
Response Time		

[Next paragraph not needed for exemptions]

Should you subsequently wish to vary any of these PFR Settings, please refer to the PFRR for the application process.

[If granting variation, confirm tests]

AEMO also wishes to confirm that you will be carrying out tests as follows:

[insert]

AEMO’s usual control room procedures will apply prior to, during, and immediately after, testing.

¹⁶ Capitalised terms are defined in the PFRR.

Please ensure you understand the performance requirements as they apply to each **Affected GSAffected Unit**, as specified in the PFRR, and note your obligations to advise AEMO of any non-compliance.

Any queries should be addressed to **[insert particulars]**.

Yours sincerely,

[insert name and title]

Appendix D. Primary ~~F~~requency ~~R~~esponse ~~R~~equirements Agreed variation for power system security

[on AEMO letterhead]

[Name and address of ~~Affected Generator~~~~Affected Provider~~]

Dear [insert as appropriate],

Primary Frequency Response Requirements – Agreed Variation of [insert name of ~~Affected GS~~~~Affected Unit~~]

Further to our recent discussions concerning a proposed variation of [insert name of ~~Affected GS~~~~Affected Unit~~] from the requirements of the Primary Frequency Response Requirements (PFRR), AEMO confirms its approval of the application of the following PFR Settings for [insert name of ~~Affected GS~~~~Affected Unit~~] for the purpose of improving power system security:

PFRP		
Affected GS Affected Unit Deadband deadband		
Droop	Under-Frequency Response	
	Over-Frequency Response	
Response Time		
Period of Variation	[Specify if temporary or permanent. If temporary, specify the period for which, or conditions under which, the variation applies, and the process for either reverting or retaining the PFR Settings at the end of the period.]	

Should you subsequently wish to vary any of these PFR Settings, please refer to the PFRR for the application process.

[If testing will be required, confirm tests]

AEMO also wishes to confirm that you will be carrying out tests as follows:

[insert]

AEMO’s usual control room procedures will apply prior to, during, and immediately after, testing.

Please ensure you understand the performance requirements as they apply to each ~~Affected GS~~~~Affected Unit~~, as specified in the PFRR, and note your obligations to advise AEMO of any non-compliance.

Any queries should be addressed to [insert particulars].

Yours sincerely,

[insert name and title]

Appendix E. Version release history

Version	Effective date	Summary of changes
3.0	TBC	Final requirements following National Electricity Amendment (Clarifying mandatory primary frequency response obligations for bidirectional plant) Rule 2024
2.0	8 May 2023	Final requirements under NER 11.152.2.
1.0	4 June 2020	First version under NER 4.4.2A(a) and interim requirements under NER 11.112.2.