

CERTIFICATE

of Product Conformity (QAL1)

Certificate No.: 0000053811

Certified AMS: LasIR for HCl and H₂O

Manufacturer: Unisearch Associates
96 Bradwick Drive
Concord, Ontario L4K 1K8
Canada

Test Institute: TÜV Rheinland Energy GmbH

This is to certify that the AMS has been tested and certified
according to the standards

EN 15267-1 (2009), EN 15267-2 (2009), EN 15267-3 (2007)
and EN 14181 (2014)

Certification is awarded in respect of the conditions stated in this certificate
(this certificate contains 7 pages).



Suitability Tested
EN 15267
QAL1 Certified
Regular
Surveillance

www.tuv.com
ID 0000053811

Publication in the German Federal Gazette
(BAnz.) of 15 March 2017

German Federal Environment Agency
Dessau, 25 April 2017



Dr. Marcel Langner
Head of Section II 4.1

This certificate will expire on:
14 March 2022

TÜV Rheinland Energy GmbH
Cologne, 24 April 2017



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Test institute accredited to EN ISO/IEC 17025:2005 by DAkkS (German Accreditation Body).
This accreditation is limited to the accreditation scope defined in the enclosure to the certificate D-PL-11120-02-00.

Test report: 936/21226120/A dated 13 October 2016
Initial certification: 15 March 2017
Expiry date: 14 March 2022
Publication: BAnz AT 15.03.2017 B6, chapter I no. 3.2

Approved application

The tested AMS is suitable for use at combustion plants according to Directive 2010/75/EU, chapter III (13. BImSchV), at waste incineration plants according to Directive 2010/75/EU, chapter IV (17. BImSchV), at plants according to 27. BImSchV and other plants requiring official approval. The measured ranges have been selected considering the wide application range of the AMS.

The suitability of the AMS for this application was assessed on the basis of a laboratory test and a six-month field test at a waste incineration plant.

The AMS is approved for an ambient temperature range of 5 °C to 40 °C and the measuring heads are approved for an ambient temperature range of -20 °C to +50 °C.

The notification of suitability of the AMS, performance testing, and the uncertainty calculation have been effected on the basis of the regulations valid at the time of performance testing. As changes in legal regulations are possible, any potential user should ensure that this AMS is suitable for monitoring the limit value relevant to the application.

Any potential user should ensure, in consultation with the manufacturer, that this AMS is suitable for the installation at which it will be installed.

Basis of the certification

This certification is based on:

- Test report 936/21226120/A dated 13 October 2016 of TÜV Rheinland Energy GmbH
- Suitability announced by the German Federal Environment Agency (UBA) as the relevant body
- The ongoing surveillance of the product and the manufacturing process

Publication in the German Federal Gazette: BAnz AT 15.03.2017 B6, chapter I no. 3.2,
Announcement by UBA from 22 February 2017:

AMS designation:

LasIR for HCl and H₂O

Manufacturer:

Unisearch Associates, Concord, Canada

Field of application:

For measurements at plants requiring official approval

Measuring ranges during the performance test:

Component	Certification range	Supplementary measurement ranges		Unit
HCl	0 - 15*	0 - 90*	-	mg/m ³ · m
H ₂ O	0 - 30*	0 - 40*	0 - 50*	Vol.-% · m

*related to a path length of 1.0 m

Software version:

4.85

Restrictions:

none

Notes:

1. HCl can be determined with the help of dry test gases from a pressured gas bottle and an unheated measurement cell.
2. The maintenance interval is three months.
3. The measuring system was tested with the Dual-Pass Optical-Unit
4. In cases where the measurement path exceeds 1m, compliance with the requirements for cross-sensitivity stipulated in EN 15267-3 has to be verified when installing the measuring system.

Test report:

TÜV Rheinland Energy GmbH, Cologne
Report No.: 936/21226120/A dated 13 October 2016

Certified product

This certificate applies to automated measurement systems conforming to the following description:

The LasIR measuring system uses the principle of light absorption in the near infrared region of the spectrum by a tunable diode laser. It was designed for in-situ waste gas measurement of HCl/H₂O. The laser diode is the heart of the LasIR measuring system. It serves as light source in the near infrared spectrum. These diodes emit a light beam in a narrow but tunable wavelength spectrum. Its high spectral sensitivity and the tunable laser diode allow the measuring system to determine the optical absorption of a single rotation/vibration line in the spectrum of the molecule to be measured. This clearly identifies the gas to be measured and makes the measurement robust against interfering gases.

Overall, the measuring system consists of:

- Lasir control/analyser unit
- Transmitter and receiver unit with flushing device
- Reflector unit with purge device
- Optical cable (between the analyser unit and the transceiver unit)
- Unheated measuring gas cell (length 12.5 cm)
- Heated measuring gas cell (length 1 m)
- Operation manual dated 30 August 2016
- Software version: 4.85.

The LasIR measuring system comprises two main components: The LasIR control (analyser) unit and the optical heads.

The control/analyser unit

The analyser unit has its own housing. The analyser's laser is selected for and tuned to the absorption wavelength of the gas to be monitored. It is mounted on a thermo-electric cooler which approximates the wavelength via the temperature of the laser. The laser voltage is used for fine tuning.

The laser is coupled to an optical fibre which again is connected to a beam splitter. This beam splitter splits the light beam in two. One output (in the range 2% to 10%) sends the laser beam to a reference channel. Light from the output for the reference channel crosses a small reference cell filled with high concentrations of the gas to be measured with this laser. The signal from the reference channel serves to tune the wavelength of the laser to the absorption line. The remaining output (90% to 98%) is used for the measurement channels.

The analyser also comes with a control circuit for the temperature and power of the laser, a data logger chip and a control chip as well as an integrated computer for automatic data control and analysis.

Optical heads

A number of different configurations of the emitter/receiver module is available for in-situ emission monitoring. At present, the version emitter/receiver unit with retro reflector (dual pass option) was performance tested.

In the dual-pass version, a light beam is sent to the channel optics via an optical fibre coupled to a specifically designed start/reception element via an APC connector. The laser beam is emitted through the waste gas duct/stack. When it hits the opposite side, the retro reflector reflects it back to the detector. The output voltage of the receiver is transmitted to the LasIR analyser via a coaxial cable.

General notes

This certificate is based upon the equipment tested. The manufacturer is responsible for ensuring that on-going production complies with the requirements of the EN 15267. The manufacturer is required to maintain an approved quality management system controlling the manufacture of the certified product. Both the product and the quality management systems shall be subject to regular surveillance.

If a product of the current production does not conform to the certified product, TÜV Rheinland Energy GmbH must be notified at the address given on page 1.

A certification mark with an ID-Number that is specific to the certified product is presented on page 1 of this certificate. This can be applied to the product or used in publicity material for the certified product.

This document as well as the certification mark remains property of TÜV Rheinland Energy GmbH. With revocation of the publication the certificate loses its validity. After the expiration of the certificate and on requests of the TÜV Rheinland Energy GmbH this document shall be returned and the certificate mark must not be employed anymore.

The relevant version of this certificate and its expiration is also accessible on the internet: qal1.de.

Certification of LasIR is based on the documents listed below and the regular, continuous monitoring of the Quality Management System of the manufacturer:

Initial certification according to EN 15267

Certificate No. 0000053811: 25 April 2017
Expiry date of the certificate: 14 March 2022

Test report: 936/21226120/A dated 13 October 2016
TÜV Rheinland Energy GmbH, Cologne
Publication: BAnz AT 15.03.2017 B6, chapter I no. 3.2
Announcement by UBA dated 22 February 2017

Calculation of overall uncertainty according to EN 14181 and EN 15267-3

Measuring system

Manufacturer	Unisearch Associates
AMS designation	LasIR
Serial number of units under test	16 / 17
Measuring principle	Laser spectroscopy

Test report

Test laboratory	936/21226120/A
Date of report	TÜV Rheinland 2016-10-13

Measured component

Certification range	HCl 0 - 15 mg/m ³
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Evaluation of the cross-sensitivity (CS)

(system with largest CS)

Sum of positive CS at zero point	0.06 mg/m ³
Sum of negative CS at zero point	0.00 mg/m ³
Sum of positive CS at span point	0.00 mg/m ³
Sum of negative CS at span point	-0.08 mg/m ³
Maximum sum of cross-sensitivities	-0.08 mg/m ³
Uncertainty of cross-sensitivity	u_i -0.046 mg/m ³

Calculation of the combined standard uncertainty

Tested parameter

			u^2
Standard deviation from paired measurements under field conditions *	u_D	0.224 mg/m ³	0.050 (mg/m ³) ²
Lack of fit	u_{lof}	-0.087 mg/m ³	0.008 (mg/m ³) ²
Zero drift from field test	$u_{d,z}$	0.095 mg/m ³	0.009 (mg/m ³) ²
Span drift from field test	$u_{d,s}$	0.121 mg/m ³	0.015 (mg/m ³) ²
Influence of ambient temperature at span	u_t	0.100 mg/m ³	0.010 (mg/m ³) ²
Influence of supply voltage	u_v	0.031 mg/m ³	0.001 (mg/m ³) ²
Cross-sensitivity (interference)	u_i	-0.046 mg/m ³	0.002 (mg/m ³) ²
Influence of sample gas pressure	u_p	0.020 mg/m ³	0.000 (mg/m ³) ²
Uncertainty of reference material at 70% of certification range	u_{rm}	0.121 mg/m ³	0.015 (mg/m ³) ²
Excursion of measurement beam	u_{mb}	0.540 mg/m ³	0.292 (mg/m ³) ²

* The larger value is used :

"Repeatability standard deviation at set point" or

"Standard deviation from paired measurements under field conditions"

Combined standard uncertainty (u_c)	$u_c = \sqrt{\sum (u_{max,j})^2}$	0.63 mg/m ³
Total expanded uncertainty	$U = u_c * k = u_c * 1.96$	1.24 mg/m ³

Relative total expanded uncertainty

Requirement of 2010/75/EU	U in % of the ELV 10 mg/m³	12.4
Requirement of EN 15267-3	U in % of the ELV 10 mg/m³	40.0
	U in % of the ELV 10 mg/m³	30.0

Calculation of overall uncertainty according to EN 14181 and EN 15267-3

Measuring system

Manufacturer	Unisearch Associates
AMS designation	LasIR
Serial number of units under test	16 / 17
Measuring principle	Laser spectroscopy

Test report

Test laboratory	936/21226120/A
Date of report	TÜV Rheinland 2016-10-13

Measured component

Certification range	H ₂ O 0 - 30 Vol.-%
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Evaluation of the cross-sensitivity (CS)

(system with largest CS)

Sum of positive CS at zero point	0.00 Vol.-%
Sum of negative CS at zero point	0.00 Vol.-%
Sum of positive CS at span point	0.20 Vol.-%
Sum of negative CS at span point	0.00 Vol.-%
Maximum sum of cross-sensitivities	0.20 Vol.-%
Uncertainty of cross-sensitivity	u_i 0.116 Vol.-%

Calculation of the combined standard uncertainty

Tested parameter

				u^2
Standard deviation from paired measurements under field conditions *	u_D	0.122 Vol.-%		0.015 (Vol.-%) ²
Lack of fit	u_{lof}	0.116 Vol.-%		0.013 (Vol.-%) ²
Zero drift from field test	$u_{d,z}$	0.121 Vol.-%		0.015 (Vol.-%) ²
Span drift from field test	$u_{d,s}$	-0.225 Vol.-%		0.051 (Vol.-%) ²
Influence of ambient temperature at span	u_t	0.115 Vol.-%		0.013 (Vol.-%) ²
Influence of supply voltage	u_v	0.139 Vol.-%		0.019 (Vol.-%) ²
Cross-sensitivity (interference)	u_i	0.116 Vol.-%		0.013 (Vol.-%) ²
Influence of sample gas pressure	u_p	0.021 Vol.-%		0.000 (Vol.-%) ²
Uncertainty of reference material at 70% of certification range	u_{rm}	0.242 Vol.-%		0.059 (Vol.-%) ²
Excursion of measurement beam	u_{mb}	0.690 Vol.-%		0.476 (Vol.-%) ²

* The larger value is used :

"Repeatability standard deviation at set point" or

"Standard deviation from paired measurements under field conditions"

Combined standard uncertainty (u_c)	$u_c = \sqrt{\sum (u_{max,j})^2}$	0.82 Vol.-%
Total expanded uncertainty	$U = u_c * k = u_c * 1.96$	1.61 Vol.-%

Relative total expanded uncertainty

Requirement of 2010/75/EU	U in % of the range 30 Vol.-%	5.4
Requirement of EN 15267-3	U in % of the range 30 Vol.-%	10.0 **
		7.5

** The EU-directive 2010/75/EU on industrial emissions provides no requirements for this component.
A value of 10.0 % was used for this.