

**13.3 Appendix A13.3 - Generating Plant Installation and Commissioning Tests (2) Non type approved generating plant and generating plant >50kW 3 phase or 17kW 1 phase.**

This appendix describes the commissioning tests to be carried out on **Generating Plant >50kW** and non type approved **Generating Plant**. It describes the background as to the requirement for the test. The pro-forma test record should be completed by the Installer. In addition to the tests indicated in this appendix, there may be additional tests required for **Medium Power Stations** and **Large Power Stations** in order to demonstrate compliance with the **Grid Code**.

**1. Objectives**

The objectives of the appendix are to:

- 1.1 Establish that the scheme has been installed in accordance with the agreed design with respect to:
  - (a) Earthing
  - (b) Synchronising
  - (c) Voltage control (where applicable)
  - (d) Frequency control (where applicable)
  - (e) **Interface Protection**
  - (f) Control procedures
  - (g) Interlocks
  - (h) Notices and Labelling
- 1.2 Ensure that the various items of protection and control are correctly installed, commissioned and the agreed settings applied and recorded.
- 1.3 Ensure that metering CTs and VTs are of a type and class compliant with the appropriate Metering Code of Practice
- 1.4 Ensure that the overvoltage tests are satisfactory (**HV** Installations)
- 1.5 Ensure that all operational aspects have been implemented and that an agreed operating procedure is established in accordance with **DNO** practice

## 2. Responsibilities

### 2.1 Host **DNO**

- 2.1.1 To establish that the scheme has been installed in accordance with the agreed design
- 2.1.2 To commission those items of protection associated with the **DNO** plant and apply appropriate settings.
- 2.1.3 To receive confirmation and certify that the various items of protection and control associated with the **Generating Plant** are correctly installed, commissioned and the agreed settings applied and recorded (See Section 2.2)
- 2.1.4 Where appropriate confirm that the metering CTs and VTs are of a type and class compliant with the appropriate Metering Code of Practice.
- 2.1.5 Ensure that the overvoltage tests on the **Customer's** plant and where appropriate on the **DNO** plant are satisfactory.
- 2.1.6 Ensure that all operational aspects have been implemented and that an agreed operating procedure is established.

### 2.2 **Generator**

- 2.2.1 To commission the various items of protection, control, synchronising, and interlocks associated with his **Generating Plant**, carry out overvoltage testing (**HV** Installations) and submit the results of the commissioning and overvoltage tests to the **DNO** commissioning engineer for comment.
- 2.2.2 To determine, apply, and record protection and control settings. The protection and control settings are to be agreed by the **DNO** commissioning engineer.

**3 GENERATING PLANT TEST RECORD<sup>1</sup>**

**Reference Number.....**

<b>1 OWNERS/COMPANY DETAILS</b>	
Name and Address	
Telephone Number(s)	
<b>2 GENERATING PLANT DETAILS</b>	
Location of <b>Generating Plant</b>	
Type of each <b>Generating Unit</b> (e.g. synchronous, asynchronous, fixed speed induction generator, doubly fed induction generator, inverter series converter connected, other)	
<b>Manufacturer</b>	
Rated: Voltage	
Frequency	
Capacity (kVA)	
Current	
Power Factor	
<b>3 SUPPLY FROM DNO</b>	
Voltage (kV)	
Service Details	
Capacity (kVA)	
Max Fault level (MVA)	

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<sup>1</sup> Where possible details such as manufacturer and types of equipment should be completed prior to the witnessing of the tests.

<b>Point of Common Coupling</b>	
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Under Voltage Stage 2			Volts %	Sec	Volts %	Sec	Volts %	Sec	Volts %	Sec		
L1-N or L1-L2												
L2-N or L2-L3												
L3-N or L1-L3												
Over Frequency Stage 1			Hz	Sec	Hz	Sec	Hz	Sec	Hz	Sec		
Over Frequency Stage 2			Hz	Sec	Hz	Sec	Hz	Sec	Hz	Sec		
Under Frequency Stage 1			Hz	Sec	Hz	Sec	Hz	Sec	Hz	Sec		
Under Frequency Stage 2			Hz	Sec	Hz	Sec	Hz	Sec	Hz	Sec		
Neutral Voltage Displacement			Volts	Sec	Volts	Sec	Volts	Sec	Volts	Sec		
Reverse Power			W	Sec	W	Sec	W	Sec	W	Sec		
Directional O/C, E/F			A	Sec	A	Sec	A	Sec	A	Sec		
RoCoF			df/dt	Sec	df/dt	Sec	df/dt	Sec	df/dt	Sec		

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Reactive Export Error Detection			VAr	Sec	VAr	Sec	VAr	Sec	VAr	Sec		
Loss of Phase Protection				Sec		Sec		Sec		Sec		
Change of Power Factor			pf	Sec	pf	Sec	pf	Sec	pf	Sec		
Change of Voltage Vector			Degrees	Sec	Degrees	Sec	Degrees	Sec	Degrees	Sec		
Voltage Controlled O/C			V and A and s	Sec	V and A and s	Sec	V and A and s	Sec	V and A and s	Sec		
Other relevant Protection at the Site of the Generating Plant												
Other relevant Protection remote from the Site of the Generating Plant												

Note 1 - This form provides for up to three tests on the same relay to be recorded

## 5 INSTALLATION INSPECTION

### 5.1 HV Installations checklist

- 5.1.1 Design and installation of the system neutral earthing satisfactory at all voltage levels
- 5.1.2 Design and installation of the synchronising and interlocking arrangements satisfactory
- 5.1.3 Over voltage tests on customer's plant complete

### 5.2 LV Installations checklist

- 5.2.1 Earthing of all equipment satisfactory
- 5.2.2 **Customers** main switch or **Generator** switch lockable in the OFF position
- 5.2.3 Warning labels fitted at mains position
- 5.2.4 Installation inspection tests carried out

## 6 SYNCHRONISING AND INTERLOCKS

- 6.1 Synchronising
- 6.2 Interlocks
- 6.3 Operation of Neutral Earth Switches
- 6.4 Intertripping
- 6.5 Diagram Numbers
- 6.6 **HV and LV Switches:**

All switching points on the **Customer's** network where supplies from the **Customer's** generation and the **Distribution System** can be paralleled must be fitted with synchronising equipment or interlocked to prevent parallel operation between out of phase supplies. The location of synchronising equipment and interlocks should be listed and proven.

- 6.7 Neutral Earthing Switches:

All parts on the **Customer's** network must have a system earth, but it may not be desirable to have a multi earthed system when running **Generating Plant** and mains in parallel. In order to satisfy these conditions electrical or mechanical interlocks may be fitted to switches in the system neutral and/or neutral earthing



connections. List the location of neutral and neutral earthing switches and check their automatic operation or the operation of interlocks.

## 7 METERING

- 7.1 Where appropriate confirm that the metering CTs and VTs are of a type and class compliant with the appropriate Metering Code of Practice.

## 8 ON LOAD TESTS (Generating Unit on load)

- 8.1 Synchronising.
- 8.2 Check that the voltage fluctuation during synchronisation does not exceed 3% of normal voltage.
- 8.3 **Generating Unit(s)** operate within agreed power factor limits.
- 8.2 Final Trip Tests
- 8.2.1 If the operation is designed to shut down a **Generating Unit** prime mover in addition to tripping the circuit breaker, a final trip test should be carried out with the machine running.

### 8.2.2 Loss of Mains

Remove one phase and prove that the machine will shut down and cannot be restarted. Reconnect and repeat for all phases (LV only)

Where this test is impractical, it may be replaced by an injection test to prove the operation of current unbalance protection provided, that such protection is installed and is set at an appropriately sensitive level. (For example, according to BS EN 60034-1, this should be <8%, 20s for a salient pole generator)

Disconnection of a voltage sensing feed from a voltage monitoring relay does not accurately replicate the conditions arising from the loss of an incoming phase and should not be relied upon as an alternative to the two methods described above.

### 8.2.3 Loss of Control Supply

Remove DC control supply and prove that the machine will shut down and cannot be restarted.

NB. In addition to protection tests it may be necessary to carry out other tests described in Section 10.2.

**9 PROTECTION AND CONTROL**

- 9.1 Where a combined protection and control system is used (see 10.2.6) demonstrate that an equipment failure affecting both the protection and control functionality results in the plant shutting down in a controlled and safe manner.

**10 CERTIFICATION**

On behalf of the **Generator** I certify that the **Generating Plant** equipment specified in Section 2 has been installed and tested and complies with the requirements of Engineering Recommendation G59/2.

Signed.....

Date.....

On behalf of the **DNO**, I confirm that I have witnessed the tests in Section 4 and it has been demonstrated that items in Section 5 – 9 are correct.

Signed.....

Date.....

**Notes**

- a) The tests are to safeguard the **DNO Distribution System**. They do not certify that the whole installation has been tested, or meets the requirements of the BS 7671 Wiring Regulations, or any statutory requirements.
- b) The over voltage and under voltage protection should be tested using an external variable voltage supply.
- c) Where the frequency of the **Generating Plant** is dependent on the mains frequency an external variable frequency audio signal **Generator**, with suitable voltage and current output, should be used for the under and over frequency protection tests.