



Draft National Electricity Amendment (Managing power system fault levels) Rule 2017

under the National Electricity Law to the extent applied by:

- (a) the National Electricity (South Australia) Act 1996 of South Australia;
- (b) the Electricity (National Scheme) Act 1997 of the Australian Capital Territory;
- (c) the Electricity - National Scheme (Queensland) Act 1997 of Queensland;
- (d) the Electricity - National Scheme (Tasmania) Act 1999 of Tasmania;
- (e) the National Electricity (New South Wales) Act 1997 of New South Wales;
- (f) the National Electricity (Victoria) Act 2005 of Victoria;
- (g) the National Electricity (Northern Territory)(National Uniform Legislation) Act 2015; and
- (h) the Australian Energy Market Act 2004 of the Commonwealth.

The Australian Energy Market Commission makes the following Rule under the National Electricity Law.

John Pierce
Chairman
Australian Energy Market Commission

Draft National Electricity Amendment (Managing power system fault levels) Rule 2017

1 Title of Rule

This Rule is the *Draft National Electricity Amendment (Managing power system fault levels) Rule 2017*.

2 Commencement

Schedule 4 commences operation on [date rule is made].

Schedules 1 to 3 commence operation on 1 July 2018.

3 Amendment of the National Electricity Rules

The National Electricity Rules are amended as set out in Schedule 1.

4 Amendment of the National Electricity Rules

The National Electricity Rules are amended as set out in Schedule 2.

5 Amendment of the National Electricity Rules

The National Electricity Rules are amended as set out in Schedule 3.

6 Savings and Transitional Amendments to the National Electricity Rules

The National Electricity Rules are amended as set out in Schedule 4.

Schedule 1 Amendment to the National Electricity Rules

(Clause 3)

[1] Clause 4.3.4 Network Service Providers

After clause 4.3.4(c), insert:

- (c1) Each *Network Service Provider* must use reasonable endeavours to plan and operate the *Network Service Provider's transmission or distribution system* so as to ensure that the *short circuit ratio* at the *connection points* for each *generating system* and *market network service facility connected to its transmission or distribution system* satisfies the requirements of clause S5.1.14.

Note:

The *AEMC* proposes to recommend that this clause be classified as a civil penalty provision under the National Electricity (South Australia) Regulations.

[2] Clause 4.6.1 Power system fault levels

Omit clause 4.6.1 in its entirety and substitute:

- (a) *AEMO*, in consultation with *Network Service Providers*, must:
 - (1) determine the fault levels at all *busbars* of the *power system* as described in clause 4.6.1(b); and
 - (2) determine the fault levels at the *connection points* for each *generating system* and *market network service facility*.
- (b) *AEMO* must ensure that there are processes in place, which will allow the determination of fault levels for normal operation of the *power system* and in anticipation of all *credible contingency events* and *protected events* that *AEMO* considers may affect the configuration of the *power system*, so that *AEMO* can identify:
 - (1) any *busbar* which could potentially be exposed to a fault level which exceeds the fault *current ratings* of the circuit breakers associated with that *busbar*; and
 - (2) any *connection point* for a *generating system* or *market network service facility* where the *short circuit ratio* is or is likely to be below the applicable *registered short circuit ratio*.
- (c) If *AEMO* identifies that the *short circuit ratio* at a *connection point* for a *generating system* or *market network service facility* is less than the applicable *registered short circuit ratio*, *AEMO* must notify the relevant *Network Service Provider* and the relevant *Registered Participant*.

- (d) Where *AEMO* considers the circumstances described in paragraph (c) are a threat to *power system security*, *AEMO* must take all reasonable actions to adjust, wherever possible, *power system* operating conditions with a view to maintaining operation of the *power system* in a *secure operating state*, which may include without limitation:
- (1) constraining the *generation* output of the affected *generating system* to a level that mitigates the risk to *power system security*;
 - (2) constraining the *power transfer capability* of the affected *market network service facility* to a level that mitigates the risk to *power system security*; and
 - (3) directing a *Registered Participant* to take equipment out of operation or be operated as *AEMO* directs.
- (e) A *Registered Participant* must comply with a direction given by *AEMO* under subparagraph (d)(3).

Note

The *AEMC* proposes to recommend that this clause be classified as a civil penalty provision under the National Electricity (South Australia) Regulations.

[3] New Clause 4.6.6 Short circuit ratio register

After clause 4.6.5, insert:

4.6.6 Short circuit ratio register

- (a) *AEMO* must establish, maintain and *publish* a register of *short circuit ratios* for *facilities* required to register a *short circuit ratio* with *AEMO* under clause 5.3.4B(a).
- (b) A *registered short circuit ratio* may be amended at any time by agreement between *AEMO*, the relevant *Registered Participant* and the *Network Service Provider* if:
 - (1) the proposed new *registered short circuit ratio* satisfies clause 5.3.4B(a); or
 - (2) the amendment is consistent with the amendment of an applicable *performance standard*.
- (c) *AEMO* must not withhold agreement under paragraph (b) unless the proposed amendment would adversely affect *power system security*.
- (d) The *Network Service Provider* may as a condition of considering an amendment proposed by a *Registered Participant* under paragraph (b) require payment of a fee to meet the reasonable costs anticipated

to be incurred by the *Network Service Provider*, other *Network Service Providers* and *AEMO*, in the assessment of the proposed amendment.

- (e) The *Network Service Provider* must require payment of a fee under paragraph (d) if so requested by *AEMO*.
- (f) On payment of the required fee referred to in paragraph (d), the *Network Service Provider* must pay the costs anticipated to be incurred by the other *Network Service Providers* and *AEMO*, as appropriate.

[4] New Clause 4.6.7 Short circuit ratio calculation guidelines

After new clause 4.6.6, insert:

4.6.7 Short circuit ratio calculation guidelines

- (a) *AEMO* must determine and *publish* and may amend *short circuit ratio calculation guidelines* that set out the methodology to be used by *Network Service Providers* when assessing:
 - (1) the *short circuit ratio* at the *connection points* for *generating systems* and *market network service facilities*; and
 - (2) the impact of the *connection* of a new *generating system* or *market network service facility* on the *short circuit ratio* at the *connection points* for other *generating systems* and *market network service facilities*.
- (b) The *short circuit ratio calculation guidelines* should:
 - (1) include the method for calculating the *short circuit ratio* from a given set of fault levels within the *network*; and
 - (2) provide guidance to the *Network Service Provider* as to the different *network* conditions and *dispatch* patterns that should be examined by the *Network Service Provider* when determining the fault levels within the *network*.
- (c) Subject to paragraph (d), *AEMO* must comply with the *Rules consultation procedures* when making or amending the *short circuit ratio calculation guidelines*.
- (d) *AEMO* may make minor or administrative amendments to the *short circuit ratio calculation guidelines* without complying with the *Rules consultation procedures*.

Schedule 2 Amendment to the National Electricity Rules

(Clause 4)

[1] Clause 5.2.3 Obligations of network service providers

In clause 5.2.3(e1)(2), omit "exceed" and substitute "breach".

[2] Clause 5.2.3 Obligations of network service providers

After the note in clause 5.2.3(g)(7), insert:

- (g1) A *Network Service Provider* must comply with any terms and conditions of a *connection agreement* for its *market network service facilities* that provide for the implementation, operation, maintenance or performance of a *system strength remediation scheme*.

Note

The *AEMC* proposes to recommend that this clause be classified as a civil penalty provision under the National Electricity (South Australia) Regulations.

[3] Clause 5.2.5 Obligations of Generators

After clause 5.2.5(b)(6), insert:

- (c) A *Generator* must comply with any terms and conditions of a *connection agreement* for its *generating system* that provide for the implementation, operation, maintenance or performance of a *system strength remediation scheme*.

Note

The *AEMC* proposes to recommend that this clause be classified as a civil penalty provision under the National Electricity (South Australia) Regulations.

[4] Clause 5.3.3 Response to connection enquiry

After clause 5.3.3(b4), insert:

- (b5) For a *connection point* for a *facility* that will be required by clause 5.3.4B(a) to register a *short circuit ratio*, within the time applicable under paragraph (b1), the *Network Service Provider* must provide the *Connection Applicant* with the following written details:
- (1) the minimum *three phase fault level* at the *connection point* determined in the accordance with the *short circuit ratio calculation guidelines*; and
 - (2) whether the *connection* of the *plant* is expected in the reasonable opinion of a *Network Service Provider* to reduce

the *short circuit ratio* at the *connection point* for any *facility* below its *registered short circuit ratio*.

[5] Clause 5.3.3 Response to connection enquiry

After clause 5.3.3(c)(2), insert:

- (2a) for a *connection* enquiry for a *facility* that will be required by clause 5.3.4B(a) to register a *short circuit ratio*, the *Connection Applicant's* proposal for the *minimum short circuit ratio* for the *facility* that will satisfy clause 5.3.4B(a) and where applicable the information in clause 5.3.4(g);

[6] Clause 5.3.4 Application for connection

In clause 5.3.4(a), omit "and clause 5.3.4A" and substitute ", clause 5.3.4A and clause 5.3.4B."

[7] Clause 5.3.4 Application for connection

After 5.3.4(f)(3), insert:

- (g) For a *connection* involving a *facility* that will be required by clause 5.3.4B(a) to register a *short circuit ratio*, a *Connection Applicant* who proposes a *system strength remediation scheme* under clause 5.3.4B(d) or (f) must submit its proposal with the *application to connect*.

[8] Clause 5.3.4A Negotiated access standards

In clause 5.3.4A(d), omit "AEMO advisory matters." and substitute "AEMO advisory matters."

[9] New Clause 5.3.4B Short circuit ratios and system strength

After clause 5.3.4A, insert:

5.3.4B Short circuit ratios and system strength

- (a) A *short circuit ratio* must be registered with AEMO for all *connection points* for *generating systems* and *market network service facilities* unless exempt under clause 11.100.1. The *short circuit ratio* registered with AEMO will be the *registered short circuit ratio* for the *facility* and must be the lesser of:
 - (1) the *minimum short circuit ratio* for the *connection point*; and
 - (2) the *short circuit ratio* agreed to be registered with AEMO in the circumstances provided for in paragraph (e) as specified in the *connection agreement*.

- (b) The *minimum short circuit ratio* for the *connection points* for a *facility* is the lowest level of *short circuit ratio* that:
- (1) is required for the *facility* to meet its *performance standards*, determined by reference to the technical capability of the *facility*;
 - (2) on AEMO's reasonable advice, does not adversely affect *power system security*; and
 - (3) in the *Network Service Provider's* reasonable opinion, does not adversely affect quality of *supply* for other *Network Users*.
- (c) A *system strength remediation scheme* is a scheme agreed or determined under this clause that:
- (1) is required to be implemented by a *Registered Participant* as a condition of its *connection agreement*; and
 - (2) will remedy or avoid a shortfall or reduction in a *short circuit ratio* in a manner that does not adversely affect *power system security* or the quality of *supply* for other *Network Users*.

Note

A *system strength remediation scheme* may include the installation, operation and maintenance of *plant* by the *Registered Participant* or an undertaking given by the *Registered Participant* to operate at a reduced level of output.

- (d) A *system strength remediation scheme* must be agreed or determined under this clause when:
- (1) establishing a *connection* for a *facility* required by clause 5.3.4B(a) to register a *short circuit ratio* and the *short circuit ratio* at the *connection points* for the *facility* will be less than the *minimum short circuit ratio* for the *facility*; or
 - (2) as a result of modification to a *connection* for a *facility* required by clause 5.3.4B(a) to register a *short circuit ratio* or alterations to *generating plant* in the circumstances set out in clause 5.3.9 the *short circuit ratio* at the *connection points* for the *facility* will be less than the *registered short circuit ratio*,

and in each case, the *Connection Applicant* has not agreed to the *Network Service Provider* undertaking all required *system strength connection works* to remedy or avoid the shortfall.

- (e) Where a *system strength remediation scheme* required under paragraph (d) will enable the *facility* to meet its *performance standards* while operating with a *short circuit ratio* that is lower than the *minimum short circuit ratio*, the *connection agreement* must provide for the lower *short circuit ratio* to be registered with

AEMO under subparagraph (a)(2). The *short circuit ratio* referred to in this paragraph must be proposed and agreed or determined as part of the *system strength remediation scheme* and must be the lowest level of *short circuit ratio* that:

- (1) is required for the *facility* to meet its *performance standards* with the *system strength remediation scheme* operating, determined by reference to the technical capability of the *facility*;
- (2) on *AEMO's* reasonable advice, does not adversely affect *power system security*; and
- (3) in the *Network Service Provider's* reasonable opinion, does not adversely affect quality of *supply* for other *Network Users*.

(f) A *system strength remediation scheme* may be agreed between a *Connection Applicant* and a *Network Service Provider* when:

- (1) establishing or modifying a *connection* for a *connection point* for a *facility* required by clause 5.3.4B(a) to register a *short circuit ratio* or alterations to *generating plant* in the circumstances set out in clause 5.3.9 is expected in the reasonable opinion of a *Network Service Provider* to reduce the *short circuit ratio* at the *connection point* for any other *facility* below its *registered short circuit ratio*; and
- (2) the *Network Service Provider* is satisfied that the *system strength remediation scheme* will enable the *Network Service Provider* to comply with its obligations under clause S5.1.14 in relation to the *registered short circuit ratio* of the other *facility* or *facilities*.

(g) A *Connection Applicant* proposing in an *application to connect* or under clause 5.3.9(b)(4) or under this clause to install *plant* as part of a *system strength remediation scheme* must include a description of the *plant*, the ratings of the proposed *plant* (in MVA) and other information reasonably required by the *Network Service Provider* and *AEMO* to model the operation of the *plant* and the impact on the *three phase fault level*.

(h) A *Network Service provider* must, following the receipt of:

- (1) a proposed *minimum short circuit ratio*; or
- (2) a proposed *system strength remediation scheme*,

in an *application to connect* or under clause 5.3.9(b)(4) or under this clause, consult with *AEMO* as soon as practical in relation to the proposal.

Note

The *AEMC* proposes to recommend that this clause be classified as a civil penalty provision under the National Electricity (South Australia) Regulations.

- (i) *AEMO* must within 20 *business days* following the submission of any proposal referred to in paragraph (h), respond to the *Network Service Provider* in writing in respect of the proposal.
- (j) A *Network Service Provider* must within 30 *business days* following the receipt of a proposal referred to in paragraph (h), accept or reject the proposal.

Note

The *AEMC* proposes to recommend that this clause be classified as a civil penalty provision under the National Electricity (South Australia) Regulations.

- (k) The *Network Service Provider* must reject a proposed *minimum short circuit ratio* if the level proposed:
 - (1) in the reasonable opinion of the *Network Service Provider*, would not satisfy subparagraph (b)(1);
 - (2) on *AEMO's* reasonable advice, would adversely affect *power system security*; or
 - (3) in the *Network Service Provider's* reasonable opinion, would adversely affect quality of *supply* for other *Network Users*.

Note

The *AEMC* proposes to recommend that this clause be classified as a civil penalty provision under the National Electricity (South Australia) Regulations.

- (l) If a *Network Service Provider* rejects a proposed *minimum short circuit ratio*, the *Network Service Provider* must at the same time, advise the value that the *Network Service Provider* will accept.

Note

The *AEMC* proposes to recommend that this clause be classified as a civil penalty provision under the National Electricity (South Australia) Regulations.

- (m) The *Connection Applicant* may, in relation to proposed *minimum short circuit ratio* advised by a *Network Service Provider* in accordance with paragraph (l):
 - (1) accept the proposed *minimum short circuit ratio*;
 - (2) propose an alternative *minimum short circuit ratio* to be further evaluated following the process initiated under paragraph (h); or

- (3) request further negotiations under paragraph (q).
- (n) The *Network Service Provider* must reject a proposed *system strength remediation scheme* if the scheme is not reasonably likely to achieve its required outcome or comply with subparagraph (e)(1) or would:
 - (1) in the reasonable opinion of the *Network Service Provider* adversely affect quality of *supply* for other *Network Users*; or
 - (2) on *AEMO's* reasonable advice, adversely affect *power system security*.

Note:

The *AEMC* proposes to recommend that this clause be classified as a civil penalty provision under the National Electricity (South Australia) Regulations.

- (o) If a *Network Service Provider* rejects a proposed *system strength remediation scheme*, the *Network Service Provider* must give its reasons but has no obligation to propose a *system strength remediation scheme* that it will accept.
- (p) The *Connection Applicant* submitting a proposed *system strength remediation scheme* advised by a *Network Service Provider* in accordance with paragraph (o) may:
 - (1) propose an alternative *system strength remediation scheme* to be further evaluated following the process initiated under paragraph (h); or
 - (2) in relation to a *system strength remediation scheme* required under paragraph (d), but not a *system strength remediation scheme* proposed for agreement under paragraph (f), request negotiations under paragraph (q).
- (q) If a *Connection Applicant* requests negotiations under this paragraph, the *Connection Applicant*, the *Network Service Provider* and *AEMO* must negotiate in good faith to reach agreement in respect of the *minimum short circuit ratio* or a *system strength remediation scheme* required under paragraph (d).
- (r) If the matter is not resolved by negotiation under paragraph (q), the matter must be dealt with as a dispute under rule 5.5 (in the case of a *connection* to a *transmission system* other than the *declared transmission system* of an *adoptive jurisdiction*) or otherwise under rule 8.2. Dispute resolution under those provisions is not available for a *system strength remediation scheme* proposed for agreement under paragraph (f).
- (s) The parties to a *connection agreement* containing a *system strength remediation scheme* must not modify the scheme unless the

modified scheme has been agreed or determined under this clause. A *Registered Participant* proposing to modify a *system strength remediation scheme* must submit its proposal for modification to the *Network Service Provider* for evaluation by the *Network Service Provider* and *AEMO* under this clause. Once agreed or determined, the modified scheme must be incorporated as an amendment to the *connection agreement* and notified to *AEMO* under clause 5.3.7(g).

[10] Clause 5.3.5 Preparation of offer to connect

After clause 5.3.5(d)(4), insert:

- (e) The *Network Service Provider* preparing the offer to *connect* must specify in reasonable detail any *system strength connection works* to be undertaken by the *Network Service Provider*.
- (f) **[Deleted]**

[11] Clause 5.3.6 Offer to connect

In clause 5.3.6(a1), after "in accordance with clause 5.3.4A" insert ", or the *minimum short circuit ratio* or a *system strength remediation scheme* in accordance with clause 5.3.4B."

[12] Clause 5.3.7 Finalisation of connection agreement and network operating agreements

In clause 5.3.7(d), after "*extension works* to a *network*" insert "or any *system strength connection works*."

[13] Clause 5.3.7 Finalisation of connection agreement and network operating agreements

In clause 5.3.7(g)(4), omit "; and" and substitute ";".

[14] Clause 5.3.7 Finalisation of connection and network operating agreements

In clause 5.3.7(g)(5), after "*connection agreement*", omit "." and substitute "; and".

[15] Clause 5.3.7 Finalisation of connection and network operating agreements

After clause 5.3.7(g)(5), insert:

- (6) if required under clause 5.3.4B, the *short circuit ratio* to be registered with *AEMO* and the details of any *system strength remediation scheme* agreed or determined under clause 5.3.4B.

[16] Clause 5.3.8 Provision and use of information

In clause 5.3.8(b)(2)(ii), omit "or".

[17] Clause 5.3.8 Provision and use of information

In clause 5.3.8(b)(2)(iii), after "*augmentation or extension*", insert "or *system strength connection works*; or"

[18] Clause 5.3.8 Provision and use of information

After clause 5.3.8(b)(2)(iii), insert:

- (iv) assess *short circuit ratio* and *system strength remediation scheme* proposals.

[19] Clause 5.3.9 Procedure to be followed by a Generator proposing to alter a generating system

Omit clause 5.3.9(a)(2), and substitute:

- (2) a *generating system* for which *performance standards* have been previously accepted by AEMO,

in a manner that will affect the performance of the *generating system* relative to any of the technical requirements set out in clauses S5.2.5, S5.2.6, S5.2.7 and S5.2.8 or the *short circuit ratio* at the *connection point* for the *generating system* or any other *facility* required by clause 5.3.4B(a) to register a *short circuit ratio*.

[20] Clause 5.3.9 Procedure to be followed by a Generator proposing to alter a generating system

In clause 5.3.9(b)(2), omit "and".

[21] Clause 5.3.9 Procedure to be followed by a Generator proposing to alter a generating system

In clause 5.3.9(b)(3)(ii), after "*negotiated access standard*", omit "." and substitute "; and".

[22] Clause 5.3.9 Procedure to be followed by a Generator proposing to alter a generating system

After clause 5.3.9(b)(3)(ii), insert:

- (4) where relevant, the proposed new *registered short circuit ratio* at the *connection point* or the *Generator's proposed system strength remediation scheme*.

[23] Clause 5.3.9 Procedure to be followed by a Generator proposing to alter a generating system

After clause 5.3.9(c), insert:

- (c1) Clause 5.3.4B applies to a submission by a *Generator* under paragraph (b)(4).

[24] Clause 5.3.10 Acceptance of performance standards for generating plant that is altered

In clause 5.3.10(b), after "*AEMO's* advisory role under clause 5.3.4A" insert "and clause 5.3.4B,".

[25] Clause 5.3.10 Acceptance of performance standards for generating plant that is altered

In clause 5.3.10(b)(2)(ii), omit "." and substitute "; and".

[26] Clause 5.3.10 Acceptance of performance standards for generating plant that is altered

After clause 5.3.10(b)(2)(ii), insert:

- (3) any amended *short circuit ratio* and any *system strength remediation scheme* satisfies clause 5.3.4B.

[27] Clause 5.3.11 Notification of request to change to normal voltage

In clause 5.3.11(b), substitute "AEMO" with "*AEMO*".

[28] Clause 5.3A.3 Publication of Information

Omit clause 5.3A.3(b)(1)(vi), and substitute:

- (vi) the process for negotiating *negotiated access standards* under clause 5.3.4A and the *short circuit ratio* to be registered with *AEMO* and any *system strength remediation scheme* under clause 5.3.4B and a summary of the factors the *Distribution Network Service Provider* takes into account when considering proposed *negotiated access standards*, *short circuit ratios* and *system strength remediation schemes*; and

[29] Clause 5.3A.3 Publication of Information

In clause 5.3A.3(b)(ix), delete "and".

[30] Clause 5.3A.3 Publication of Information

After clause 5.3A.3(6)(x), insert:

- (xi) circumstances in which a *system strength remediation scheme* or *system strength connection works* will be required as a condition of *connection*; and

[31] Clause 5.3A.8 Detailed Response to Enquiry

Omit clause 5.3A.8(g)(2) and substitute:

- (2) paragraphs (a) - (e1), (h) - (l) and (n)-(o) of Schedule 5.4B.

[32] Clause 5.3A.9 Application for connection

Omit clause 5.3A.9(a), and substitute:

- (a) Following receipt of a detailed response under clause 5.3A.8, a *Connection Applicant* may make an *application to connect* in accordance with this clause 5.3A.9, clause 5.3.4A and clause 5.3.4B.

[33] Clause 5.3A.9 Application for connection

After clause 5.3A.9(g)(2), insert:

- (h) For a *connection* involving a *facility* that will be required by clause 5.3.4B(a) to register a *short circuit ratio*, a *Connection Applicant* who proposes a *system strength remediation scheme* under clause 5.3.4B(d) or (f) must submit its proposal with the *application to connect*.

[34] Clause 5.3A.10 Preparation of offer to connect

After clause 5.3A.10(e), insert:

- (f) The *Distribution Network Service Provider* preparing the offer to *connect* must specify in reasonable detail any *system strength connection works* to be undertaken by the *Distribution Network Service Provider*.

[35] New Clause 5.7.3A Tests to demonstrate compliance with system strength remediation schemes

After clause 5.7.3, insert:

5.7.3A Tests to demonstrate compliance with system strength remediation schemes

- (a) Each *Registered Participant* required under a *connection agreement* to implement a *system strength remediation scheme* by means of *facilities* owned, operated or controlled by the *Registered Participant* must at the request of *AEMO* or the relevant *Network*

Service Provider made not more than once in a calendar year provide evidence that those *facilities* satisfy the requirements of the *system strength remediation scheme* set out in the *connection agreement*.

Note

The *AEMC* proposes to recommend that this clause be classified as a civil penalty provision under the National Electricity (South Australia) Regulations.

- (b) If at any time the *facilities* do not satisfy the requirements of the *system strength remediation scheme* set out in the *connection agreement*, the *Registered Participant* must:
- (1) promptly notify the relevant *Network Service Provider* and *AEMO* of that fact;
 - (2) promptly notify the *Network Service Provider* and *AEMO* of the remedial steps it proposes to take and the timetable for such remedial work;
 - (3) diligently undertake such remedial work and report at monthly intervals to the *Network Service Provider* on progress in implementing the remedial action; and
 - (4) conduct further tests or monitoring on completion of the remedial work to confirm compliance with the requirements of the *system strength remediation scheme*.

Note

The *AEMC* proposes to recommend that this clause be classified as a civil penalty provision under the National Electricity (South Australia) Regulations.

- (c) If *AEMO* reasonably believes the requirements of a *system strength remediation scheme* are not being complied with, *AEMO* may instruct the *Registered Participant* to conduct tests within 25 *business days* to demonstrate that the requirements are being met

Note

The *AEMC* proposes to recommend that this clause be classified as a civil penalty provision under the National Electricity (South Australia) Regulations.

- (d) If the tests undertaken in accordance with paragraph (c) provide evidence that the requirements of a *system strength remediation scheme* are being complied with, *AEMO* must reimburse the *Registered Participant* for the reasonable expenses incurred as a direct result of conducting the tests.
- (e) If *AEMO*:

- (1) is satisfied that the requirements of a *system strength remediation scheme* are not being complied with; and
- (2) holds the reasonable opinion that the failure is impeding or will impede *AEMO's* ability to carry out its role in relation to *power system security*,

AEMO may direct the relevant *Registered Participant* to operate its *facility* at a particular output or *power transfer capability* or in a particular mode until the relevant *Registered Participant* submits evidence reasonably satisfactory to *AEMO* that the requirements of a *system strength remediation scheme* are being complied with.

- (f) Each *Registered Participant* referred to in paragraph (a) must maintain records for 7 years for each of its relevant *facilities* setting out details of the results of monitoring and testing conducted under this clause 5.7.3A and make these records available to *AEMO* on request.

[36] Clause 5.12.1 Transmission annual planning review

In clause 5.12.1(b)(4), omit "." and substitute "; and".

[37] Clause 5.12.1 Transmission annual planning review

After clause 5.12.1(b)(4), insert:

- (5) consider the need for *system strength remedial works*.

[38] Clause 5.12.2 Transmission Annual Planning Report

In clause 5.12.2(c)(3), omit ";" and substitute ":".

[39] Clause 5.12.2 Transmission Annual Planning Report

Omit clause 5.12.2(c)(5) and substitute:

- (5) for all proposed *augmentations* to the *network* or *system strength remedial works* the following information, in sufficient detail relative to the size or significance of the project and the proposed operational date of the project:

[40] Clause 5.12.2 Transmission Annual Planning Report

In clause 5.12.2(c)(6), after "the proposed *augmentations*", insert "or *system strength remedial works*".

[41] Clause 5.13.1 Distribution annual planning review

In clause 5.13.1(d)(2)(iii), after "*reliability* improvement" insert "or for *system strength remedial works*";

[42] Clause 5.15.2 Identification of a credible option

In clause 5.15.2(b), omit "5.16.3(a)(1)-(7)," and substitute "5.16.3(a)(1)-(8),".

[43] Clause 5.15.2 Identification of a credible option

In clause 5.15.2(c), omit "5.17.3(a)(1)-(6)," and substitute "5.17.3(a)(1)-(7),".

[44] Clause 5.20.2 Publication of NTNDP

After clause 5.20.2(c)(9), insert:

- (9A) include an assessment that identifies any *connections point* for a *facility* where the *short circuit ratio* is below or likely to fall below the *registered short circuit ratio*; and

[45] New Clause S5.1.14 System strength

After clause S5.1.13, insert:

S5.1.14 System strength

A *Network Service Provider* must use reasonable endeavours to plan and operate its *transmission or distribution system* so as to ensure that the *short circuit ratio* at the *connection point* for each *generating system* and *market network service facility* connected to its *transmission or distribution system* is at least equal to the *registered short circuit ratio* for the *generating system* or *market network service facility*:

- (a) when the *power system* is in a *secure operating state*;
- (b) following a *credible contingency event* when the *power system* was in a *secure operating state* immediately before the *credible contingency event*; and
- (c) following a *protected event* when the *power system* was in a *secure operating state* immediately before the *protected event*.

[46] Clause S5.2.4 Provision of information

In clause S5.2.4(e1)(4), after "and *voltage* unbalance;", omit "and".

[47] Clause S5.2.4 Provision of information

In clause S5.2.4(e1)(5)(ii), omit "." and substitute "; and".

[48] Clause S5.2.4 Provision of information

After clause S5.2.4(5)(ii), insert:

- (6) the *Network Service Provider's* expected *minimum short circuit ratio* at the *connection point* for the *generating system* following the *connection* of the *generating system*.

[49] Schedule 5.4 Information to be Provided with Preliminary Enquiry

After schedule 5.4(g), insert:

- (g1) The lowest *short circuit ratio* at which the *plant* can operate.

[50] Schedule 5.4A Preliminary Response

In schedule 5.4A(a)(7), after "*synchronising* arrangements;", omit "and".

[51] Schedule 5.4A Preliminary Response

In schedule 5.4A(a)(8), insert "and".

[52] Schedule 5.4A Preliminary Response

After schedule 5.4A(a)(8), insert:

- (9) establishing or maintaining the *short circuit ratio* to be registered for the *generating system* or the *registered short circuit ratio* for any other *generating system* affected by the *connection*;

[53] Schedule 5.4A Preliminary Response

After schedule 5.4A(i), insert:

- (i1) an indication of whether the new *connection* is expected in the reasonable opinion of a *Network Service Provider* to reduce the *short circuit ratio* below the *register short circuit ratio* for any other *facility*;

[54] Schedule 5.4A Preliminary Response

After schedule 5.4A(o)(2), insert:

- (3) the *Connection Applicant's* proposal for the *minimum short circuit ratio* for the *generating system* that will satisfy clause 5.3.4B(a) and where applicable its proposal for any *system strength remediation scheme*;

[55] Schedule 5.4B Detailed Response to Enquiry

After schedule 5.4B(e), insert:

- (e1) written details of:

- (1) the minimum *three phase fault level* at the *connection point* determined in accordance with the *short circuit ratio calculation guidelines*; and
- (2) whether the proposed new *connection* is expected in the reasonable opinion of a *Network Service Provider* to reduce the *short circuit ratio* at the *connection point* for any other *facility* below its *registered short circuit ratio*.

[56] Schedule 5.6 Terms and Conditions of Connection agreements and network operating agreements

After schedule 5.6(c1), insert:

- (c2) the *minimum short circuit ratio*;
- (c3) details of any *system strength remediation scheme* agreed or determined in accordance with clause 5.3.4B and associated terms and conditions;
- (c4) details of any *system strength connection works*;

Schedule 3 Amendment to the National Electricity Rules

(Clause 5)

[1] Chapter 10 New Definitions

In Chapter 10, insert the following definitions in alphabetical order:

minimum short circuit ratio

For a *facility*, the *short circuit ratio* for the *connection points* for the *facility* that satisfies clause 5.3.4B(b).

registered short circuit ratio

For a *facility*, the *short circuit ratio* for the *facility* registered with AEMO as required by clause 5.3.4B(a) and recorded in the register maintained by AEMO under clause 4.6.6.

short circuit ratio

In relation to:

- (a) a *generating system*, the ratio of the *three phase fault level* (in MVA) at the *connection points* for the *generating system* to the *active power* output of the *generating system* (in MW);
- (b) a *connection point* for a *market network service facility*, the ratio of the *three phase fault level* (in MVA) at the *connection point* to the *active power* transfer (in MW) of the *facility*,

in each case calculated in accordance with the *short circuit ratio calculation guidelines*.

short circuit ratio calculation guidelines

The guidelines develop by AEMO under clause 4.6.7.

system strength connection works

System strength works undertaken where a *connection* for a *facility* required by clause 5.3.4B(a) to register a *short circuit ratio* is to be established or modified or alterations to *generating plant* are to be made in the circumstances set out in clause 5.3.9 and either:

- (a) the *system strength works* are required to ensure the *short circuit ratio* at the *connection points* for the *facility* is at least the *registered short circuit ratio* for the *facility*; or
- (b) the *system strength works* are required to ensure the *short circuit ratio* at the *connection points* for any other *facility* is at least the *registered short circuit ratio* for the *facility*.

system strength remedial works

System strength works required to achieve or maintain the *registered short circuit ratio* for one or more *generating systems* or *market network service facilities* in accordance with the standard in clause S.5.1.14, but not including *system strength connection works*.

system strength remediation scheme

A scheme described in clause 5.3.4B and agreed or determined under that clause.

system strength works

Investment in a *transmission or distribution system* in order to establish or maintain the *short circuit ratio* at a *connection point* at or above a particular level. *System strength works* may include without limitation the installation of *synchronous condensers* or other apparatus or equipment capable of contributing to the *three phase fault level* at a *connection point*.

three phase fault level

Measured in MVA at a *connection point*, the product of the pre-fault *nominal voltage* (measured in kV between a pair of phases), the fault current in each phase for a three phase fault at the *connection point* (measured in kA), and the square root of 3.

[2] Chapter 10 Substituted Definitions

In Chapter 10, substitute the following definitions:

AEMO advisory matter

A matter that relates to *AEMO's* functions under the *National Electricity Law* and a matter in which *AEMO* has a role under clause 5.3.4B or in schedules 5.1a, 5.1, 5.2, 5.3 and 5.3a.

negotiated transmission service

Any of the following services:

- (a) a *shared transmission service* that:
 - (1) exceeds the *network* performance requirements (whether as to quality or quantity) (if any) as that *shared transmission service* is required to meet under any *jurisdictional electricity legislation*; or
 - (2) except to the extent that the *network* performance requirements which that *shared transmission service* is required to meet are prescribed under any *jurisdictional electricity legislation*, exceeds or does not meet the *network*

performance requirements (whether as to quality or quantity) as are set out in schedule 5.1a or 5.1;

- (b) *connection services* that are provided to serve a *Transmission Network User*, or group of *Transmission Network Users*, at a *single transmission network connection point*, other than *connection services* that are provided by one *Network Service Provider* to another *Network Service Provider* to *connect* their networks where neither of the *Network Service Providers* is a *Market Network Service Provider*;
- (c) services specified to be *negotiated transmission services* under rule 5.2A.4; or
- (d) undertaking *system strength connection works*

but does not include an *above-standard system shared transmission service* or a *market network service*.

plant

- (a) In relation to a *connection point*, includes all equipment involved in generating, utilising or transmitting electrical *energy*.
- (b) In relation to *dispatch bids* and *offers*, controllable generating equipment and controllable *loads*.
- (c) In relation to the *statement of opportunities* prepared by *AEMO*, individually controllable generating facilities registered or capable of being registered with *AEMO*.
- (d) In relation to the *regulatory investment test for transmission*, any of the definitions of *plant* in paragraphs (a) to (c) relevant to the application of the *regulatory investment test for transmission* to a RIT-T project.
- (e) In relation to the *regulatory investment test for distribution*, any of any of the definitions of *plant* in paragraphs (a) to (c) relevant to the application of the *regulatory investment test for distribution* to a RIT-D project
- (f) In relation to a *system strength remediation scheme*, includes all equipment involved in the implementation of the scheme.

prescribed transmission service:

Any of the following services:

- (a) a *shared transmission service* that:
 - (1) does not exceed such *network* performance requirements (whether as to quality or quantity) as that *shared transmission*

service is required to meet under any *jurisdictional electricity legislation*;

- (2) except to the extent that the *network* performance requirements which that *shared transmission service* is required to meet are prescribed under any *jurisdictional electricity legislation*, does not exceed such *network* performance requirements (whether as to quality or quantity) as are set out in schedule 5.1a or 5.1; or
 - (3) is an *above-standard system shared transmission service*.
- (b) services that are required to be provided by a *Transmission Network Service Provider* under the *Rules*, or in accordance with *jurisdictional electricity legislation*, to the extent such services relate to the provision of the services referred to in paragraph (a), including such of those services as are:
- (1) required by *AEMO* to be provided under the *Rules*, but excluding those acquired by *AEMO* under rule 3.11; and
 - (2) necessary to ensure the integrity of a *transmission network*, including through the maintenance of *power system security* and assisting in the planning of the *power system*;
- (c) *connection services* that are provided by a *Transmission Network Service Provider* to another *Network Service Provider* to connect their *networks* where neither of the *Network Service Providers* is a *Market Network Service Provider*; or
- (d) undertaking *system strength remedial works*,

but does not include a *negotiated transmission service* or a *market network service*.

Schedule 4 Savings and Transitional Amendments to the National Electricity Rules

(Clause 6)

[1] Chapter 11 New Part ZZZB

In chapter 11, after Part ZZZ[X], insert:

Part ZZZ[X] System Strength Amendments

11.100 Rules consequential on the making of the National Electricity Amendment (Managing power system fault levels) Rule 2017

11.100.1 Definitions

(a) In this rule 11.00:

Amending Rule means the National Electricity Amendment (Managing power system fault levels) Rule 2017.

commencement date means the date of commencement of Schedules 1, 2 and 3 of the Amending Rule.

new Chapter 10 means Chapter 10 as amended by the Amending Rule.

(b) Italicised terms used in this rule 11.100 have the same meaning as in new Chapter 10.

11.101 Determination of minimum short circuit ratio for existing facilities

11.101.1 Application and exemptions

(a) This rule applies to a *facility* required to register a *short circuit ratio* by clause 5.3.4B(a) and:

(1) that was already *connected* at the commencement date; or

(2) was not already *connected* at the commencement date, but for which the *application to connect* was submitted to the *Network Service Provider* on or before the commencement date.

(b) A *Generator* who owns, operates or controls a *generating system* to which this rule applies may apply to *AEMO* for an exemption from the obligation to register a *minimum short circuit ratio* for its

generating system under this rule. The application must be in the form and contain the information specified by *AEMO*. *AEMO*:

- (1) must consult with each affected *Network Service Provider* in relation to the application;
 - (2) must use reasonable endeavours to determine the application within 20 *business days* of the completed application and all required information being submitted; and
 - (3) may grant the exemption if *AEMO* is reasonably satisfied that a failure by the *generating system* to meet its *performance standards* is unlikely to have an adverse impact on *power system security* by reason of:
 - (i) the size of the *generating system* and its location in the *power system*;
 - (ii) it being reasonably unlikely that changes elsewhere in the *power system* will have an adverse impact on the *three phase fault level* at the *generating system's connection points*; or
 - (iii) the *generating system* not being required to have registered *performance standards*.
- (c) *AEMO* may revoke an exemption granted under paragraph (b) by giving not less than 20 *business days'* notice to the *Generator* specifying the date on which the exemption ceases to apply, if *AEMO* at any time ceases to be satisfied in accordance with subparagraph (3) in relation to the *generating system*.

11.101.2 Obligations to register

- (a) A *Registered Participant* who owns, operates or controls a *facility* to which this rule applies and that is not exempt under rule 11.100.1(b) must register the *minimum short circuit ratio* for the *facility* agreed or determined under this rule with *AEMO* in accordance with clause 5.3.4B(a) no later than 1 July 2018 or, if paragraph (b) or (c) applies, the date determined under that paragraph.

Note

The *AEMC* proposes to recommend that this clause be classified as a civil penalty provision under the National Electricity (South Australia) Regulations.

- (b) If immediately before 1 July 2018 a dispute about the *minimum short circuit ratio* has been referred to an *Advisor* under rule 8.2, the *Registered Participant* must register the *minimum short circuit ratio* most recently proposed by the *Network Service Provider* on a provisional basis and must register the final *minimum short circuit ratio* within 2 *business days* of it being agreed or determined.

- (c) If an exemption under clause 11.100.1(b) is revoked, the *Registered Participant* must register the *minimum short circuit ratio* within 6 months of the exemption being revoked or (if later) within 2 *business days* of the *minimum short circuit ratio* being determined through the dispute resolution process under rule 8.2.

11.101.3 Determination of the minimum short circuit ratio

- (a) The *minimum short circuit ratio* for a *connection point* for a *facility* to which this rule applies must satisfy the requirements of clause 5.3.4B(b) and must be registered with *AEMO* as the *registered short circuit ratio* for the *connection point*.
- (b) A *Registered Participant* required to register a *minimum short circuit ratio* for a *facility* under clause 11.100.2(a) must submit to the *Network Service Provider* its proposal for the *minimum short circuit ratio* for the *facility* to be registered with *AEMO*.
- (c) Unless the *Registered Participant* has applied for an exemption under clause 11.100.1(b), a proposal under paragraph (b) must be submitted as soon as practical after the commencement date.
- (d) A *Network Service Provider* must following the receipt of a proposed *minimum short circuit ratio* under paragraph (b) consult with *AEMO* as soon as practical in relation to that proposal.

Note

The *AEMC* proposes to recommend that this clause be classified as a civil penalty provision under the National Electricity (South Australia) Regulations.

- (e) *AEMO* must within 20 *business days* following the submission of a proposed *minimum short circuit ratio* under paragraph (b), respond to the *Network Service Provider* in writing in respect of the proposal.
- (f) A *Network Service Provider* must within 30 *business days* following the receipt of a proposed *minimum short circuit ratio* under paragraph (b), accept or reject the proposal.

Note

The *AEMC* proposes to recommend that this clause be classified as a civil penalty provision under the National Electricity (South Australia) Regulations.

- (g) The *Network Service Provider* must reject the proposed *minimum short circuit ratio* if the level proposed by the *Registered Participant*:
 - (1) in the reasonable opinion of the *Network Service Provider*, would not satisfy clause 5.3.4B(b)(1);

- (2) on *AEMO's* reasonable advice, would adversely affect *power system security*; or
- (3) in the *Network Service Provider's* reasonable opinion, would adversely affect quality of *supply* for other *Network Users*.

Note

The *AEMC* proposes to recommend that this clause be classified as a civil penalty provision under the National Electricity (South Australia) Regulations.

- (h) If a *Network Service Provider* rejects a proposed *minimum short circuit ratio*, the *Network Service Provider* must at the same time, advise the *minimum short circuit ratio* that the *Network Service Provider* will accept.

Note

The *AEMC* proposes to recommend that this clause be classified as a civil penalty provision under the National Electricity (South Australia) Regulations.

- (i) The *Registered Participant* submitting a proposed *minimum short circuit ratio* under paragraph (b) may, in relation to proposed *minimum short circuit ratio* advised by a *Network Service Provider* in accordance with paragraph (h):
 - (1) accept the proposed *minimum short circuit ratio*;
 - (2) propose an alternative *minimum short circuit ratio* to be further evaluated in accordance with the process initiated under paragraph (b); or
 - (3) request negotiations under paragraph (j).
- (j) If the *Registered Participant* requests negotiations under this paragraph, the *Registered Participant*, the *Network Service Provider* and *AEMO* must negotiate in good faith to reach agreement in respect of the *minimum short circuit ratio*.
- (k) If the matter is not resolved by negotiation under paragraph (j), the matter must be dealt with as a dispute under rule 8.2.

11.101.4 Meaning of reasonable endeavours in clauses 4.3.4(c1) and S5.1.14

- (a) for the purposes of clauses 4.3.4(c1) and S5.1.14, a *Network Service Provider* is taken to be using reasonable endeavours to satisfy the requirements of clause S5.1.14 with respect to a *connection point* where:

- (1) *system strength remedial works* are required in order to achieve the outcome specified in S5.1.4 at that *connection point*; and
 - (2) the *Network Service Provider* is using reasonable endeavours to ensure those *system strength remedial works* are completed as soon as practical after the commencement date.
- (b) Paragraph (a) expires 2 years after the commencement date.

11.101.5 Interim Short Circuit Ratio Guidelines

- (a) The interim guidelines in this clause constitute the *short circuit ratio calculation guidelines* until AEMO determines *short circuit ratio calculation guidelines* in accordance with clause 4.6.7.
- (b) These interim guidelines set out the methodology to be used by *Network Service Providers* when assessing:
 - (1) the *short circuit ratio* at the *connection points* for *generating systems* and *market network service facilities*; and
 - (2) the impact of the *connection* of a new *generating system* or *market network service facility* on the *short circuit ratio* at the *connection points* for other *generating systems* and *market network service facilities*.
- (c) These interim guidelines:
 - (1) include the method for calculating the *short circuit ratio* from a given set of *three phase fault levels* within the *network*; and
 - (2) provide guidance to the *Network Service Provider* as to the different *network* conditions and *dispatch* patterns that should be examined by the *Network Service Provider* when determining the *three phase fault levels* within the *network*.
- (d) Assumed *synchronous generating units dispatch*:
 - (1) The *three phase fault level* at a *generating system's connection point*, and therefore its *short circuit ratio*, depends on which *synchronous generating units* are operating in that part of the *power system*.
 - (2) When applying this interim guideline, the *Network Service Provider* should consider the lowest *three phase fault levels* that are reasonably likely to occur in that part of the *power system* given:
 - (i) the combination of *synchronous generating units* that are likely to be operating at times of low *three phase fault levels*; and

- (ii) at least the minimum number of *synchronous generating units* or *synchronous condensers* required to maintain the *power system* in a *secure operating state*, including having *three phase fault levels* that are sufficient for the *Network Service Provider* to maintain the correct operation of its *protection systems* and *voltage control equipment*.
- (e) Calculating the *short circuit ratio* for a set of electrically close *generating systems*:
- (1) The *short circuit ratio* for a single *generating system* is the ratio of the *three phase fault level* at the *connection point* to the rated *active power output* of the *generating system*. However, applying this approach to a *generating system* that is electrically close to other *generating systems* provides a misleading result. This is because *generating systems* that are electrically close need to be considered as one large *generating system*, with each individual *generating system* effectively only getting a portion of the overall available *three phase fault level*.
 - (2) In calculating a *short circuit ratio* for *generating systems* that are electrically close, *Network Service Providers* must use the weighted short circuit ratio (WSCR), which provides a single *short circuit ratio value* for the electrically close *generating systems*. The formula for WSCR is:

$$\begin{aligned}
 \text{WSCR} &= \frac{\text{Weighted } S_{\text{SCMVA}}}{\sum_i^N P_{\text{RMWi}}} \\
 &= \frac{(\sum_i^N S_{\text{SCMVA}i} * P_{\text{RMWi}}) / \sum_i^N P_{\text{RMWi}}}{\sum_i^N P_{\text{RMWi}}} \\
 &= \frac{\sum_i^N S_{\text{SCMVA}i} * P_{\text{RMWi}}}{(\sum_i^N P_{\text{RMWi}})^2}
 \end{aligned}$$

Where

$S_{\text{SCMVA}i}$ is the *three phase fault level* at *busbar i* (ignoring any contribution from the *generating system i* being included in the WSCR calculation);

P_{RMWi} is the MW output of *generating system i*;

N is the number of electrically close *generating systems*;

i is the index for the individual *generating systems*.

- (f) The WSCR calculation method assumes that the operation of the electrically close *generating systems* interact with other, which is equivalent to assuming that all the *generating systems* are *connected* to a virtual *connection point*. For an actual *power system*, there is usually some electrical distance between each *generating system's connection point* and the *generating systems* will not fully interact with each other.
- (g) Determining which *generating systems* are regarded as electrically close:
- (1) *Generating systems* that comprise *asynchronous generating units* are to be regarded as being electrically close to one another for the purposes of these interim guidelines if:
 - (i) all the *generating systems* comprising *asynchronous generating units* included in the WSCR calculation are within 250 km and the *generating systems' connection points* are connected at the same *voltage level*;
 - (ii) all the *generating systems* comprising *asynchronous generating units* included in the WSCR calculation are within 150 km and the *generating systems' connection points* are connected via a single voltage transformation; and
 - (iii) all the *generating systems* comprising *asynchronous generating units* included in the WSCR calculation are within 50 km and the *generating systems' connection points* are connected via two voltage transformations.
 - (2) *Generating systems* comprising *asynchronous generating units* that are three or more voltage transformations from each other should not be treated as electrically close.
- (h) Application of the WSCR calculation to *market network services*:
- (1) A *market network service facility* generally has power electronic converters at the *connection points* at both terminals. Each of these converters requires a *minimum short circuit ratio* to operate correctly. In addition, the *minimum short circuit ratio* requirement varies with the direction of *active power transfer* via the *market network service facility*.
 - (2) Therefore, the *Market Network Service Provider* needs to negotiate *minimum short circuit ratios* for each power flow

direction with both the *Network Service Providers* it has *connection agreements* with.
