



Testing and Commissioning
Generator Set

ISSUE - 1
DATE 23/03/2021

Location	External Test Generator Area
Project Manager	S. Porter
Commissioning Engineer	Matt Wyatt
Supervisor	Matt Wyatt
No of Operatives	2-4
Duration	1 Day
Start Date	TBC
Date Issued	23/03/21
Revision	00

1. Scope of Works,
2. System Operation
3. Safety Policy
4. Objectives
5. Preparation of Genset for Test
6. Conduct of the Witness Test
7. Load test for the generator

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Emergency telephone numbers

Mr. Jason Buckwell BPS Commissioning Engineer
Tel: 0203 259 0100
Mobile 07702 743 296

References

Safe working procedures COSHH and Risk Assessments available through BPS Construction or Project Manager

Program

When: TBC, @09:00-16:30 (GMT) Greenwich Mean Time

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1 Scope of Works

This procedure applies to the processes involved in presenting the generator supplied by Bells Control Equipment LTD generator equipment below for Witness Test. The scope of the Witness Test will be: testing of auxiliary equipment, impact load steps, testing of shutdowns, alarms and control functionality, duration load run and additional tests as agreed between the customer and Bells Power Solutions.

Customer Order details

FG Wilson Model	P550-3	
Engine Model	2506A-E15TAG2	Alternator Model FGL 60020
Engine Serial Number	MGBF8014214323F	Alternator Serial Number 37937300001
Genset Serial Number (17 PIN)	FGWPE27CPCA02578	

The generator rating is as follows

Load kVA 500		Volts / V	400	Phase	3
Load kW 400		Full load current / 722A		Connection / Wires	4
10% Overload	✓	Frequency / Hz	50	Winding	STAR
Rated Power factor	0.8	Speed / RPM	1500	Ambient Temp. / °C	27
Test Power factor	0.8	(Default condition 1.0)		Altitude/ m. ASL	####

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2. System Operation

The procedure involves the testing of the standby rated diesel generator for the project – Ashley Road

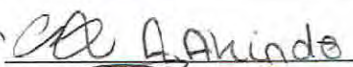
3. Safety Policy

The safety policy to be observed during testing is as stated below.

1. Current company safety regulations are to be observed at all times.
2. BPS operates a NO smoking policy at all times.
3. All attendees must comply with BPS health and safety procedures when entering the test area.
4. All personnel must wear the Personal Protective Equipment appropriate for the area.
5. Attendees are permitted in the test area only with the permission of the Test Operator conducting the Witness Test. The Test Operator or the Project Manager must accompany the attendees in the test area at all times.
6. Only BPS test personnel are permitted to conduct test operations.
7. Attendees must heed all instructions from the Test Operator. The Test Operator and / or Project Manager may suspend the Witness Test at any time if there is a breach in Health & Safety policy.
8. All personnel should exercise general safety awareness for moving parts (guarded & unguarded), for live unprotected areas, for hot surfaces and for the safety of others.
9. The Test Operator is responsible for reporting any incidents which breach current Health & Safety policy. The breaches must be reported as Dangerous Occurrences or Incidents on the Company's Health & Safety intranet site.

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I have read and understood my responsibilities with regards to the Test Safety policy and agree to co-operate accordingly:

	Name	Company	Position	Date
Signed	<u> M. WYATT</u>	<u>BELLS</u>	<u>ENGINEER</u>	<u>4-6-21</u>
Signed	<u> A. MAHENDRAN</u>	<u>FWEL</u>	<u>PROJECT ENGINEER</u>	<u>4/6/21</u>
Signed	<u> A. AKANDE</u>	<u>Gallipord Ty</u>	<u>Grad Site Manager</u>	<u>04/06/2021</u>
Signed	<u>PK  P. KENSI</u>	<u>PR NELSON'S</u>	<u>PROJECT MANAGER</u>	<u>04/06/21</u>

All Attendees must sign the above before the start of the Test schedule

<u> SL</u>	<u>BELLS</u>	<u>PM</u>	<u>04/06/21</u>
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3.1 Constraints

The following shall be observed:

- 1). No work shall commence without prior authority from the client and all relevant permits to work systems in place shall be adhered to.
- 2). All electrical isolations and proving dead shall be carried out by the client or authorised person and witnessed by the contractor prior to carrying out works.
- 3). Site specific safety codes shall be followed at the advice of the client or authorised person.

To ensure safe operation of the security systems the following shall be implemented during testing:

The nature and condition of all supplies shall be verified as correct prior to supporting any site equipment.

Site equipment shall not be supplied by the new plant until all off-load tests are completed to the satisfaction of the client.

If site equipment loads are to be supported by UPS battery only, the test shall be aborted or mains restored if the autonomy of the batteries reduces below 20%.

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4 Objectives

This commissioning document is broken down into the following sections:

TEST	Description	Objective
1	Pre-delivery inspection and testing	To ensure that all equipment operates and functions satisfactorily prior to final delivery to site.
2	Pre-commissioning testing	To ensure that all protection functions and switches operate correctly.
3	Standby supply testing	To ensure that the standby supply is connected and configured correctly at each point of isolation and switch device
4	Automatic operation	To ensure that the automatic sensing and switching between utility and standby supplies operate correctly

4.1 Prerequisites

The following shall be completed prior to the commencement of testing:

- 1). Verify all circuits and devices are correct and as per drawing.
- 2). Verify all switches are set correctly and in the open position.
- 3). All packaging and transport equipment removed.
- 4). Diesel generator fuel level checked.
- 5). Diesel generator starting battery charged.
- 6). All commissioning personnel shall be trained and qualified.
- 7). Scheme wired as shown on approved drawings.

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4.2 Commissioning Personnel

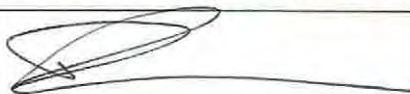
- Commissioning Manager
- Electrical Engineer
- AP (E)
- Mechanical Engineer
- Client Witnessing authority
- Commissioning Engineers – Generator (BPS)

4.3 References

Reference is made to the following in the commissioning stages:

<u>Ref</u>	<u>Description</u>
1	F G WILSON Generator start up document
2	F G WILSON Generator panel set-up and commissioning instructions

4.4 Prerequisites Complete

Electrical Engineer Mandatory Sign Point		
Name:	Signature:	Date:
Commissioning Authority Mandatory Sign Point		
Client Mandatory Sign Point		
PAUL KENT		04/06/2021

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5.0 Preparation of Genset for Test

1. The generator to be presented for test will be prepared according to the test instructions relevant to that generator model. These detailed test instructions are available if requested at the time of approval.
2. The Project Manager will submit this document to client in advance of the Witness Test date to define the scope of the test.
3. The generator will undergo thorough preparation for the test. This will take the form of a complete run through this test instruction on a working day prior to Witness Test date to ensure all tests can be completed on the test date.

5.1 Schedule of Testing

The Schedule of testing is as follows:

- 5.1.1 Insure correct PPE and check for suitability.
- 5.1.2 Introductions by the Test Operator
- 5.1.3 Safety Induction
- 5.1.4 Outline of schedule for the test.
- 5.1.5 Pre-Witness test documentation review

5.2 Arrival in the test area

- 5.2.1 Test Operator re-iterates safety requirements including PPE.
- 5.2.2 Attendees complete visual inspection of generator and associated equipment to be tested.
- 5.2.3 Demonstration of all features that do not require the generator to be started

5.3 Initial testing that requires the generator to be running

- 5.3.1 Proving load steps are achieved.
- 5.3.2 Test Operator proving shutdowns / alarms / functionality of generator and its control system.
- 5.3.3 The Commissioning manager is responsible for ensuring the completion of documentation with respect to pass / fail criteria.

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5.4 PRE-START CHECKS

5.4.1.	Individually check that all power connections have a good mechanical connection and all cables are of adequate size for given purpose.	Y / N
5.4.2.	Check that the system is adequately earthed.	Y / N
5.4.3.	Identify the start/stop linkage on the set and ensure its freedom in operation.	Y / N
5.4.4.	Identify the correct method of stopping the Genset in case of an emergency and ensure it is operating correctly.	Y / N
5.4.5.	Bleed fuel system according to manufacturer's manual.	Y / N
5.4.6	Check oil and coolant levels and top up where necessary.	Y / N
5.4.7.	Complete a visual check of genset	Y / N
5.4.8	Check proximity of loom relative to any moving part, hot surfaces, especially exhaust	Y / N
5.4.9.	Check for any leaks in fuel, oil and coolant systems.	Y / N
5.4.10	Check alternator air inlet/outlet for any blockages.	Y / N
5.4.11	Check for any slack nuts and bolts	Y / N
5.4.12	Carry out a check on control wiring connections both on the Generator and within the control panel for tightness and suitability.	Y / N

Schedule Comments:

6. Conduct of the Witness Test

The generator is to be tested according to the schedule above. The exact order of test may be altered during the outline of schedule for the Witness Test on the day of the test.

6.1 Visual Inspection of stationary generator.

The attendees complete a visual inspection of the generator and associated equipment. The Commissioning Manager documents any customer comments.

6.2 Auxiliary equipment (If Applicable)

Equipment / Control	Applicable	Pass
Jacket water heater	✓	✓
Battery Charger	✓	✓

6.3 Impact Load steps

- 6.3.1 Start the load bank.
- 6.3.2 Start the generator and check that the voltage and frequency are visible.
- 6.3.3 Apply the first load step.
- 6.3.4 Apply subsequent load steps.
- 6.3.5 Reject full load.
- 6.3.6 The Test Operator will record (Voltage, Frequency and Time)

NOTE:

Only the BPS Test Operator is permitted to start the generator.

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6.4 Shutdowns / Alarms / Control Functionality Genset

Function (Dependant on configuration)	Alarms				Shutdowns			
	Applicable	Indication	VFC	Pass	Applicable	Indication	VFC	Pass
Low oil pressure								
High engine temp.								
Over speed (Note 6.4a)								
Over frequency (Note 6.4a)								
Under frequency								
Over voltage								
Under voltage					✓			
Low battery voltage	✓				NA			
Low coolant Temp								
Emergency stop					✓			
FAIL TO START					✓			

Note 6.4a The governing systems / ECM's on some engines do not permit running at the speed required to activate the over speed / over frequency shutdown. In these cases, set points will be adjusted to show the operation of this protection at or just above rated speed.

Functionality	Applicable	Pass
Auto start	✓	✓

Comments:

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7. Load Test of the Generator

The generator will be run on reactive load according to the table below. The Test Operator records readings at **15-minute intervals**. These readings include Water Temp and Oil Pressure. The generator from start up will be "ready to accept load" <10 seconds.

BMS signals can be proven onto a laptop used to simulate the head end.

Load (%)	Rating of Generator		Record engine parameters in the columns below at the end of the specified duration for each value of load.	
	Continuous / Prime	Standby / Emergency		
	N / A		Pass	Fail
No Load 0%	N / A	N / A	✓	
~~25% 0%~~			✓	
50% 0%			✓	
75% 0%			✓	
100% 0%			✓	
0% 50%				
Cool Down 0%	N/A	N / A	✓	

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Load (Kva)	Rating of Generator		Record engine parameters on the record sheet (a sample is below) at the end of the specified duration for each value of load.	
	Continuous / Prime	Standby / Emergency		
	N / A			
	Standard Duration	Standard Duration	Pass	Fail
No Load 0	15 minute intervals – allow generator to stabilise and take readings A	N / A		
25%				
50%				
75%				
Full Load	180 minutes	N / A		
Overload	60 Minutes	N / A		
Cool Down	3 minutes (minimum)	N / A		

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Allow the generator to run at no load for a minimum duration of 3 minutes to cool down before switching off.

The generator tests included in this procedure have been completed satisfactorily, subject to comments.

Signed	Name	Company	Position	Date
	<u>JK</u>	<u>Bells</u>	<u>PM</u>	<u>04/06/21</u>
Signed	<u>Mr A. Akinde</u>	<u>G.T</u>	<u>S.M</u>	<u>04/06/21</u>
Signed	<u>P. Kent</u>	<u>R.R. Morison</u>	<u>PM</u>	<u>04/06/21</u>
Signed	<u>[Signature]</u>	<u>Luceo</u>	<u>PM</u>	<u>04/06/21</u>
Signed				
Signed				
Signed				



7.1 Load test certificate - Sample

GENERATOR LOAD TEST CERTIFICATE

[illegible]

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7.2 POST-WITNESS TEST DOCUMENTATION

Ensure that this document has been completed to reflect the results of the Test.

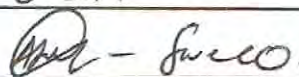
Obtain all Attendees signatures

Review all documentation:

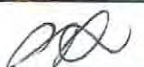
Document	BELLS ID NO	Complete
Generator Load Test Certificate		

General Comments:

All alarms to be shown on site e SAT

 - J. W. CO.

 - R. M. MORRISON

 Gallyard T. J.