Detailed customer connection schedules for small generator installations

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Table of contents

1. Background

This document is intended to assist Users planning to connect small generators to the distribution system of the Western Power south west interconnected network (SWIN) in the south west of Western Australia. It addresses planning, protection, operational, certification and approval for commissioning issues.

This document provides schedules of detailed technical information for connection of small generator installations. Western Power will provide these schedules to customers as part of processing their access application for connection, as is explained below. Note that customers are not required to fill-in these schedules when they apply for connection.

This document complements "*User Guide for the connection of generators of up to 10 MW to the Western Power SWIN distribution system*" and both documents are available from the Western Power internet site:

http://www.westernpower.com.au/mainContent/workingWithPower/NetworkAccessServices/accessArrangement/Technical_Rules.html

2. Introduction

This document provides the following schedules:

Schedule A: Specific technical requirements for generators connected to the Western Power distribution system

Schedule B: Operating procedures for generators connected to the Western Power distribution system

Schedule C: Certification and approval for commissioning of a facility with embedded generating units to be connected to the Western Power distribution system

Together with the completed access application form, completed Schedules A, B and C and attachments are intended to form part of connection agreements with Western Power for small generator installations. They derive primarily from the requirements of Technical Rules sections 3.6, 4.0 and 5.0 and Attachments 10 and 12.

Schedules A and B are presented as templates and may require rewording in some aspects for each situation addressed. The forms would initially be completed (in part) by Western Power in response to information received in the application form for distribution connected generators found on the Western Power Internet site:

http://www.westernpower.com.au/mainContent/connectionsUpgrades/newConnections/Generators.html

Subsequently the customer would be required to complete the Schedules A and B with required details.

The information specified in **Attachment 10** of the Technical Rules, "*Distribution system connected generators up to 10 MW (except inverter connected generators up to 30kVA)"*, is included in the

Western Power application form for distribution connected generators and forms part of connection agreements for distribution connected power stations.

The requirements of **Attachment 12** "*Testing and commissioning of small power stations connected to the distribution system"* have been incorporated in Schedule C and also form part of connection agreements.

3. Certification

Prior to connecting the facility to the network for testing and commissioning purposes, the user shall:

- confirm that the information appearing in Schedule A and that required by Attachment 10 of the Technical Rules (the information in the application form) is correct and up to date
- arrange for a registered professional engineer to certify, by completing **Schedule C Part 1**, that the facility complies with the Technical Rules, manufacturer's recommendations and good practice and is ready for testing and commissioning in accordance with the requirements of Attachment 12 of the Technical Rules

This requirement for certification applies to the initial establishment of the facility and all subsequent modifications.

Western Power approval for commissioning is effected by the signing of this form.

4. Operation

Following commissioning and testing but prior to connecting the facility to the network for normal operation, the user shall arrange for a registered professional engineer to certify, by completing **Schedule C Part 2**, that the facility complies with the Technical Rules, manufacturer's recommendations and good practice and is ready for normal operation.

This requirement applies to the initial establishment of the facility and all subsequent modifications.

Western Power approval for network connection is effected by the signing of this form.

5. Other approvals

The user shall be entirely responsible for obtaining all appropriate and necessary approvals for the facility from all interested authorities including the Independent Market Operator, the Economic Regulation Authority, environmental authorities, occupational health & safety authorities and local councils.

Schedule A: Part 1 – Specific technical requirements for generators connected to the Western Power distribution system

	Description/Heading	Units	Technical Rules clauses	Party to complete	Requirement	Comment
A1	**General**			WP		
A1.1	**Name of Customer or Generator:**	text		WP		
A1.2	**Facility Name & Address:**	text		WP		
A1.3	**Technical Requirements review period:**	years	3.6.12, 4.1.4, A10, A12.15	WP		
A2	**Connection Arrangements**		3.4, 3.6.3			
A2.1	Mode of operation (e.g. bumpless transfer), connection duration and frequency:	text	3.6.2	WP		
A2.2	Simplified SLD No. & revision:	text	3.6.7, 3.6.12, 5.11	WP		
A2.3	Connection voltage	kV	3.6.2	WP		
A2.4	Locations of points of connection	text, diagram	3.6.7.2	WP		Specify all points of connection to the Western Power network (HV and LV)
A2.5	Source of LV supply for generator auxiliaries (e.g. battery chargers, lighting etc.)			Customer		This is required for safety and power outage considerations
A2.6	Number of generating units and ratings	kVA	3.6.3, 3.6.6,Table 3.5	WP		
A2.7	Generator types, e.g. synchronous or induction, method of excitation	text	3.6.3, 3.6.6,Table 3.5 3.6.8 (d)	WP		
A2.8	Generator terminal voltage	kV	3.6.2	Customer		
A2.9	Prime mover types	text	3.6.3, Table 3.5	Customer		
A2.10	Prime movers continuous rating	kW	3.6.3, Table 3.5	Customer		
A3	**Safety requirements**		3.6.4			
A3.1	Safety Risk Categories					
A3.1.1	*Overload Risk*: Does the facility generation capacity exceed 50% of the network supply capacity at the point of connection?	text	3.6.9	WP		Included for operational purposes
A3.1.2	*Switching Risk:* Does the facility maximum fault current contribution exceed 50% of the network fault current interrupting capacity?	text	3.6.9, 3.6.10.2	WP		Included for operational purposes
A3.1.3	*Energisation Risk:* Does the facility generation capacity exceed 50% of the minimum facility load plus 10% of the minimum load on any portion of the HV network that may be left connected to the facility following the operation of an automatic switch?	text	3.6.10.3	WP		Included for operational purposes
A3.2	Earthing diagram	text	3.6.7.1	Customer		
A3.3	Maximum network fault current contributions at points of connection	kA, seconds 3 ph & 1ph	2.5.6, 2.5.7, 3.6.4, 3.6.6	WP		

A3.4		Maximum facility fault current contributions at points of connection	kA, seconds 3 ph & 1ph	3.6.4, 3.6.6, 5.5.1(b)	Customer		
A3.5		Minimum facility fault current contributions at points of connection	kA, seconds 3 ph & 1ph	3.6.4, 3.6.6	Customer		
A3.6		Other	text				
A4		**Quality of supply**		3.6.3, 3.6.8, 3.6.10.2			
A4.1		Quality of supply risk categories					
A4.1.1		*Damage or disruption risk*: Does the generation capacity exceed 2% of the network minimum fault contribution at the points of connection?	text	3.6.8	WP		Included for operational purposes
A4.1.2		*Annoyance risk*: Does the generation capacity exceed 1% of the network minimum fault contribution at the points of connection?	text	3.6.8	WP		Included for operational purposes
A4.2		Particular requirements including those for wind generators	text	3.6.3	WP		
A4.3		**Power flow, power factor and voltage control (normal network connection)**		3.6.3, 3.6.8, 3.6.9, Table 3.5			
A4.3.1		Maximum export real power	MW	3.6.3, 3.6.9	WP		
A4.3.2		Maximum export reactive power	MVAr	3.6.3, Table 3.5	WP		
A4.3.3		Maximum import real power	MW	3.6.3	WP		
A4.3.4		Maximum import reactive power	MVAr	3.6.3, Table 3.5	WP		
A4.3.5		Power factor during normal operation	Cos Φ, lead & lag	3.6.3, Table 3.5	WP		
A4.3.6		Voltage/power control strategy	text	3.6.8, Table 3.5	WP		
A4.3.7		Voltage/power control requirements: set point, range	kV	3.6.8, Table 3.5	WP		
A4.3.8		Frequency control requirements:	text	Table 3.5	WP		
A4.4		**Power flow, power factor and voltage control (for alternative network connection - when required)**		2.5.4.1(b), 3.6.3, 3.6.8, 3.6.9, Table 3.5, 3.6.12 (a) (3)			Alternative sources of supply are at the discretion of Western Power and will entail additional system studies at customer expense
A4.4.1		Maximum export real power	MW	3.6.3, 3.6.9	WP		
A4.4.2		Maximum export reactive power	MVAr	3.6.3, Table 3.5	WP		
A4.4.3		Maximum import real power	MW	3.6.3	WP		
A4.4.4		Maximum import reactive power	MVAr	3.6.3, Table 3.5	WP		
A4.4.5		Power factor during normal operation	Cos Φ, lead & lag	3.6.3, Table 3.5	WP		
A4.4.6		Voltage control requirements: set point, range	kV	3.6.8, Table 3.5	WP		
A4.4.7		Frequency control requirements:	text	Table 3.5	WP		
A4.5		**Frequency response requirements**					
A4.51		Immunity to frequency excursions	Hz	3.3.3.3(b), Fig. 3.4	WP		Under and over frequency protection settings
A4.5.2		Other settings			WP		This may include other settings using rate of change of frequency blocking
A5		**Remote control, monitoring and communications**		3.6.9, 3.6.10.3			
A5.1		Particular requirements	text		WP		

Schedule A: Part 2 – Protection apparatus requirements and settings

	ANSI No	Protection Scheme	Settings	Type	TR clause	Tick which is not applicable & note reason	Tick Nominated Islanding Protection(s)	Notes
			Western Power Recloser					
	51V	Three Phase IDMT Overcurrent	Pickup= _____ Amps, TMS = _____ , Curve = _____					Refer note 13
	50	Three Phase Instantaneous / Highset Overcurrent	Pickup= _____ Amps, Definite Time Delay = _____ secs					Refer note 13
	64G	IDMT Earth Fault	Pickup= _____ Amps, TMS = _____ , Curve = _____					Refer note 13
	51G	Sensitive (definite time) Earth Fault	Pickup= _____ Amps, Definite Time Delay = _____ secs					Refer note 13
			CMS Tripping					
	51V	Three Phase IDMT Overcurrent	Pickup= _____ Amps, TMS = _____ , Curve = _____		3.6.10.1(f)			Refer Note 1 & 3
	50	Three Phase Instantaneous / Highset Overcurrent	Pickup= _____ Amps, Definite Time Delay = _____ secs		3.6.10.1(f)			Refer Note 1
	64G	IDMT Earth Fault	Pickup= _____ Amps, TMS = _____ , Curve = _____		3.6.10.1(g)			Refer Note 1 & 3
	51G	Sensitive (definite time) Earth Fault	Pickup= _____ Amps, Definite Time Delay = _____ secs		3.6.10.1(g)			
		Any CPS fails to open ("local backup")	Fails to open when required by protective apparatus, maximum delay of 0.3 seconds		3.6.10.1(d)			
		Insert additional lines for any other events that cause tripping						Refer Note 8 & 10
		Trip power supply failure or irregularity	1 second		3.6.10.4			
			CPS Tripping (*or CMS as required if no CPS*)					
	51V	Three Phase IDMT Overcurrent	Pickup= _____ Amps, TMS = _____ , Curve = _____		3.6.10.1(f)			Refer Note 1 & 3
	50	Three Phase Instantaneous / Highset Overcurrent	Pickup= _____ Amps, Definite Time Delay = _____ secs		3.6.10.1(f)			Refer Note 1
	64G	IDMT Earth Fault	Pickup= _____ Amps, TMS = _____ , Curve = _____		3.6.10.1(g)			Refer Note 1 & 3
	32	Real and Reactive Power Export (Max)	_____ kW or _____ kVAr for 1 second		3.6.10.1(h),(i), 3.6.10.3, 3.6.12(b)			Refer Note 4
	32	Real and Reactive Power Import (Min)	_____ kW or _____ kVAr for 1 second		3.6.10.1(h)			
	27	Under Voltage	0.80 per unit for 10 seconds		3.6.10.1(f),Table 3.5			Refer Note 5
	59	Over Voltage	1.10 per unit for 10 seconds		3.6.10.1(f),Table 3.5			Refer Note 6
	81	Under Frequency	<47.5Hz for 10 seconds		3.6.10.1(f),Table 3.5			
	81	Over Frequency	>52.5Hz for 6 seconds		3.6.10.1(f),Table 3.5			

		Reactive Power Perturbation	1%, 0.5 second pulse / second 3%, 0.5 second check pulse					Refer note 7
		Loss of 1 or more phases	TBA		2.9.2(b)(2), 3.6.10.1(h),			
	32R	Reverse Power	TBA		3.6.10.1(h),(i), 3.6.10.3, 3.6.12(b)			
	67	Directional over current	TBA		3.6.10.1 (h),(i), 3.6.12(b)			
		Voltage vector shift	TBA		2.9.2(b)(2),3.6.10.1(h), 3.6.10.3,			
		Neutral voltage displacement	TBA		3.6.10.1(g)			
	51G	Sensitive (Definite Time) Earth Fault	Pickup= _____ Amps, Definite Time Delay = _____ secs		3.6.10.1(g)			
		Transformer Overpressure			3.6.10.4			
		Any GMS fails to open ("local backup")	Fails to open when required by Protective Apparatus, maximum Delay of 0.3 seconds		3.6.10.1(d)			
		Disconnection Timer	Less than1 or 60 seconds per transfer		3.6.2.(d)(4), 3.6.10.1(k),(l)			
		RTU Trip signal						
		Insert additional lines for any other events that cause tripping						Refer Note 8 & 10
		Trip power supply failure or irregularity	1 second					
CPS Prevent Closing (*or GMS if no CPS*)								
	27,59	Under and Over Voltage	Ensure supply is within trip limits for at least 1 minute		3.6.10.1(f)			
		Check Synchronising			3.6.7.3			
		Protection Healthy			3.6.10.1(d)			
		Insert additional lines for any other events preventing closing						Refer Note 9
		RTU Close Enable Signal (Permissive)			3.6.9(a)(2)			Refer to Note 2
GMS Tripping								
	51V	Three Phase IDMT Overcurrent	TBA		3.6.10.1(f)			
	50	Three Phase Instantaneous / Highset Overcurrent	TBA		3.6.10.1(f)			
	64G	Earth Fault	TBA		3.6.10.1(g)			
	32	Reverse Real & Reactive Power	TBA					
		Pole Slip	Trip before second pole slip		3.6.10.2			
		Any CPS (CMS if no CPS) fails to open	Fails to open when required by Protective Apparatus, maximum Delay of 0.3 seconds		3.6.10.1(d)			

		Trip power supply failure or irregularity	1 second		3.6.10.1(j), 3.6.10.4(b)			
		Transformer Overpressure	TBA		3.6.10.4			
		Transformer Overtemperature	TBA		3.6.10.4			
		Insert additional lines for any other events that cause tripping						Refer Note 8 & 10
Islanding protection options (for CPS tripping)								
		Reactive Power Perturbation	1%, 0.5 second pulse / second 3%, 0.5 second check pulse					Refer note 7
		Loss of 1 or more phases	TBA		3.6.10.1(h)			
		Reverse Power	TBA		3.6.10.1(h)			
		Directional over current	TBA		3.6.10.1 (h),(i), 3.6.12(b)			
		Voltage vector shift	TBA		3.6.10.1(h)			
		Neutral voltage displacement	TBA		3.6.10.1(g)			
		Sensitive (Definite Time) Earth Fault	Pickup= _____ Amps, Definite Time Delay = _____ secs		3.6.10.1(g)			
		Negative Phase Sequence	TBA		3.6.10.1(h)			
		LV Standby Earth Fault	_____ Amps for _____ seconds		3.6.10.1(g)			Refer Note 11

NOTES:

1. CMS protection settings to grade with Western Power equipment protection settings with a minimum margin of 0.3 seconds.
2. The CPS shall be prevented from closing unless the RTU Enable Signal is present or the mechanical interlocking is arranged to prevent paralleling of generators.
3. Definition of TMS = (Required time to trip) / (Time to trip with TMS = 1.0)
4. From previous implementation of non-exporting generators, 10kW & 30kVAR for 2 seconds was not sufficient during zone sub cap bank switching due to slow response; the governor/excitation system could not respond in time.
5. Under-voltage set points depend on the Distribution Transformer tap settings in the area of the point-of-connection (typically determined during the system study). Should not fall below the extreme value of 0.940pu.
6. Over-voltage set points depend on the Distribution Transformer tap settings in the area of the point-of-connection (typically determined during the system study). Should not ever exceed extreme value of 1.050pu.
7. In the past, an example value has been: kW: 1%, 0.5 second pulse/second; kVAR: 3%, 0.5 second check pulse
8. List any other protection that trips the circuit breaker in question, eg: Transformer Overpressure, Overtemperature, etc.
9. Other events preventing closing may include interlocking, eg: CMS Open prevent CPS closing.
10. Insert all items that cause tripping, eg: this may include other items no specifically under CMS/CPS/GMS heading such as FSU (Fuse Switch Units)
11. The single line diagram to define where the LV Standby Earth Fault protection is being implemented (where applicable)
12. Protection key diagram to be submitted with the schedule to assist in review.
13. Included for information only to protection coordination

Schedule B: Part 1 – Operating procedures for generators connected to the Western Power distribution system

	Description	Technical Rules clause
B1	**General details**	
B1.1	**Name of Customer or Generator:**	
B1.2	**Facility Name:** **Fax:** **Email:** **Telephone (s) – office hours:** **Address:**	5.10.2 3.6.9(d)
B2	**Contact Personnel**	
B2.1	**Customer's contact:** The customer shall ensure that a responsible person can be contacted by Western Power at all times for the purpose of performing switching operations and adjusting generator performance. The customer's contact is: **Title:** **Phone (daytime): (after hours):** **Mobile:**	5.3.3 5.10.2 5.10.3
B2.2	**Western Power's contact:** The Western Power Network Operations Control Centre (NOCC) is manned at all times. The Western Power contact person is: **Title: Network Controller** **Phone: (08) <dedicated number to be entered – list is maintained internally in DMS#2756426>**	5.3.2 5.10.3 5.10.4
B3	**Customer Operations:**	
B3.1	**Title of customer operating procedure document:**	5.9.1 A12.5
B3.2	**Customer protection apparatus:** Western Power's protection requirements for this facility are specified in the Technical Rules and Schedule A. Upon request the Customer shall demonstrate the accuracy and operation of the facility's protection apparatus	3.6.10 5.5.2
B3.3	**Operating requirements:** The customer shall operate the facility including the generators and protective apparatus in accordance with good electricity industry practice. The following conditions shall be observed for any equipment associated with the facility's electrical system:	5.9
B3.3.1	***Maintenance in good order:*** The customer shall ensure that all equipment in the facility is maintained in good order and that all protective apparatus and control equipment is at all times capable of performing its required function	4.1.4, 5.3.3 5.7.1 5.8
B3.3.2	***Competent Personnel:*** The customer shall ensure that all operating personnel are competent in that they have adequate knowledge and sufficient judgment to take correct action when facing an emergency. All testing and maintenance work is to be carried out by suitably trained and qualified personnel.	5.3.3
B3.3.3	***Approval and Notice for Modifications:*** The customer shall provide Western Power with full details of any intended modifications to the electrical arrangements shown on the simplified Single Line Diagram stated in Schedule A. Modifications shall not be implemented without Western Power approval. Unless otherwise agreed, the notice period for the implementation of modifications shall be as specified in the Technical Rules (currently 65 business days)	4.2.4
B3.3.4	***Service Intervals:*** The customer regularly shall service and test for equipment including protective apparatus (as specified in Schedule A) associated with the electrical path between the facility's generators and the Western Power distribution system. The maximum interval shall be 3 years.	4.1.4 A12.15
B3.3.5	***Testing of customer equipment requiring changes to agreed operation:*** The customer shall provide Western Power with notice in writing (currently 15 business days) of commissioning, calibration and trip tests on any existing or direct replacement equipment associated with the electrical path between the facility's generators and the network. The customer shall permit Western Power representatives to witness any such tests that Western Power deems to be relevant to safe and reliable operation of the distribution system.	4.1.5

B3.3.6	***Records:*** The customer shall maintain logbooks detailing: inspection and operating activities equipment settings and results of commissioning and periodical tests	5.3.3, 5.8, 5.10.4, 5.11
B3.3.7	***Western Power access:*** The customer shall at all times permit and enable representatives of Western Power to access Western Power equipment installed within the facility, subject to adequate prior notice. The customer shall also grant access to Western Power to inspect or test customer facilities in accordance with the Technical Rules. In the case of an emergency condition, prior notice may not be given.	4.1.1, 4.1.2, 4.1.3, A12.16
B3.4	**Procedure for restoration on loss of Western Power supply:** In the event of loss of supply, the following steps shall be taken: 1. Check whether the loss of supply has been caused by a trip on one of the facility's protection devices or if supply from Western Power has been lost. This may be determined by checking if any of the facility's circuit breakers have tripped and then by checking with NOCC if any Western Power protective devices connecting the facility have tripped. 2. If supply from Western Power has been lost then check that the CPS has opened and isolated the facility's generating equipment from the network. While restoration work on the network is being performed by Western Power, the facility generation may be run islanded with the CPS open to supply internal load only. 3. When Western Power has completed restoration work, NOCC will, upon request, send an 'enable' signal to permit re-synchronisation of the facility.	5.3.2, 5.3.3
B4	**Western Power Operations**	5.3.1
B4.1	**General:** General procedures dealing with distribution connected generators are contained in Western Power Network Operating Instruction NWI-82 ***"Private parallel generators- General operating guidelines"***. Specific requirements are detailed in the following sections.	
B4.2	**Feeder connections:** The facility will be normally connected to the AAAAA substation via the BBBBB feeder (DDD###). The facility may only be connected to this BBBBB feeder and the alternative CCCCC feeder (EEE###) from the AAAAA substation. Connection to other feeders can only be considered after further power system studies.	2.5.4.1(b)
B4.3	**Feeder protection:** All feeder circuit breakers and field reclosers are normally fitted with overcurrent and earth fault protection. Feeder switches are **not** normally fitted with protection to prevent unsynchronised automatic or manual switching. The BBBBB feeder has the following features: • The feeder circuit breaker does not have an automatic reclose facility • The feeder circuit breaker does not have a synchronisation or dead line closure check facility. • The feeder contains no field reclosers • SCADA inter trip signal between the BBBBB feeder circuit breaker (DDD###) and the facility. When the BBBBB feeder circuit breaker opens, a 'trip' signal is sent to the facility to isolate the facility's generating equipment from the network via the CPS. There is no automatic acknowledgement signal from the facility to confirm receipt of the command.	

Schedule B: Part 2 – Remote control, monitoring and communications

B5 The SCADA scheme needed for the satisfactory monitoring and control of the facility in accordance with clauses 3.6.9 and 3.6.10.3 of the Technical Rules is given in the following table:

Generator SCADA I/O **Description**	**Facility Equipment**	**Facility RTU**		**NOCC**
From Power Station				**To NOCC**
Voltage on Western Power side of CPS	Field transducer	Analog Input		Voltage Measurement
MW/MVAr Import/Export at the CPS	Field transducer	Analog Input		Signed MW/MVAr Measurement
CPS open/closed	Field contact	Digital Input		CPS CB Status
CMS open/closed	Field contact	Digital Input		CMS CB Status
GMS open/closed	Field contact	Digital Input		GMS CB Status
50V battery charger fail	Field contact	Digital Input		Alarm
CMS/GMS/CPS Protection Alarm	Field contact	Digital Input		Alarm
To Power Station				**From NOCC**
'Close Enable' - paralleling latch (Notes 2,4)	Enable latched interpose relay	Digital Output		Operator Action
'Trip' - isolate the facility's Customer Main Switch or generation equipment Notes 3,4,5)	Trip interpose relay	Digital Output		Operator or Automatic Action

NOTES:

1. All signals between the Facility and the Network Operations Control Centre (NOCC) will be direct to NOCC, or, via the Substation normally connecting the Facility where deemed necessary for feeder inter-tripping.
2. The 'Close Enable' signals shall be issued by Western Power and incorporated in the Facility to operate as follows:

   'Close Enable' will allow the paralleling switches to be closed, therefore connecting the Facility's generation equipment to the Network. The NOCC operator issues a 'Close Enable' command via the SCADA with a resultant relay contact closure at the Facility RTU. Once the 'Close Enable' command is issued, the 'Close Enable' contacts will be held closed by the RTU for a period of "x" mins or until a 'Trip' signal is received.
3. The 'Trip' signals shall be issued by NOCC and incorporated in the Facility to operate as follows:

   'Trip' shall isolate the Facility's generation equipment from the Network via the CPS. The Facility RTU issues a 'Trip' signal with a contact opening.

   Whenever practicable, Western Power will warn the Customer of an impending NOCC 'Trip' signal. 'Trip' signals will generally only be issued for an emergency or routine maintenance on the Network. (Also see Note 5)
4. The 'Trip' and 'Close Enable' signals shall be 'Fail Safe', i.e. a trip signal be sent on fail of DC supply and the 'Close Enable' signal be unlatched if it is latched.
5. Where a feeder inter-trip from the Substation is deemed necessary by Western Power the following additional events will result in a 'Trip' signal being automatically sent by Wester Power:
   a) Automatic switching operations on the network such as feeder circuit breakers opening;
   b) Facility RTU communications failure (>7secs) to the Substation;
6. Facility CPS Voltage and MW/MVAR transducer metering inputs to the Facility RTU are typically 0-10mA and -5 to +5mA respectively. Alternative input options may be considered by WP if compatible with the WP Facility SCADA RTU.
7. Facility digital inputs to Facility RTU are to be voltage free (RTU supplies 50V DC, 20mA wetting)
8. Facility RTU digital outputs will be voltage free and rated 50V DC @ 1Amp.

<table>
<tr><td>B6</td><td>Customer responsibilities

The Customer shall have available at all times a sole-purpose telephone link to enable voice communications between the facility and NOCC.

The Customer shall be responsible for the following components of the SCADA scheme:
• Provision and maintenance of a continuous communications link between the facility and NOCC or AAAAA substation for the monitoring and control of generating units.
• Provision and maintenance of the input signals to and output commands from Western Power’s SCADA Remote Terminal Unit (RTU) at the Facility. The output commands shall be incorporated into a Fail Safe electrical interlocking scheme.
• Provision and maintenance of a suitable environment for the satisfactory operation and maintenance of the RTU.</td><td>3.6.9
5.10.1
5.10.2</td></tr>
<tr><td>B7</td><td>Western Power responsibilities

Western Power shall be responsible for provision and maintenance of a back-up voice communication channel.

Western Power shall be responsible for the following components of the SCADA scheme:
• Provision and maintenance of a SCADA RTU at the Facility
• Provision and maintenance of all SCADA equipment between NOCC and the Western Power AAAAA substation</td><td></td></tr>
<tr><td>B8</td><td>Metering signals

The customer shall provide for remote monitoring at NOCC of (signed) MW, MVAR and voltage</td><td>3.6.9</td></tr>
<tr><td>B9</td><td>Acceptance

The undersigned accept the above operating procedures for the facility.

---------- ----------
(Western Power Network Operations Engineer) (Customer)

Date: Date:</td><td></td></tr>
</table>

Schedule C: Part 1 – C**ommissioning**

Certification & Approval for Commissioning of a Facility with Embedded Generating Units to be connected to the Western Power Distribution System

Name of Customer or Generator:
Authorised Representative:
Facility Name & Address:

CERTIFICATION

I,
(name of chartered professional engineer with NPER standing)

certify that the facility complies with the Technical Rules, the relevant connection agreement, good engineering practice and relevant standards and are ready for operation. In particular that the following have been verified:

1. The single line diagram approved by the Network Service Provider has been checked and accurately reflects the installed electrical system;
2. All required switches present and operate correctly as per the single line diagram;
3. The specified generation facility is the only source of power that can be operated in parallel with the distribution network;
4. The earthing systems complies with Australian Standards AS3000 and AS2067 and do not rely upon the Network Service Provider's earthing system;
5. Electrical equipment is adequately rated to withstand specified network fault levels;
6. All protection apparatus (that serves a network protection function, including backup function) complies with IEC 60255 and has been correctly installed and tested.
7. Interlocking systems specified in the connection agreement have been correctly installed and tested;
8. The islanding protection operates correctly and disconnects the power station from the network within 2 seconds;
9. Synchronising and auto-changeover equipment has been correctly installed and tested;
10. The delay in reconnection following restoration of normal supply is greater than 1 minute;
11. The protection settings specified in the connection agreement have been approved by the Network Service Provider and are such that satisfactory coordination is achieved with the Network Service Provider's protection systems;
12. Provision has been made to minimise the risk of injury to personnel or damage to equipment that may be caused by an out-of-synchronism fault;
13. Control systems have been implemented to maintain voltage, active power flow and reactive power flow requirements for the connection point as specified in the connection agreement;
14. The facility complies with the quality of supply requirements specified in the Technical Rules
15. Systems or procedures are in place such that the testing, commissioning, and operation requirements specified in the Technical Rules and the connection agreement are adhered to; and
16. Operational settings are as specified.

Notes: _____

Signature: ..... Date: ……..
(Signature of Registered Professional Engineer)

APPROVAL

Approval is hereby given for the above facility to be connected to the Western Power Network for the period from…….to…….for the purpose of testing and commissioning.

Notes: _____

Signature: ..... Date: ……
(Signature of Western Power Operations Engineer)

Schedule C: Part 2 – Approval to operate

Certification & Approval for Commissioning of a Facility with Embedded Generating Units to be connected to the Western Power Distribution System

Name of Customer or Generator:
Authorised Representative:
Facility Name & Address:

CERTIFICATION

I,
(name of chartered professional engineer with NPER standing)

certify that the facility complies with the Technical Rules, the relevant connection agreement, good engineering practice and relevant standards. In particular that the following have been verified:

1. The single line diagram approved by the Network Service Provider has been checked and accurately reflects the installed electrical system;
2. All required switches present and operate correctly as per the single line diagram;
3. The specified generation facility is the only source of power that can be operated in parallel with the distribution network;
4. The earthing systems complies with Australian Standards AS3000 and AS2067 and do not rely upon the Network Service Provider's earthing system;
5. The facility's electrical equipment is adequately rated to withstand specified network fault levels as defined in the Technical Rules;
6. All protection apparatus (that serves a network protection function, including backup function) complies with IEC 60255 and has been correctly installed and tested.
7. Interlocking systems specified in the connection agreement have been correctly installed and tested;
8. The islanding protection operates correctly and disconnects the power station from the network within 2 seconds;
9. Synchronising and auto-changeover equipment has been correctly installed and tested;
10. The delay in reconnection following restoration of normal supply is greater than 1 minute;
11. The protection settings specified in the connection agreement have been approved by the Network Service Provider and are such that satisfactory coordination is achieved with the Network Service Provider's protection systems;
12. Provision has been made to minimise the risk of injury to personnel or damage to equipment that may be caused by an out-of-synchronism fault;
13. Control systems have been implemented to maintain voltage, active power flow and reactive power flow requirements for the connection point as specified in the connection agreement;
14. The facility complies with the quality of supply requirements specified in the Technical Rules
15. Systems or procedures are in place such that the testing, commissioning, and operation requirements specified in the Technical Rules and the connection agreement are adhered to; and
16. Operational settings are as specified.

Notes: _____

Signature: .....Date: ……..
(Signature of Registered Professional Engineer)

APPROVAL

Approval is hereby given for the above facility to be connected to the Western Power Network for the agreed mode of operation until further notice

Notes: _____

Signature: ..... Date: .....
(Signature of Western Power Operations Engineer)

Glossary

User, Customer and Generator have the meanings defined in the Technical Rules. However most facilities covered by this document both consume and generate power, so for simplicity the term Customer has been used to cover the User, Customer and Generator roles unless otherwise indicated.

CB (Circuit Breaker): Circuit breaker, a switching device capable of breaking load and fault current.

CMS (Customer Main Switch): Circuit breaker that serves to connect the facility to the network.

CPS (Customer Paralleling Switch): Circuit breaker between CMSs and GMSs used for synchronised switching.

GMS (Generator Main Switch): Circuit breaker that connects a facility's generator to the Network via CMSs and CPSs.

NOCC (Network Operation Control Centre): Control centre for the Western Power's distribution system.

RTU (Remote Terminal Unit): A communication unit located at the remote end of a communication channel.