



Performance Standard for Portable Emission Monitoring Systems

**Performance standard for
stack emission monitoring, fugitive emissions,
and landfill-gas bore-hole emissions**

**Environment Agency
Version 3.1
February 2010**



Foreword

The Environment Agency established its Monitoring Certification Scheme (MCERTS) to deliver environmental measurements that meet our requirements for suitability and quality. MCERTS covers the product certification of monitoring systems, the competency certification of personnel, the accreditation of laboratories and the provision of third party inspection services.

This document specifies the performance characteristics and test procedures for portable emission monitoring systems (referred to as *portable systems*). Portable systems are instruments that are used to make measurements in a wide variety of applications, for example, stack emissions monitoring for indicative purposes or where emissions are less than 50% of the emission limit value, fugitive emissions and gaseous releases from landfill bore-holes. Portable systems would typically be simpler and have a higher measurement-uncertainty than continuous emission monitoring systems (CEMs).

Some transportable monitoring systems, however, are variants of CEMs and designed to perform to the same high standards as required for CEMs. These transportable monitoring systems are suitable for measuring emissions close to emission limit values, verifying and calibrating CEMs, and are typically designed to meet or exceed the uncertainty requirements specified in applicable EC Directives. Such transportable systems are also required to be used where a process falls under the Large Combustion Plant Directive or Waste Incineration Directive. The specifications for these systems, referred to as transportable systems are included in the *MCERTS Performance Standards and Test Procedures for Continuous Emission Monitoring Systems*.

The benefits of this standard are that it:

- provides confidence to regulatory authorities that portable systems, once certified, are fit for purpose and capable of producing results of the required quality and reliability;
- provides confidence to users that the portable system selected is robust and meets performance standards that are accepted by UK regulators;
- supports the supply of accurate and reliable data to the public;
- provides instrument manufacturers with an independent authoritative endorsement of their products, which will improve their access to international markets and increase the take-up of their products in the UK.

The performance requirements described in this document are based on relevant sections of a number of international ISO or CEN standards, as well as taking into account other relevant national standards.

The Environment Agency has appointed Sira Certification Service (Sira) to manage MCERTS on its behalf. If you have any questions about the how the certification process works, or you would like more information on how to apply, please contact Sira using the details below.

Sira Certification Service
12 Acorn Industrial Park
Crayford Road
Crayford
Kent
DA1 4AL

Phone : +44 (0)1322 520500
Fax : +44 (0)1322 520501
email : mcerts@siraenvironmental.com
web : www.siraenvironmental.com/mcerts/

If you have any general questions about MCERTS, please contact us.

Environment Agency
National Monitoring Services
PO Box 519
Preston
PR5 8GD

Phone : +44 (0)1772 714361
Fax : +44 (0)1772 714360
web : www.mcerts.net

Record of Amendments

Version number	Date	Amendment
Version 1 published March 2005	-	-
Version 2	March 2008	Removal of performance standards for former Type I systems, and redefining Type II systems simply as <i>portable systems</i> .
Version 3	September 2009	Performance characteristics and test methods aligned with EN 15267-3.
Version 3	September 2009	All performance characteristics are expressed as % of certification range, with the exception of oxygen, where the performance standards are expressed as a percentage of volume.
Version 3	September 2009	Performance standards for flow rate added.
Version 3	September 2009	Interferent concentrations for testing landfill-gas bore-hole monitoring systems changed.
Version 3.1	February 2010	Performance characteristic for landfill monitors amended: <ul style="list-style-type: none"> - Ambient temperature amended - H₂S response time added - Table A1.2 – CO concentration amended

Contents

1	Introduction	1
1.1	Background.....	1
1.2	Testing and certification	2
1.3	Unique identification of portable systems	2
1.4	Repairs, maintenance and modifications to certified portable systems	2
1.5	Certificate validity	3
2	References	3
3	Scope	4
3.1	Scope of MCERTS for portable emission monitoring systems.....	4
3.2	Use of portable systems for regulatory monitoring	4
4	Definitions	4
5	Requirements, performance characteristics and test methods.....	5
5.1	General requirements.....	5
5.2	Performance characteristics and test methods	6
6	Manufacturer's quality system.....	7
7	Status of this document	8
Appendix 1:	Standard gas concentrations for cross-sensitivity testing	9
Appendix 1:	Standard gas concentrations for cross-sensitivity testing	9

Performance Standard for Portable Emission Monitoring Systems

1 Introduction

1.1 Background

- 1.1.1 The Environment Agency established the Monitoring Certification Scheme (MCERTS) to deliver environmental measurements that meet our requirements for suitability and quality.
- 1.1.2 This document specifies the performance characteristics and test procedures for portable emission monitoring systems (referred to as *portable systems* in the remainder of this document). The determinands covered include, but are not restricted to:
- sulphur dioxide (SO₂);
 - oxides of nitrogen (principally NO and NO₂, but also N₂O);
 - carbon monoxide (CO) and carbon dioxide (CO₂);
 - hydrogen chloride (HCl);
 - hydrogen fluoride (HF);
 - methane (CH₄);
 - sulphur hexafluoride (SF₆);
 - hydrofluorocarbons (HFCs) and perfluorocarbons (PFCs);
 - mercury (Hg);
 - formaldehyde;
 - benzene;
 - volatile organic compounds, expressed as total organic carbon (TOC);
 - oxygen (O₂);
 - water vapour (H₂O);
 - flow rate.
- 1.1.3 Portable systems are instruments that are used to make measurements in a wide variety of applications, for example, stack emissions monitoring for indicative purposes or where emissions are less than 50% of the emission limit value, fugitive emissions and gaseous releases from landfill bore-holes.
- 1.1.4 Some portable systems are variants of continuous emission monitoring systems (CEMs), designed to perform to the same high standards as required for CEMs and suitable for measuring emissions close to emission limit values and calibrating CEMs. They are also required to be used where a process falls under the Large Combustion Plant Directive or Waste Incineration Directive. These systems are not covered by this standard. The specifications for these systems, referred to as transportable systems are included in the *MCERTS Performance Standards and Test Procedures for Continuous Emission Monitoring Systems*.
- 1.1.5 The general requirements and performance characteristics for portable systems are included in section 4. The test procedures are included in EN 15267 : Part 3. This standard has been applied through the *MCERTS Performance Standards and Test Procedures for Continuous Emission Monitoring Systems* .

1.2 Testing and certification

- 1.2.1 Portable systems shall undergo testing either by a laboratory acceptable to the Certification Body or alternatively, manufacturers may carry out in-house testing, if the Certification Body is satisfied that the test facilities of the manufacturer meet the applicable requirements for quality assurance. Manufacturers may also choose to use a combination of both external and in-house testing.
- 1.2.2 When manufacturers wish to carry out in-house testing, they should describe their test facilities to the Certification Body, including provisions for quality assurance and quality control of testing, and indicate which tests manufacturers wish to perform themselves.
- 1.2.3 If a manufacturer carries out in-house testing, then the results of the tests will be subject to audit and supervision by the Certification Body. The audit will examine the test methods, test results and traceability.
- 1.2.4 When applying for certification, manufacturers shall state the determinands measured, ranges and intended process applications. The performance data from testing may indicate that the possible range for each determinand may be greater or less than the nominated range. As lower ranges indicate better performance, manufacturers may elect to have a lower range based on the test results.
- 1.2.5 Manufacturers may have had some tests already performed. If so, then the manufacturer should include any applicable test reports with the application for certification. When some or all testing has already been carried out, the Certification Body will decide if any further tests are required and then agree with the manufacturer whether any such supplementary tests are to be performed using the manufacturers own test facilities or at third-party test laboratories.

1.3 Unique identification of portable systems

- 1.3.1 Portable systems shall have a unique designation that unambiguously identifies the equipment as a certified model.
- 1.3.2 Any changes in the design that have an effect on the performance of the portable system must be reflected in the unique designation of the system.

NOTE: For example, a portable system that has been modified shall be given a new model designation or number to distinguish it clearly from previous models.

1.4 Repairs, maintenance and modifications to certified portable systems

- 1.4.1 Any spares or replacement parts for certified portable systems shall meet the same performance standards as the original parts. Operators and equipment suppliers may be required to provide evidence that the replacement parts meet the required performance standards of the original equipment as specified by the manufacturer.
- 1.4.2 Modifications to certified portable systems are allowable so long as manufacturers can demonstrate that these design changes do not degrade the performance of the

portable system below the MCERTS performance standards.

- 1.4.3 Manufacturers shall keep detailed records and drawings of all design changes to portable systems, and have provisions for design verification, inspection and testing to ensure that the portable systems still meet the required performance standards. The requirements for a manufacturer's quality management system are described in Section 6 of this document.
- 1.4.4 The Certification Body will conduct audits of the design changes to portable standards to meet the requirements of product certification. Manufacturers shall notify the Certification Body of any modifications to equipment that may have a significant effect on the performance of the portable system.
- 1.4.5 Design modifications or extensions to the range of application of a portable system may require renewed testing. The extent of this renewed testing will depend upon the nature of the modifications to the portable system.
- 1.4.6 If there is evidence that a modification has only limited effects on the performance of the portable system, then it would not be necessary to retest a portable system completely. In such cases, only a supplementary test would be required.
- 1.4.7 In the case of modifications to software, documentation must be presented to the Certification Body indicating the nature of the modification as well as resultant effects on operation and functionality. The Certification Body will then decide if any further testing is required.

1.5 Certificate validity

- 1.5.1 MCERTS certificates are valid for five years, after which the certification is reviewed against the current MCERTS performance standard. Any necessary retesting will be identified to maintain the certification.

2 References

Performance Standards and Test Procedures for Continuous Emission Monitoring Systems. For gaseous, particulate and flow-rate monitoring systems, Version 3.1, July 2008. Environment Agency.

EN ISO 9001:2008, Quality management systems – Requirements.

EN 15267-2:2009, Air quality - Certification of automated measuring systems - Part 2: Minimum requirements for product quality assurance, initial assessment and on-going surveillance.

EN 15267-3:2007, Air quality — Certification of automated measuring systems — Part 3: Performance criteria and test procedures for automated measuring systems for monitoring emissions from stationary sources.

3 Scope

3.1 Scope of MCERTS for portable emission monitoring systems

The scope covers portable systems designed to monitor:

- emissions from chimney stacks and vents, including landfill flare stacks
- fugitive emissions, for example, from pipe-work
- landfill gas emissions

3.2 Use of portable systems for regulatory monitoring

3.2.1 Portable systems for monitoring stack emissions have a less demanding set of specifications than those for CEMs and transportable systems. Portable systems can be used for the following applications:

- indicative monitoring
- installations where the daily average emissions are likely to be below 50% of the emissions limit and where the Large Combustion Plant Directive or Waste Incineration Directive do not apply
- fugitive emissions
- gaseous releases from landfill bore-holes
- installations with a smaller risk of a significant environmental impact. The latter could include processes under local authority control

4 Definitions

4.1 certification range

range over which the portable system is tested and certified for compliance with the relevant performance criteria

4.2 cross-sensitivity

response of the portable system to interferents

4.3 interference

negative or positive effect that a substance has upon the output of the portable system, when that substance is not the measured component

4.4 lack of fit (linearity)

systematic deviation, within the range of application, between the accepted value of a reference material applied to the measuring system and the corresponding result of the measurement produced by the calibrated measuring system

4.5 output

reading, or digital or analogue electrical signal generated by a portable system in response to a measured object

- 4.6 performance characteristic**
quantity assigned to a portable system in order to define its performance
- 4.7 repeatability**
ability of a portable system to provide closely similar indications for repeated applications of the same measurand under the same conditions of measurement
- 4.8 response time, T_{90}**
time interval between the instant of a sudden change in the value of the input quantity to a portable system and the time as from which the value of the output quantity is reliably maintained above 90% of the correct value of the input quantity
- 4.9 span point**
value of the output quantity (measured signal) of the portable system for the purpose of calibrating, adjusting etc. that represents a correct measured value generated by reference material between 70% and 90% of the range tested
- 4.10 zero point**
specified value of the output quantity (measured signal) of the portable system and which, in the absence of the measured component, represents the zero crossing of the portable system characteristic
NOTE: In the case of oxygen and some flow monitoring portable systems, the zero point is interpreted as the lowest measurable value
- 4.11 span drift**
change in portable system reading at the span point over a stated period of unattended operation
- 4.12 zero drift**
change in portable system reading at the zero point over a stated period of unattended operation
- 4.13 Zero gas**
gas mixture used to establish the zero point of a calibration curve when used with a given analytical procedure within a given calibration range

5 Requirements, performance characteristics and test methods

5.1 General requirements

- 5.1.1 Portable systems shall have an indicator to show the measured parameter(s) and value.
- 5.1.2 Portable systems shall have an output of at least -5% to $+105\%$ of the certification range.

NOTE: This is to provide for a living zero reading, which can indicate both positive and negative drift. This requirements does not apply to oxygen monitors which use Zirconia sensors.

- 5.1.3 When the portable system is provided with a printer, the printer output for each set of data will include a record of the date, time and value of all the specified measurement parameters.
- 5.1.4 The portable system shall be equipped with a security mechanism to prevent inadvertent and unauthorised adjustment
- NOTE: Security mechanisms can include a key or security code programmed in to the portable system before adjustments are permitted
- 5.1.5 The portable system shall comply with all applicable EC Directives.
- 5.1.6 Any sampling system will be so constructed as to prevent damage to the sensor(s) and pump by particulate matter and liquids that may be expected in the application. Verification will be by inspection.
- 5.1.7 There are no performance characteristics for drop tests or vibration tests. However, if the portable system has undergone such tests for other purposes, then this will be reported on the certificate.

5.2 Performance characteristics and test methods

- 5.2.1 Performance characteristics for portable systems are shown in Table 1. The values for individual performance characteristics are expressed as a percentage of the certification range unless otherwise stated.

Table 1: Performance characteristics for portable systems

Performance characteristic	Stack emissions monitors	Landfill gas monitors	Fugitive emissions monitors	Oxygen ¹	Gas flow monitors	EN 15267-3 clause
Response time	<200s	<60s <90s H ₂ S	<5s	<200s	<60s	10.9
Repeatability at zero point	<±5%	<±5%	<±5%	<±0.4%	-	10.10
Repeatability at span point	<±5%	<±5%	<±5%	<±0.4%	<±5%	10.11
Lack-of-fit (linearity)	<±5%	<±5%	<±5%	<±0.4%	<±5%	10.12
Influence of ambient temperature change from 20°C within specified range at zero point	<±5%	<±10%	<±5%	<±0.8% (<±1.5%) ²	<±5%	10.14
Influence of ambient temperature change from 20°C within specified range at span point	<±5%	<±10%	<±5%	<±0.8% (<±1.5%) ²	<±5%	10.14
Cross-sensitivity	<±5%	<±5%	<±5%	<±0.8%	-	10.19
Zero drift (1 hour)	<±3%	<±3%	<±5%	<±0.3%	-	-
Span drift (1 hour)	<±3%	<±3%	<±5%	<±0.3%	-	-

NOTE 1: The performance specifications for oxygen apply to monitoring systems for stack emissions and landfill gas. The performance specifications are expressed as a percentage of volume concentration of oxygen.

NOTE 2: The performance specification for the effects of ambient temperature on landfill-gas monitoring-systems is <±1.5%.

5.2.2 Warm up time

The portable system shall be switched off and left off for at least 24 hours in clean air. After the 24 hour period the portable system shall be switched on and the time taken for the unit to indicate a stable reading shall be determined.

5.2.3 Response time

The test shall be carried out generally in accordance with the requirements of EN 15267-3.

5.2.4 Repeatability at zero point

The test shall be carried out generally in accordance with the requirements of EN 15267-3. The repeatability standard deviation at zero point shall be calculated based on at least 5 consecutive individual readings.

5.2.5 Repeatability at span point

The test shall be carried out generally in accordance with the requirements of EN 15267-3. The repeatability standard deviation at span point shall be calculated based on at least 5 consecutive individual readings.

5.2.6 Lack-of-fit (linearity)

The test shall be carried out generally in accordance with the requirements of EN 15267-3.

5.2.7 Influence of ambient temperature

The test shall be carried out generally in accordance with the requirements of EN 15267-3. The ambient temperature range is ordinarily +5°C to +40°C. The manufacturer may specify an alternative ambient temperature range. The ambient temperature range will be stated on the certificate.

5.2.8 Cross-sensitivity

The test shall be carried out generally in accordance with the requirements of EN 15267-3. Appropriate interferences (Table A1-1) shall be agreed between the manufacturer and the Certification Body. The sum total of positive deviations and the sum total of negative deviations will be specified individually identifying the actual magnitude. For landfill gas borehole monitoring systems, a test gas with the composition shown in Table A1-2 shall be used.

5.2.9 Zero and span drift

The portable system shall be switched on and left to warm up in clean air for a minimum of 15 minutes. A reading shall be obtained for each channel and the portable system left switched on. After one hour has elapsed further readings shall be taken.

The test shall then be repeated with a reading obtained with a test gas at the span point being applied before and after one the hour period.

6 Manufacturer's quality system

6.1 The manufacturer shall have a quality system in place that complies with the requirements of ISO 9001 and the supplementary requirements of EN 15267-2.

6.2 The manufacturer shall have an annual audit managed by the Certification Body. The purpose of this audit is not to repeat the elements which are assessed during routine ISO 9001 certification and surveillance visits, but to cover the requirements of

MCERTS above and beyond those of ISO 9001, i.e. the supplementary requirements of EN 15267-2.

The audit will include an evaluation of the provisions for:

- the management and control of the design change process
- manufacturing (process control), final inspection tests and calibration - to ensure reproducibility
- unambiguous identification of MCERTS certified equipment
- assuring that design changes do not degrade instrument performance such that instruments no longer meet the MCERTS performance standards

6.3 Manufacturers shall inform the Certification Body of any design changes to the portable system. The Certification Body will then decide if the current certificate is still valid, or if further testing is required to ensure the performance specification is still within the MCERTS Standard.

7 Status of this document

This MCERTS Standard may be subject to review and amendment following publication. The latest version is available on the Agency's website at www.mcerts.net

Appendix 1: Standard gas concentrations for cross-sensitivity testing

A1.1 Stack emissions monitoring systems

When determining cross-sensitivity of stack emission monitoring systems, the following concentrations of interferents shall be used. The concentrations may need to be changed depending on the measuring technique, the type of system involved and the intended application. The interferents shall be admitted individually.

Table A1-1: Recommended minimum concentrations of interferents

interferent	Concentration	Unit
O ₂	3 and 21	%
H ₂ O	30	%
CO	300	mg/m ³
CO ₂	15	%
CH ₄	50	mg/m ³
N ₂ O	20	mg/m ³
NO	300	mg/m ³
NO ₂	30	mg/m ³
NH ₃	20	mg/m ³
SO ₂	200	mg/m ³
SO ₂ (coal-fired power stations without desulphurisation)	1000	mg/m ³
HCl	50	mg/m ³
HCl (coal-fired power stations)	200	mg/m ³

A1.2 Landfill bore-hole emissions monitoring systems

When determining the cross-sensitivity of landfill bore-hole monitoring systems, the following concentrations of interferents shall be used: The interferents shall be admitted collectively.

Table A1-2: Interferent concentrations for testing landfill-gas bore-hole monitoring systems

Interferent	Concentration
CO ₂	48%
CH ₄	48%
CO	70 mg/m ³
H ₂ S	20 mg/m ³
N ₂	balance