

<b>Document title:</b>		SAT for CEMSIIe - v3.doc	
<b>Document author:</b>		<b>Signed:</b>	<b>Date:</b>
<b>Document reviewer:</b>		<b>Signed:</b>	<b>Date:</b>

# Site Acceptance Test

Forepower Ltd

CEMS IIe



# Table of Contents


## Table of Contents

1	Revision history .....	3
2	Signature Sheet.....	4
3	Important Symbols Used in this document .....	5
4	Health and Safety Considerations .....	5
5	Abbreviations .....	5
6	Documentation notes .....	5
7	System provision .....	6
7.1	Purpose .....	6
7.2	List of supplied equipment.....	6
7.3	Description of Standards and list of gasses used.....	7
7.4	System inspection .....	8
8	Operational tests.....	9
8.1	Purpose .....	9
8.2	Power-up tests .....	9
8.3	System operation checks .....	10
8.3.1	GASMET FTIR.....	11
8.3.2	SK Thermo FID .....	12
8.3.3	Enotec O2 analyzer .....	14
8.4	System safety checks .....	18
9	Certificate of system acceptance.....	20

## 1 Revision history

Version	Date	Creator	Signature:	Comments
1.0	18/1/17	P Coulson		First release
2.0	08/10/18	L Spencer		Change logo & name
3.0	05/04/19	A Dabrowski		Additional test added

## 2 Signature Sheet

Name	Company	Signature	Initials
Adam Dabrowski	Gasmot Technologies Ltd		AD

### 3 Important Symbols Used in this document



This symbol identifies important operating instructions

### 4 Health and Safety Considerations

It is the responsibility of the user to understand and comply with all applicable safety regulations. These will be variable based on the installation location of the system. Quantitech Limited takes no responsibility for determining the safe use of this system based on this qualification procedure.

The following actions / precautions must always be observed while using the system.

- An appropriate risk assessment must be conducted by a competent person prior to any work being carried out
- Care should be taken when handling the system that is not dropped as this could cause injury or damage. Appropriate moving and handling risk assessments should be carried out beforehand
- The system should be used only in a location with a suitable and stable power supply.
- The system should only be opened by personnel trained by the manufacturers of the equipment. High voltage, high temperature and spark hazards exist when the system is open

### 5 Abbreviations

The following is a list of abbreviations used in this manual:

<b>CEMS</b>	Continuous Emissions Monitoring System
<b>MIR</b>	Mid Infra-red
<b>FAT</b>	Factory Acceptance Test
<b>SAT</b>	Site acceptance test
<b>FTIR</b>	Fourier Transform Infra-Red
<b>FID</b>	Flame Ionisation Device
<b>IO</b>	Input/Output
<b>PPM</b>	Parts per million
<b>IS</b>	Intrinsically safe
<b>AI</b>	Analogue input
<b>AO</b>	Analogue output
<b>DI</b>	Digital input
<b>DO</b>	Digital output
<b>NA</b>	Not applicable

### 6 Documentation notes

This document supplements any manufacturers procedures for the Gasmeter CEMS IIe system, and as such, any SAT procedure should have been executed within the 12 months prior to this FAT being executed

## 7 System provision

### 7.1 Purpose

The purpose of this section is to ensure and identify that all of the instrumentation and equipment listed is checked and identified to confirm delivery. Any discrepancies should be noted in the comments section below

### 7.2 List of supplied equipment

Record the details of supplied equipment below

Name	Model	Serial Number*	
Gasmet CEMIIe System	CEM IIe-O2FID-SWIP	18632	Present
Cabinet Air Conditioner	Rittal SK3305500		Present
Gasmet FTIR	CX4000	173791	Present
Gasmet PC	COM-PC-001	18813	Present
Gasmet Sampling System	SAM-SYS-008	18757	Present
Gasmet Heated (180 C) stationary sample probe, with 1 m stainless steel sample tube (max 600°C)	SAM-PRO-002	26062/2099002	Present
Heated ZrO2 Oxygen Analyzer	OXY-380	18369	Present
10m Heated line (including power to probe and span line to probe)	SAM-LIN-001	191374/0618	Present
1m Heated line (SS to O2)	SAM-LIN-001	18114/6118	Present
1m Heated line (SS to FTIR)	SAM-LIN-001	1844123/0118	Present
SK ES Mcerts FID	(207.000300)	3282918	Present
1m Heated line (pt100 FTIR to FID)	Winkler	1808200713	Present
Heated line accessory (tee)	WZZHEATC-230XX017-0060	1806195392	Present
Envirosoft DSU logger	EN 0008/1	504	Present
Envirosoft PC	EN 0010/1	180013	Present
PCME StackFlow200 ctr/probe	SYS-SF200P2-V-06-S-0	68691/68118	Present
PCME Dust Monitor QAL181	SEN181-0250V	68820/64684	Present

### 7.3 Description of Standards and list of gases used

Record the details of the calibration gases used below. Please note that these may not be the same as used for the Site Acceptance Test

FAT:

Gas / Gases Mix	Concentration (s) [ppm] / %	Identifying number*	Tolerance [%]	Conversion factor	Concentration [mg/m3]
Nitrogen	99.999%	n/a	n/a	n/a	99.999%
Hydrogen	99.999%	VC67187	n/a	n/a	99.999%
Propane	39.9	VC83386	2	1.607	64.12
Sulphur Dioxide	26.9	VC83386	2	2.86	76.93
Carbon Monoxide	50.5	VC83386	2	1.25	63.13
Nitric Oxide	100.7	VC83386	2	1.34	134.94
Carbon Dioxide	8%	VC83386	2	n/a	8%
Balance nitrogen					

SAT:

Gas / Gases Mix	Concentration (s)	Identifying number*	Tolerance [%]	Conversion factor	Concentration [mg/m3]
Nitrogen	99.999%	n/a	n/a	n/a	99.999%
Hydrogen	99.999%	n/a	n/a	n/a	99.999%
Propane	5.96	189087SG	2	1.607	9.58
Sulphur Dioxide	17.3		2	2.86	49.48
Carbon Monoxide	42.1		2	1.25	52.63
Nitric Oxide	74.8		2	1.34	100.23
Carbon Dioxide	42.1		2	n/a	4210%
HCl	10	n/a	5	1.628	16.28
NO2	71.4	133060SG	2	2.0253	144.61
O2	2.10%	154056-AV-B	2		

\*If given

### 7.4 System inspection

Confirm that the system meets the following requirements.



These tests should be conducted with all mains power removed from the system

Step No.	Procedure	Expected Result / Data	Pass	Fail
1	Visually inspect housing for physical damage or non-uniform appearance	Housing appears in good condition and free of damage	<input checked="" type="checkbox"/>	<input type="checkbox"/>
3	Ensure all internal cables and lines are properly connected without excessive tension or prospect of wearing on other components	All cables and lines are positioned correctly	<input checked="" type="checkbox"/>	<input type="checkbox"/>
4	Ensure all connections to external wiring is appropriately identified and labelled	Connections to external wiring is appropriately identified and labelled	<input checked="" type="checkbox"/>	<input type="checkbox"/>
5	Ensure all internal hardware is tightly fastened	All fastenings are correctly installed and tightened	<input checked="" type="checkbox"/>	<input type="checkbox"/>
6	Visually inspect external components supplied such as probes and lines for any signs of damage and condition	Components are free from any damage and in good condition	<input checked="" type="checkbox"/>	<input type="checkbox"/>

Section PASSED  FAILED

Comments:

Checked by: AD  Date 13/06/2019

Validated by: \_\_\_\_\_ Date \_\_\_\_\_



## 8 Operational tests

### 8.1 Purpose

This section ensures and records that each aspect of the supplied equipment performs as expected.

### 8.2 Power-up tests

This section outlines the initial tests that need to be demonstrated on system and records the results.

Step No.	Procedure	Expected Result / Data	Pass	Fail
1	Attach system power to the system and activate the F2 and F5 breakers	Power is provided to the analysers,	<input checked="" type="checkbox"/>	<input type="checkbox"/>
2	Switch on the monitor and press the power button on the Gasmet computer	The computer boots up	<input checked="" type="checkbox"/>	<input type="checkbox"/>
3	Check computer date and time is set correctly.	Date and time are correct.	<input checked="" type="checkbox"/>	<input type="checkbox"/>
4	Start-up the Gasmet FTIR instrument	The Gasmet FTIR instrument powers up,	<input checked="" type="checkbox"/>	<input type="checkbox"/>
5	Start-up the Gasmet sampling system	The Gasmet sampling system powers up,	<input checked="" type="checkbox"/>	<input type="checkbox"/>
6	Start-up the SK FID instrument	The SK FID instrument powers up,	<input checked="" type="checkbox"/>	<input type="checkbox"/>
7	Start-up the Enotec O2 instrument	The Enotec O2 instrument powers up,	<input checked="" type="checkbox"/>	<input type="checkbox"/>
8	Start-up the PCME Dust instrument	The PCME instrument powers up,	<input checked="" type="checkbox"/>	<input type="checkbox"/>
9	Start-up the PCME Flow instrument	The PCME instrument powers up	<input checked="" type="checkbox"/>	<input type="checkbox"/>
10	Start-up the Envirosoft PC	The Envirosoft datalogger powers up,	<input checked="" type="checkbox"/>	<input type="checkbox"/>

Power up tests  PASSED  FAILED

Comments:

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### 8.3 System operation checks



The tests should be done only when the system has been on (except for brief interruptions.) and thermally stable for at least 1 hour. If this time period is not respected, the tests may fail. As access to the Digital and Analogue inputs and outputs are required for these checks, it is not a requirement that the air conditioner is running, and the cabinet closed for these tests to be performed



As the following tests require the correct functioning of the GASMET computer and sampling system to pass, those items are not specifically tested in the following sections



Due to the large volumes of gas required, the PCME alarms are disabled for the following tests until the PCME module itself is tested at which point normal functionality is restored for the duration of the test

Note: In the following tests, values have been assigned to analogue and digital outputs only for the purposes of demonstrating the link between measurements and outputs. The final configuration will be user-defined

### 8.3.1 GASMET FTIR

Step No.	Procedure	Expected Result / Data	Pass	Fail
1	Ensure there are no alarms existing on the system for the FTIR	No alarms indicated	<input checked="" type="checkbox"/>	<input type="checkbox"/>
2	Ensure the gasses are on at the regulators	All gasses are on	<input checked="" type="checkbox"/>	<input type="checkbox"/>
3	In Calcmet, click on "Measure" on the menu bar, and then "Background.	The system purges the cell with zero gas and collects a new background.	<input checked="" type="checkbox"/>	<input type="checkbox"/>
4	Click on "Measure" on the menu bar and then "Zero check"	The cell is flushed with zero gas and a zero spectrum is collected	<input checked="" type="checkbox"/>	<input type="checkbox"/>
5	Click on "View" on the menu bar and then "Calibration info". In the window that pops up, check the status for each indicated gas is "OK" in the bottom "Zero calibration check" pane.	Status for each gas is "OK" indicating the zero is within tolerance	<input checked="" type="checkbox"/>	<input type="checkbox"/>
6	Click on "Measure" on the menu bar and then "Span check"	The cell is flushed with span gas and a span spectrum is collected	<input checked="" type="checkbox"/>	<input type="checkbox"/>
7	Click on "View" on the menu bar and then "Calibration info". In the window that pops up, check the status for each indicated gas is "OK" in the middle "Span calibration check" pane.	Status for each gas is "OK" indicating the span check is within tolerance	<input checked="" type="checkbox"/>	<input type="checkbox"/>
8	The value for SO <sub>2</sub> has been assigned to the analogue output channel AO4 such that a value of -15mg/m <sup>3</sup> =4mA and 150 = 20mA	The value for AO4 is within range	<input checked="" type="checkbox"/>	<input type="checkbox"/>
9	Click on "Measure" on the menu bar and then "Continuous"	System is in continuous measurement. Results updating. Result Valid LED is on	<input checked="" type="checkbox"/>	<input type="checkbox"/>

Operation check  PASSED  FAILED

Comments:

Checked by: AD *[Signature]* Date 13/06/2019

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**8.3.2 SK Thermo FID**

Step No.	Procedure	Expected Result / Data	Pass	Fail
1	Ensure the gasses are on at the regulators	All gasses are on	<input checked="" type="checkbox"/>	<input type="checkbox"/>
2	Ensure there are no alarms existing on the system for the FTIR (Note: If the AIR has only just been turned on, the system will wait to go through a self-test procedure and alarms will be present until that is completed)	No alarms indicated	<input checked="" type="checkbox"/>	<input type="checkbox"/>
3	Start Calcmet running in continuous mode with a 5 second interval	Calcmet running with a 5 second interval	<input checked="" type="checkbox"/>	<input type="checkbox"/>
4	Push "Zero check" on FID. The system will purge clean air through the system	System purging with clean air	<input checked="" type="checkbox"/>	<input type="checkbox"/>
5	Monitor the front panel of the FID and channel 516 on Calcmet. Both values should agree and drop to a nominal 0 mgC/m <sup>3</sup>	Both readings indicate a nominal 0 mgC/m <sup>3</sup>	<input checked="" type="checkbox"/>	<input type="checkbox"/>

Step No.	Procedure	Expected Result / Data	Pass	Fail
6	Push "Span check" on FID. The system will purge the mix gas containing propane through the system. Calibration gas concentration: 5.96 ppm	System purging with mixture gas	<input checked="" type="checkbox"/>	<input type="checkbox"/>
7	Monitor the front panel of the FID and channel 516 on Calcmet. Both values should agree and climb to a nominal 9.58 mgC/m <sup>3</sup>	Both readings indicate a nominal 64 mgC/m <sup>3</sup>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
10	The value for TOC has been assigned to the analogue output channel A09 such that a value of 0 mgC/m <sup>3</sup> = 4mA and 160 mgC/m <sup>3</sup> = 20mA	The value for A09 is within range	<input checked="" type="checkbox"/> Type text here	<input type="checkbox"/>
8	Shut off the AIR to the Fid. The FID FAILURE alarm should trigger on channels 509.	Channel 509 alarm trigger	<input checked="" type="checkbox"/>	<input type="checkbox"/>
9	Shut off the Hydrogen to the Fid. The FID FAILURE alarm should trigger on channels 509.	Channel 509 alarm trigger	<input checked="" type="checkbox"/>	<input type="checkbox"/>
10	Test Service Alarm output	Channel 507 alarm trigger	<input checked="" type="checkbox"/>	<input type="checkbox"/>
11	Test Maintenance Alarm output	Channel 508 alarm trigger	<input checked="" type="checkbox"/>	<input type="checkbox"/>

Operation check  PASSED  FAILED

Comments:

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Validated by: \_\_\_\_\_ Date \_\_\_\_\_

### 8.3.3 Enotec O2 analyser

Step No.	Procedure	Expected Result / Data	Pass	Fail
1	Ensure NITROGEN and AIR gases are on at the regulator	NITROGEN and AIR gases are on	<input checked="" type="checkbox"/>	<input type="checkbox"/>
2	Set the Calcmet mode to "Continuous"	Calcmet is continually collecting data	<input checked="" type="checkbox"/>	<input type="checkbox"/>
3	Click on "Manual", Click on "Zero".	Zero gas starts flowing through the system	<input checked="" type="checkbox"/>	<input type="checkbox"/>
4	Observe the front panel on the Enotec analyser and ensure the Oxygen readings drop to a nominal zero	Enotec front panel readings drop to a nominal Zero	<input checked="" type="checkbox"/>	<input type="checkbox"/>
5	The value for O2 has been assigned to the analogue output channel A010 such that a value of 0% = 4mA and 25% = 20mA. Measure the 4-20 mA output and ensure the value is nominally 4mA	The value for A010 is within range	<input checked="" type="checkbox"/>	<input type="checkbox"/>
6	Click on "Zero" and then "Manual" to stop the zero gas flowing	Zero gas stops flowing. Calcmet continues to run in continuous mode	<input checked="" type="checkbox"/>	<input type="checkbox"/>
7	Observe the front panel on the Enotec analyser and channel 523 on Calcmet and ensure the Oxygen readings recover to normal values	Enotec front panel and Calcmet channel 523 readings recover	<input checked="" type="checkbox"/>	<input type="checkbox"/>
8	The value for O2 has been assigned to the analogue output channel A010 such that a value of 0% = 4mA and 25% = 20mA. Measure the 4-20 mA output and ensure the value is nominally 17mA	The value for A010 is within range	<input checked="" type="checkbox"/>	<input type="checkbox"/>

Operation check  PASSED  FAILED

Comments:

Checked by: AD Date 13/06/2019

Validated by: \_\_\_\_\_ Date \_\_\_\_\_

**8.3.4 PCME Particulate**



The following scatter values are nominal values for the FAT as final alignment of the probes will take place on-site

Step No.	Procedure	Expected Result / Data	Pass	Fail
1	Put the unit into maintenance mode by going to the "QC" screen on the PCME data logger, and selecting "Start Maint" and "Yes"	The PCME system is in maintenance mode	<input checked="" type="checkbox"/>	<input type="checkbox"/>
2	Ensure there is no standard in place at the sample position. Select the "Zero check" and "Activate". The unit will run a zero check	The logger displays "PASS" to indicate the unit is within tolerances	<input checked="" type="checkbox"/>	<input type="checkbox"/>
3	Select the "Span check" and "Activate". The unit will run a span check	The logger displays "PASS" to indicate the span check is within tolerances	<input checked="" type="checkbox"/>	<input type="checkbox"/>
4	Exit from maintenance mode by going to the "QC" screen on the PCME Data logger and selecting "Stop Maint", "Yes"	The unit exits maintenance mode	<input checked="" type="checkbox"/>	<input type="checkbox"/>

Step No.	Procedure	Expected Result / Data	Pass	Fail
5	Enter to outputs calibration menu on PCME unit and select 20mA TEST. Collect a single acquisition in Calcmnet and ensure the value on channel 517 Dust is full scale.	The values displayed is full range of PCME data logger.	<input checked="" type="checkbox"/>	<input type="checkbox"/>
6	Test alarm relay on channel 511	The value displayed changed on entering to the alarm	<input checked="" type="checkbox"/>	<input type="checkbox"/>
7	Adjust purge air flow and pressure to values indicated on regulator	Purge alarm cleared.	<input checked="" type="checkbox"/>	<input type="checkbox"/>

Operation check  PASSED  FAILED

Comments:

Checked by: AD  Date 13/06/2019

Validated by: \_\_\_\_\_ Date \_\_\_\_\_



8.3.5 PCME Flow



The following scatter values are nominal values for the FAT as final alignment of the probes will take place on-site

Step No.	Procedure	Expected Result / Data	Pass	Fail
1	Put the unit into maintenance mode by going to the "QC" screen on the PCME data logger, and selecting "Start Maint" and "Yes"	The PCME system is in maintenance mode	<input checked="" type="checkbox"/>	<input type="checkbox"/>
2	Exit from maintenance mode by going to the "QC" screen on the PCME Data logger and selecting "Stop Maint", "Yes"	The unit exits maintenance mode	<input checked="" type="checkbox"/>	<input type="checkbox"/>
3	Enter to outputs calibration menu on PCME unit and select 20mA TEST. Collect a single acquisition in Calcmeter and ensure the value on channel 522 Dust is full scale.	The values displayed is full range of PCME data logger.	<input checked="" type="checkbox"/>	<input type="checkbox"/>
4	Test alarm relay on channel 506	The value displayed changed on entering to the alarm	<input checked="" type="checkbox"/>	<input type="checkbox"/>

Operation check  PASSED  FAILED

Comments:

Checked by: AD 

Date 13/06/2019

Validated by: \_\_\_\_\_

Date \_\_\_\_\_

#### 8.4 System protection checks

Step No.	Procedure	Expected Result / Data	Pass	Fail
1	Power failure test: Isolate system from power	Safety air activated – check flow meter on Sampling System. Check if air flow is present on sample line at probe end	<input checked="" type="checkbox"/>	<input type="checkbox"/>
2	Power failure test: Restore power to the system	System should return to normal operation.	<input checked="" type="checkbox"/>	<input type="checkbox"/>
3	Isolate power from probe	System in Error – Probe alarm. Safety air activated	<input checked="" type="checkbox"/>	<input type="checkbox"/>
4	Isolate power from Line 1 (Heated line)	System in Error – Heated Line alarm Safety air activated	<input checked="" type="checkbox"/>	<input type="checkbox"/>
5	Isolate power from Line 2 (Heated line)	System in Error – Heated Line alarm Safety air activated	<input checked="" type="checkbox"/>	<input type="checkbox"/>
6	Isolate power from Line 3 (Heated line)	System in Error – Heated Line alarm Safety air activated	<input checked="" type="checkbox"/>	<input type="checkbox"/>
7	Isolate power from Air conditioning	Service Request – Cabinet Cooler Alarm	<input checked="" type="checkbox"/>	<input type="checkbox"/>
8	Change settings of cabinet temperature sensor to activate alarm	Service Request – Cabinet Temperature Alarm	<input checked="" type="checkbox"/>	<input type="checkbox"/>
9	Isolate power from Oxygen monitor	Service Request – O2 analyser alarm	<input checked="" type="checkbox"/>	<input type="checkbox"/>
10	Isolate power from FT analyser	System Error – Safety air activated, PC Watchdog notification	<input checked="" type="checkbox"/>	<input type="checkbox"/>
11	Isolate power Sampling system	System Error – Safety air activated, activated	<input checked="" type="checkbox"/>	<input type="checkbox"/>
12	Confirm operation of front LED	Status LED illuminate to indicate current status	<input checked="" type="checkbox"/>	<input type="checkbox"/>
13	System restored to measurement when alarms cleared	System valid LED active on sampling system	<input checked="" type="checkbox"/>	<input type="checkbox"/>
14				

Operation check  PASSED  FAILED

Comments:

Checked by: AD 

Date 13/06/2019

Validated by: \_\_\_\_\_

Date \_\_\_\_\_

## 9 Certificate of system acceptance

This system has passed all Site Acceptance Tests as outlined in this document

Tester (name)	Tester (signature)	Position	Company	Date
Adam Dabrowski		Assistant Service Manager	Gasmet Technologies	13/06/2019

This system is accepted as having passed all Site Acceptance Tests

Acceptor (name)	Acceptor (signature)	Position	Company	Date

Installation location:

Comments: