
Embedded Generator 30kW to 200 kW: Central Protection Commissioning Test Report

Standard Operating Procedures

Document number	SOP 33-07
Issue number	1
Status	Approved
Approver	P Grove
Date of approval	12/6/2015

Embedded Generator 30kW to 200 kW: Central Protection Commissioning Test Report

ISSUE/AMENDMENT STATUS

Issue Number	Date	Description	Author	Approved by
1	12/6/2015	Embedded Generator 30kW to 200 kW: Central Protection Commissioning Test Report	H Al-Khalidi	P Grove

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1 Introduction

The procedure outlined in this report, describes the on-site Commissioning tests reports required to be provided by the Installer of Embedded Generator systems 30 kW to <200 kW which require Central Protection.

The tests and certification are the minimum requirement. Additional test to confirm the initial performance of an Embedded Generator may be required by the installer or by AusNet Services.

As the Installation of an Embedded Generator is prescribed in accordance with the Electrical Safety Installations) Regulations Clause 238 (1) (f), a Certificate of Electrical Service will always need to be provided.

The approved installer is required to submit the proposed Commissioning test plan. Relevant test results are to be provided in the following format.

If the Commissioning tests require that the system is energised AusNet Services provides consent for the installer to undertake Commissioning tests subject to compliance with Clause 6.9.2.6 of the Victorian Service and Installation Rules and when appropriate as advised by AusNet Services with the AusNet Services Operations Control Room.

2 Relay Test Report

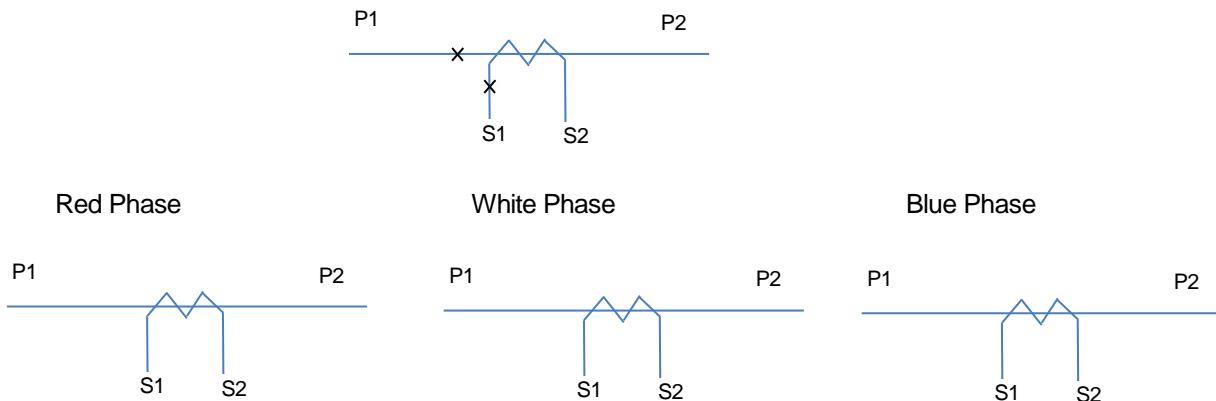
The following information is required for each Relay followed by the appropriate test report for each element required; a single line diagram with ANSI elements labelled is required in the Test Report.

Information	Details
Project No	
Customer:	
Location:	
Relay Make:	
Model (if Applicable)	
Serial Number:	
Date:	

1.1 Generic Test Results

2.1.1 CT Polarity Test

The following indication of correct polarity shall be provided for each phase.



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2.1.2 Central Protection Anti-Islanding Functionality test record

The test should be undertaken by opening the site main switch so that generation and the site load is interrupted.

Inverter No 1 Anti –Islanding operation		
Test 1: Disconnection time must be < 2 seconds to pass	MeasurementSec	Result Pass / Fail (circle one)
Test 2: Reconnection Time Must be >60 seconds to pass	MeasurementSec	Result Pass / Fail (circle one)

2.1 Relay Elements Test Report

2.1.3 Test Plan: Limited Export Central protection

Refer to SOP 33-06 for Commissioning requirements.

2.1.4 Test Plan: Overvoltage Central Protection

Test	Expected	Actual	Comments	Result Pass/Fail
R.Ph.Overvoltage Time Stage 1	2 Sec			
R.Ph.Overvoltage Pickup Stage 1	260 V			
W.Ph.Overvoltage Time Stage 1	2 Sec			
W.Ph.Overvoltage Pickup Stage 1	260 V			
B.Ph.Overvoltage Time Stage 1	2 Sec			
B.Ph.Overvoltage Pickup Stage 1	260 V			

2.1.5 Test Plan: Undervoltage Central Protection

Test	Expected	Actual	Comments	Result Pass/Fail
R.Ph. Undervoltage Time Stage 1	2 Sec			
R.Ph. Undervoltage Pickup Stage 1	180 V			
W.Ph. Undervoltage Time Stage 1	2 Sec			
W.Ph. Undervoltage Pickup Stage 1	180 V			

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B.Ph. Undervoltage Time Stage 1	2 Sec			
B.Ph. Undervoltage Pickup Stage 1	180 V			

2.1.6 Test Plan: Overfrequency Central Protection

Test	Expected	Actual	Comments	Result Pass/Fail
3.Ph. Overfrequency Pickup	52 Hz			
3.Ph. Overfrequency	2 Sec			

2.1.7 Test Plan: Underfrequency Central Protection

Test	Expected	Actual	Comments	Result Pass/Fail
3.Ph. Underfrequency Pickup	47.5 Hz			
3.Ph. Underfrequency Time	2 Sec			

2.1.8 Test Plan Phase Balance Central Protection

If required, unbalance between any two phases e.g. Required for micro inverter systems and single phase inverter systems.

Test	Expected	Actual	Comments	Result Pass/Fail
R phase Pick up	20 amps			
R Phase Time	2 sec			
W phase Pick up	20 amps			
W Phase Time	2 sec			
B phase Pick up	20 amps			
B Phase Time	2 sec			

No Volts disconnect all phases

R Phase Time	2 sec			
W Phase Time	2 sec			
B Phase Time	2 sec			

2.1.9 Test Plan: Vector Shift Central Protection

Test	Expected	Actual	Comments	Result Pass/Fail
Leading Angle Vector Shift time	1 Sec			
Leading Angle Vector Shift setting	8 Deg			

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Lagging Angle Vector Shift time	1 Sec			
Lagging Angle Vector Shift setting	8 Deg			
60 Sec Reconnection delay once nominal source voltage established				

2.1.10 Test Plan: ROCOF Central Protection

Ramp in range 49.5-50.5Hz

Test	Expected	Actual	Comments	Result Pass/Fail
Increasing Frequency RoCoF Time	1 Sec			
Increasing Frequency RoCoF Setting	2 hz/sec			
Decreasing Frequency RoCoF Time	1 Sec			
Decreasing Frequency RoCoF Setting	2 Hz/sec			
60 Sec Reconnection delay once nominal; source voltage established				
Increasing Frequency inside normal band	No Trip			
Decreasing Frequency inside normal band	No Trip			

2.1.11 Test Plan Declaration

Tested By

Name	
Signature	
Date	

Witnessed By (If Applicable)

Name	
Signature	

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2.1.12 Referenced Standard

Information	Detail
Test Instrument Manufacturer	
Test Instrument model	
Serial number	
Last Calibration date	
Next Calibration date	

Comments

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3 Anti-Island Inverter Functionality Test Report

ANTI-ISLANDING FUNCTIONALITY TEST RECORDS

Each test should be undertaken by opening the site main switch on each occasion in accordance with this form. To be undertaken for each inverter and also for the total installation.

Inverter No 1 Anti –Islanding operation	Inverter Make	Inverter Model
Test 1: Time for inverter to disconnect Must be < 2 seconds to pass	Measurement Sec	Result Pass / Fail (circle one)
Test 2: Reconnection Time for inverter to reconnect. Must be >60 seconds to pass	Measurement Sec	Result Pass / Fail (circle one)

Inverter No 2 Anti –Islanding operation	Inverter Make	Inverter Model
Test 1: Time for inverter to disconnect Must be < 2 seconds to pass	Measurement Sec	Result Pass / Fail (circle one)
Test 2: Reconnection Time for inverter to reconnect Must be >60 seconds to pass	Measurement Sec	Result Pass / Fail (circle one)

Inverter No 3 Anti –Islanding operation	Inverter Make	Inverter Model
Test 1: Time for inverter to disconnect Must be < 2 seconds to pass	Measurement Sec	Result Pass / Fail (circle one)
Test 2: Reconnection Time for inverter to reconnect Must be >60 seconds to pass	Measurement Sec	Result Pass / Fail (circle one)

Inverter No 4 Anti –Islanding operation	Inverter Make	Inverter Model
Test 1: Time for inverter to disconnect Must be < 2 seconds to pass	Measurement Sec	Result Pass / Fail (circle one)
Test 2: Reconnection Time for inverter to reconnect Must be >60 seconds to pass	Measurement Sec	Result Pass / Fail (circle one)

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Inverter No 5 Anti –Islanding operation	Inverter Make	Inverter Model
Test 1: Time for inverter to disconnect Must be < 2 seconds to pass	Measurement Sec	Result Pass / Fail (circle one)
Test 2: Reconnection Time for inverter to reconnect Must be >60 seconds to pass	Measurement Sec	Result Pass / Fail (circle one)

Total Installation Anti –Islanding operation		
Test 1: Time for inverter/s to disconnect Must be < 2 seconds to pass	Measurement Sec	Result Pass / Fail (circle one)
Test 2: Reconnection Time for inverter/s to reconnect Must be >60 seconds to pass	Measurement Sec	Result Pass / Fail (circle one)

By signing this form, you acknowledge and represent that:

- the Inverter Energy System complies with the *Electricity Safety Act 1998 (Vic)* and associated Safety Regulations, the Electricity Distribution Code, the Victorian Service & Installation Rules, AS/NZS3000 (Wiring Rules) and AS4777 (Grid Connection of Energy Systems via Inverters), and any other relevant Acts, regulations, standards or guidelines;
- the Inverter Energy System is connected to a dedicated circuit complete with lockable isolating switch at the switchboard;
- the main switchboard, isolating fuse/switch/circuit breaker are labelled correctly;
- commissioning tests as specified in the Service & Installation Rules have been completed and passed.
- alternative supply signage has been installed;
- a Prescribed Certificate of Electrical Safety (CES) has been obtained; with
- copies of the Electrical Works Request and CES to be sent to the Inverter Energy System owner's Retailer and a copy of [this form](#) is to be sent directly to AusNet Services ; and
- the Inverter Energy System owner has been advised that the Inverter Energy System should remain switched off until any metering upgrades are complete to avoid potential metering and billing issues. Once the metering upgrades have been completed, it is the IES owner's responsibility to turn their Inverter energy system on.

TEST UNDERTAKEN BY

Licensed Electrical Installation Worker Name: _____

Licence No*. _____ Date: _____

Signature: _____

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Inverter Test Procedure

Process for functionality testing of Inverter Energy Systems

This document outlines a simple testing process to confirm the operation of the AC solar main switch and testing of the Anti-Islanding protection of the installation as per AS/NZS 4777.

Test Methodology

Carrying out this test involves dealing with live 230 volt terminals and must only be carried out by a licensed electrician.

The test must be conducted at a time of day when the prevailing weather conditions allow the PV system to be producing at least a minimum power output. This output from the inverter must be greater than 20% of the rated output of the PV array or the inverter (whichever is less). Note the site connected load should be selected to match. As close as practicable the power output of the inverter being tested.

Test 1: inverter must cease supplying power within two seconds of a loss of mains

The time taken for the inverter to cease supplying power is to be measured with a timing device and recorded. A voltage probe placed on the installation side of the main solar switch is to be used to determine when the inverter has ceased attempting to export power.

The DC supply from the solar array is to remain connected to the inverter for the duration of the test the inverter must cease supplying power within two seconds of loss of mains.

Test 2: Inverter must not resume supplying power until mains has been present for more than sixty seconds

The time taken for the inverter to resume power supply after installation has been re-energized is to be measured and recorded. A Voltage Amp Meter is to be placed on the installation side of the main solar switch to determine when the inverter recommences exporting power.

The DC supply from the solar array is to remain connected to the inverter for the duration of the test, the inverter must not resume supplying power until mains has been present for more than 60 seconds.