

CERTIFICATE

of Product Conformity (QAL1)

Certificate No.: 0000062064

AMS designation: 49iQ for Ozone

Manufacturer: Thermo Fisher Scientific
27, Forge Parkway
Franklin, MA 02038
USA

Test Laboratory: TÜV Rheinland Energy GmbH

**This is to certify that the AMS has been tested
and found to comply with:
VDI 4202-1 (2018), EN 14625 (2012),
EN 15267-1 (2009) and DIN EN 15267-2 (2009).**

Certification is awarded in respect of the conditions stated in this certificate
(this certificate contains 9 pages).



Suitability Tested
Complying with
2008/50/EC
EN 15267
Regular Surveillance

www.tuv.com
ID 0000062064

Publication in the German Federal Gazette
(BAnz) of 26 March 2019

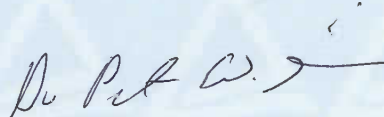
This certificate will expire on:
25 March 2024

German Federal Environment Agency
Dessau, 12 June 2019

TÜV Rheinland Energy GmbH
Cologne, 11 June 2019



Dr Marcel Langner
Head of Section II 4.1



ppa. Dr Peter Wilbring

www.umwelt-tuv.eu
tre@umwelt-tuv.eu
Phone: + 49 221 806-5200

TÜV Rheinland Energy GmbH
Am Grauen Stein
51105 Köln

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:	936/21242986/A dated 2 October 2018
Initial certification:	26 March 2019
Expiry date:	25 March 2024
Publication:	BAnz AT 26.03.2019 B7, chapter III number 3.1

Approved application

The certified AMS is suitable for continuous ambient air monitoring of ozone (stationary operation).

The suitability of the AMS for this application was assessed on the basis of a laboratory test and a three-months field test.

The AMS is approved for an ambient temperature range of +0 °C to +30 °C.

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

Any potential user should ensure, in consultation with the manufacturer, that this AMS is suitable for the intended purpose.

Basis of the certification

This certification is based on:

- Test report 936/21242986/A dated 2 October 2018 issued by 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 26.03.2019 B7, chapter III number 3.1
UBA announcement dated 27 February 2019:

AMS designation:

49iQ for Ozone

Manufacturer:

Thermo Fisher Scientific, Franklin, USA

Field of application:

For the continuous measurement of ozone concentrations in ambient air in stationary use

Measuring ranges during performance testing:

Component	Certification range	Unit
Ozone	0–500	µg/m ³

Software version:

Version: 1.5.1.32120

Restrictions:

None

Note:

This report on the performance test is available online at www.qal1.de.

Test Report:

TÜV Rheinland Energy GmbH, Cologne
Report no.: 936/21242986/A dated 2 October 2018

Certified product

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

The 49iQ ambient air quality measuring system is a continuous ozone analyser. The instrument uses the UV absorption method as its measuring principle. It was designed for the continuous measurement of ozone in ambient air.

The sample is drawn into the 49iQ through the sample bulkhead and is split into two gas streams. One gas stream flows through an ozone scrubber to become the reference gas (I_0). The reference gas then flows to the reference solenoid valve. The sample gas (I) flows to the sampling solenoid valve directly. The solenoid valves alternate the reference and sample gas streams between cells A and B every 10 seconds. When cell A contains reference gas, cell B contains sample gas and vice versa.

The UV light intensities of each cell are measured by detectors A and B. When the solenoid valves switch the reference and sample gas streams to opposite cells, the light intensities are ignored for several seconds to allow the cells to be flushed. The 49iQ calculates the ozone concentration for each cell and outputs the average concentration to both the front panel display and the analogue outputs, and also makes the data available over the serial or Ethernet connection.

The 49iQ system components include:

- Photometer DMC: The optical bench has two airtight chambers that contain the sample and reference gases with a common photometer lamp at one end and two individual detectors at the other end. The photo-diode in each detector transmits light intensity information to the DMC board for sample measurement computations. The photometer lamp power supply generates high voltage AC and contains heater control circuits for the photometer lamp.
- Common electronics: The common electronics contain the core computational and power routing hardware, and is replicated throughout other iQ series products. It also contains front panel display, the USB ports, the Ethernet port, and the I/O interfaces. All electronics operate from a universal VDC supply. The System Controller Board (SCB) contains the main processor, power supplies, and a sub-processor, and serves as the communication hub for the instrument.
- Peripheral Support System: The peripheral support system operates these additional devices that are needed, but do not require special feedback control or processing. The chassis fan provides air cooling of the active electronic components. Internal vacuum pump for generating air/sample through the instrument.
- Flow/Pressure DMC: The flow/pressure DMC is used to measure instrument pressures that assure proper flow regulation and for sample pressure within the measurement bench for pressure corrections and compensation. The DMC includes two pressure sensors.

General remarks

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 manufacturing process for 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 certification mark may be applied to the product or used in advertising materials for the certified product.

This document as well as the certification mark remains property of TÜV Rheinland Energy GmbH. Upon revocation of the publication the certificate loses its validity. After the expiration of the certificate and on request of TÜV Rheinland Energy GmbH this document shall be returned and the certificate mark must no longer be used.

The relevant version of this certificate and its expiration date are also accessible on the internet at qal1.de.

Document history

Certification of the 49iQ measuring system is based on the documents listed below and the regular, continuous surveillance of the manufacturer's quality management system:

Initial certification according to EN 15267

Certificate no. 0000062064: 12 June 2019
Expiry date of the certificate: 25 March 2024
Test report no.936/21242986/A dated 2 October 2018
TÜV Rheinland Energy GmbH, Cologne
Publication: BAnz AT 26.03.2019 B7, chapter III number 3.1
UBA announcement dated 27 February 2019

Expanded uncertainty laboratory, system 1

Measuring device:		49IQ		Serial-No.:		1180540009	
Measured component:		O ₃		1h-alert threshold:		120 nmol/mol	
No.	Performance characteristic	Performance criterion	Result	Partial uncertainty	Square of partial uncertainty		
1	Repeatability standard deviation at zero	≤ 1.0 nmol/mol	0.190	u _{r,z}	0.05	0.0024	
2	Repeatability standard deviation at 1h-alert threshold	≤ 3.0 nmol/mol	0.340	u _{r,h}	0.09	0.0077	
3	"lack of fit" at 1h-alert threshold	≤ 4.0% of measured value	1.880	u _{l,h}	1.30	1.6965	
4	Sensitivity coefficient of sample gas pressure at 1h-alert threshold	≤ 2.0 nmol/mol/kPa	0.200	u _{gp}	2.28	5.1939	
5	Sensitivity coefficient of sample gas temperature at 1h-alert threshold	≤ 1.0 nmol/mol/K	0.090	u _{gt}	0.98	0.9693	
6	Sensitivity coefficient of surrounding temperature at 1h-alert threshold	≤ 1.0 nmol/mol/K	0.115	u _{st}	0.84	0.7034	
7	Sensitivity coefficient of electrical voltage at 1h-alert threshold	≤ 0.30 nmol/mol/V	0.020	u _v	0.27	0.0752	
8a	Interferent H ₂ O with 19 mmol/mol	≤ 10 nmol/mol (Zero) ≤ 10 nmol/mol (Span)	-2.030 -1.670	u _{H2O}	-1.25	1.5528	
8b	Interferent Toluene with 0.5 µmol/mol	≤ 5.0 nmol/mol (Zero) ≤ 5.0 nmol/mol (Span)	1.460 4.270	u _{int,pos} or	5.21	27.1201	
8c	Interferent Xylene with 0.5 µmol/mol	≤ 5.0 nmol/mol (Zero) ≤ 5.0 nmol/mol (Span)	2.300 4.750	u _{int,neg}	-3.74	13.9968	
9	Averaging effect	≤ 7.0% of measured value	-5.400	u _{av}	0.20	0.0416	
18	Difference sample/calibration port	≤ 1.0%	0.170	u _{asc}	1.20	1.4400	
21	Uncertainty of test gas	≤ 3.0%	2.000	u _{cg}		7.2663	
Combined standard uncertainty				u _c		14.5327	
Expanded uncertainty				U		12.11	
Relative expanded uncertainty				W		15	
Maximum allowed expanded uncertainty				W _{req}			

Expanded uncertainty laboratory, system 2

Measuring device:		Serial-No.:		1180540010	
Measured component:		1h-alert threshold:		120	
49IQ		O ₃		nmol/mol	
No.	Performance characteristic	Performance criterion	Result	Partial uncertainty	Square of partial uncertainty
1	Repeatability standard deviation at zero	≤ 1.0 nmol/mol	0.200	u _{r,z} 0.05	0.0027
2	Repeatability standard deviation at 1h-alert threshold	≤ 3.0 nmol/mol	0.390	u _{r,lv} 0.10	0.0106
3	"lack of fit" at 1h-alert threshold	≤ 4.0% of measured value	1.480	u _{l,lv} 1.03	1.0514
4	Sensitivity coefficient of sample gas pressure at 1h-alert threshold	≤ 2.0 nmol/mol/kPa	0.140	u _{gp} 1.62	2.6192
5	Sensitivity coefficient of sample gas temperature at 1h-alert threshold	≤ 1.0 nmol/mol/K	0.050	u _{gt} 0.55	0.2992
6	Sensitivity coefficient of surrounding temperature at 1h-alert threshold	≤ 1.0 nmol/mol/K	0.091	u _{st} 0.66	0.4404
7	Sensitivity coefficient of electrical voltage at 1h-alert threshold	≤ 0.30 nmol/mol/V	0.010	u _v 0.14	0.0194
8a	Interferent H ₂ O with 19 nmol/mol	≤ 10 nmol/mol (Zero)	-0.890	u _{H2O} -0.35	0.1230
		≤ 10 nmol/mol (Span)	-0.470		
8b	Interferent Toluene with 0.5 µmol/mol	≤ 5.0 nmol/mol (Zero)	2.240	u _{int,pos}	
		≤ 5.0 nmol/mol (Span)	4.050	or	25.1141
8c	Interferent Xylene with 0.5 µmol/mol	≤ 5.0 nmol/mol (Zero)	2.450	u _{int,neg}	
		≤ 5.0 nmol/mol (Span)	4.630	u _{av} -4.43	19.6608
9	Averaging effect	≤ 7.0% of measured value	-6.400	u _{bsc} 0.10	0.0092
18	Difference sample/calibration port	≤ 1.0%	0.080	ucg 1.20	1.4400
21	Uncertainty of test gas	≤ 3.0%	2.000		
Combined standard uncertainty			u _c		nmol/mol
Expanded uncertainty			U		nmol/mol
Relative expanded uncertainty			W		%
Maximum allowed expanded uncertainty			W _{req}		%
				15	

Combined uncertainty, laboratory and field, system 1

Measuring device:		49IQ		Serial-No.:		1180540009	
Measured component:		O ₃		1h-alert threshold:		120 nmol/mol	
No.	Performance characteristic	Performance criterion	Result	Partial uncertainty	Square of partial uncertainty		
1	Repeatability standard deviation at zero	≤ 1.0 nmol/mol	0.190	U _{r,z}	0.05	0.0024	
2	Repeatability standard deviation at 1h-alert threshold	≤ 3.0 nmol/mol	0.340	U _{r,h}	not considered, as u _{r,h} = 0.08 < u _{r,f}	-	
3	"lack of fit" at 1h-alert threshold	≤ 4.0% of measured value	1.880	U _{l,h}	1.30	1.6965	
4	Sensitivity coefficient of sample gas pressure at 1h-alert threshold	≤ 2.0 nmol/mol/kPa	0.200	U _{gp}	2.28	5.1939	
5	Sensitivity coefficient of sample gas temperature at 1h-alert threshold	≤ 1.0 nmol/mol/K	0.090	U _{gt}	0.98	0.9693	
6	Sensitivity coefficient of surrounding temperature at 1h-alert threshold	≤ 1.0 nmol/mol/K	0.115	U _{st}	0.84	0.7034	
7	Sensitivity coefficient of electrical voltage at 1h-alert threshold	≤ 0.30 nmol/mol/V	0.020	U _v	0.27	0.0752	
8a	Interferent H ₂ O with 19 nmol/mol	≤ 10 nmol/mol (Zero)	-2.030	U _{H2O}	-1.25	1.5528	
		≤ 10 nmol/mol (Span)	-1.670				
8b	Interferent Toluene with 0.5 µmol/mol	≤ 5.0 nmol/mol (Zero)	1.460	U _{int,pos}			
		≤ 5.0 nmol/mol (Span)	4.270				
8c	Interferent Xylene with 0.5 µmol/mol	≤ 5.0 nmol/mol (Zero)	2.300	or	5.21	27.1201	
		≤ 5.0 nmol/mol (Span)	4.750	U _{int,neg}			
9	Averaging effect	≤ 7.0% of measured value	-5.400	U _{av}	-3.74	13.9968	
10	Reproducibility standard deviation under field conditions	≤ 5.0% of average over 3 months	2.420	U _{r,f}	2.90	8.4332	
11	Long term drift at zero level	≤ 5.0 nmol/mol	1.890	U _{gl,z}	1.09	1.1907	
12	Long term drift at span level	≤ 5.0% of max. of certification range	-2.700	U _{gl,h}	-1.87	3.4992	
18	Difference sample/calibration port	≤ 1.0%	0.170	U _{sc}	0.20	0.0416	
21	Uncertainty of test gas	≤ 3.0%	2.000	U _{cg}	1.20	1.4400	
				Combined standard uncertainty	u _c	8.1188 nmol/mol	
				Expanded uncertainty	U	16.2376 nmol/mol	
				Relative expanded uncertainty	W	13.53 %	
				Maximum allowed expanded uncertainty	W _{req}	15 %	

Combined uncertainty, laboratory and field, system 2

Measuring device:		Serial-No.:		1180540010	
Measured component:		1h-alert threshold:		120	
49IQ		O ₃		nmol/mol	
No.	Performance characteristic	Performance criterion	Result	Partial uncertainty	Square of partial uncertainty
1	Repeatability standard deviation at zero	≤ 1.0 nmol/mol	0.200	U _{r,z} 0.05	0.0027
2	Repeatability standard deviation at 1h-alert threshold	≤ 3.0 nmol/mol	0.390	U _{r,h} not considered, as U _{r,h} = 0.1 < U _{r,f}	-
3	"lack of fit" at 1h-alert threshold	≤ 4.0% of measured value	1.480	U _{i,h} 1.03	1.0514
4	Sensitivity coefficient of sample gas pressure at 1h-alert threshold	≤ 2.0 nmol/mol/kPa	0.140	U _{gp} 1.62	2.6192
5	Sensitivity coefficient of sample gas temperature at 1h-alert threshold	≤ 1.0 nmol/mol/K	0.050	U _{gt} 0.55	0.2992
6	Sensitivity coefficient of surrounding temperature at 1h-alert threshold	≤ 1.0 nmol/mol/K	0.091	U _{st} 0.66	0.4404
7	Sensitivity coefficient of electrical voltage at 1h-alert threshold	≤ 0.30 nmol/mol/V	0.010	U _v 0.14	0.0194
8a	Interferent H ₂ O with 19 mmol/mol	≤ 10 nmol/mol (Zero) ≤ 10 nmol/mol (Span)	-0.890 -0.470	U _{H2O} -0.35	0.1230
8b	Interferent Toluene with 0.5 µmol/mol	≤ 5.0 nmol/mol (Zero) ≤ 5.0 nmol/mol (Span)	2.240 4.050	U _{int,pos} 5.01 or	25.1141
8c	Interferent Xylene with 0.5 µmol/mol	≤ 5.0 nmol/mol (Zero) ≤ 5.0 nmol/mol (Span)	2.450 4.630	U _{int,neg}	
9	Averaging effect	≤ 7.0% of measured value	-6.400	U _{av} -4.43	19.6608
10	Reproducibility standard deviation under field conditions	≤ 5.0% of average over 3 months	2.420	U _{r,f} 2.90	8.4332
11	Long term drift at zero level	≤ 5.0 nmol/mol	1.650	U _{l,z} 0.95	0.9075
12	Long term drift at span level	≤ 5.0% of max. of certification range	1.810	U _{l,h} 1.25	1.5725
18	Difference sample/calibration port	≤ 1.0%	0.080	U _{asc} 0.10	0.0092
21	Uncertainty of test gas	≤ 3.0%	2.000	U _{cg} 1.20	1.4400
Combined standard uncertainty			U _c 7.8545 nmol/mol		
Expanded uncertainty			U 15.7089 nmol/mol		
Relative expanded uncertainty			W 13.09 %		
Maximum allowed expanded uncertainty			W _{req} 15 %		