

CERTIFICATE

of Product Conformity (QAL1)

Certificate No.: 0000062064_01

Certified AMS: 49iQ for O₃

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

Test Institute: TÜV Rheinland Energy & Environment GmbH

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

Certification is awarded in respect of the conditions stated in this certificate
(this certificate contains 11 pages).
The present certificate replaces certificate 0000062064_00 dated 12 June 2019.



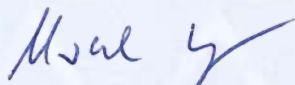
Suitability Tested
Complying with
2008/50/EC
EN 15267
Regular
Surveillance
www.tuv.com
ID 0000062064

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

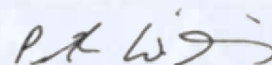
German Environment Agency
Dessau, 20 March 2024

This certificate will expire on:
25 March 2029

TÜV Rheinland
Energy & Environment GmbH
Cologne, 13 March 2024



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Test institute accredited to EN ISO/IEC 17025 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 2029
Certificate:	Renewal (of previous certificate 0000062064_00 of 12 June 2019 valid until 25 March 2024)
Publication:	BAnz AT 26.03.2019 B7, chapter III No. 3.1

Approved application

The tested AMS is suitable for continuous ambient air monitoring of O₃ (stationary operation).

The suitability of the AMS for these applications was assessed based on 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 that this AMS is suitable for monitoring the measured values relevant to the application.

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

Basis of the certification

This certification is based on:

- Test report 936/21242986/A dated 2 October 2018 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 26.03.2019 B7, chapter III No. 3.1,
Announcement by UBA 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 the performance test:

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

Software version:

Version: 1.5.1.32120

Restrictions:

None

Notes:

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

Test institute:

TÜV Rheinland Energy GmbH, Cologne

Report No.: 936/21242986/A dated 2 October 2018

Publication in the German Federal Gazette: BAnz AT 05.08.2021 B5, Chap. IV notification 15, Announcement by UBA dated 29 June 2021:

15 Notification as regards Federal Environment Agency (UBA) notice of 27 February 2019 (BAnz AT 26.03.2019, chapter III number 3.1)

The latest software version of the ambient air monitoring system 49iQ for Ozone manufactured by Thermo Fisher Scientific is:

01.06.10

In addition, the version 01.06.07 is available.

Statement issued by TÜV Rheinland Energy GmbH dated 25 February 2021

Publication in the German Federal Gazette: BAnz AT 28.07.2022 B4, Chap. III notification 51, Announcement by UBA dated 28 June 2022:

51 Notification as regards Federal Environment Agency (UBA) notices of 27 February 2019 (BAnz AT 26.03.2019 B7, chapter III number 3.1) and of 29 June 2021 (BAnz AT 05.08.2021 B5, chapter IV notification 15)

The current software version of the immission measuring device 49iQ for ozone from Thermo Fisher Scientific is:

01.06.12 (118209-00)

Version 01.06.11 (118209-00) is also available.

Statement issued by TÜV Rheinland Energy GmbH dated 18 May 2022

Publication in the German Federal Gazette: BAnz AT 20.03.2023 B6, Chap. IV notification 84, Announcement by UBA dated 21 February 2023:

84 Notification as regards Federal Environment Agency (UBA) notices of 27 February 2019 (BAnz AT 26.03.2019, chapter III number 3.1) and of 28 June 2022 (BAnz AT 28.07.2022 B4, chapter III notification 51)

The current software version of the 49iQ ambient air measuring system for O₃ from Thermo Fisher Scientific is:

01.06.14.34444

In addition, the versions 01.06.13.34155 and 01.06.14.34442 are available. To increase operational reliability, a "footprint" has been corrected on the optional analog IO board of the measuring system.

Statement issued by TÜV Rheinland Energy GmbH dated 15 September 2022

Certified product

This certificate 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_o). 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 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 & Environment 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 & Environment 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 & Environment 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.

History of documents

Certification of 49iQ 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. 0000062064_00: 12 June 2019
Expiry date of the certificate: 25 March 2024
Test report: 936/21242986/A dated 2 October 2018
TÜV Rheinland Energy GmbH
Publication: BAnz AT 26.03.2019 B7, chapter III number 3.1
UBA announcement dated 27 February 2019

Notifications

Statement issued by TÜV Rheinland Energy GmbH dated 25 February 2021
Publication: BAnz AT 05.08.2021 B5, chapter IV notification 15
UBA announcement dated 29 June 2021
(Software change/Softwareänderung)

Statement issued by TÜV Rheinland Energy GmbH dated 18 May 2022
Publication: BAnz AT 28.07.2022 B4, chapter III notification 51
UBA announcement dated 28 June 2022
(Software changes)

Statement issued by TÜV Rheinland Energy GmbH dated 15 September 2022
Publication: BAnz AT 20.03.2023 B6, chapter IV notification 84
UBA announcement dated 21 February 2023
(Soft- and hardware changes)

Renewal of certificate

Certificate No. 0000062064_01: 20 March 2024
Expiry date of the certificate: 25 March 2029

Expanded uncertainty laboratory, system 1

Measuring device:		Serial-No.:		1180540009	
Measured component:		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}	0.0024
2	Repeatability standard deviation at 1h-alert threshold	≤ 3.0 nmol/mol	0.340	u _{r,th}	0.0077
3	"lack of fit" at 1h-alert threshold	≤ 4.0% of measured value	1.880	u _{lf,th}	1.6965
4	Sensitivity coefficient of sample gas pressure at 1h-alert threshold	≤ 2.0 nmol/mol/kPa	0.200	u _{sp}	5.1939
5	Sensitivity coefficient of sample gas temperature at 1h-alert threshold	≤ 1.0 nmol/mol/K	0.090	u _{gt}	0.9893
6	Sensitivity coefficient of surrounding temperature at 1h-alert threshold	≤ 1.0 nmol/mol/K	0.115	u _{st}	0.7034
7	Sensitivity coefficient of electrical voltage at 1h-alert threshold	≤ 0.30 nmol/mol/V	0.020	u _v	0.0752
8a	Interferent H ₂ O with 19 mmol/mol	≤ 10 nmol/mol (Zero)	-2.030	u _{H2O}	-1.25
		≤ 10 nmol/mol (Span)	-1.670		
8b	Interferent Toluene with 0.5 µmol/mol	≤ 5.0 nmol/mol (Zero)	1.460	u _{tol,pos}	
		≤ 5.0 nmol/mol (Span)	4.270	or	27.1201
8c	Interferent Xylene with 0.5 µmol/mol	≤ 5.0 nmol/mol (Zero)	2.300		
		≤ 5.0 nmol/mol (Span)	4.750	u _{int,neg}	
9	Averaging effect	≤ 7.0% of measured value	-5.400	u _{av}	13.9968
18	Difference sample/calibration port	≤ 1.0%	0.170	u _{asc}	0.0416
21	Uncertainty of test gas	≤ 3.0%	2.000	u _{cg}	1.4400
Combined standard uncertainty				u _c	7.2663
Expanded standard uncertainty				U	14.5327
Relative expanded uncertainty				W	12.11
Maximum allowed expanded uncertainty				W _{req}	15

Expanded uncertainty laboratory, system 2

Measuring device:		49IQ		Serial-No.:		1180540010	
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	0.200	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 _{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}	5.01	25.1141	
		≤ 5.0 nmol/mol (Span)	4.050	or			
8c	Interferent Xylene with 0.5 µmol/mol	≤ 5.0 nmol/mol (Zero)	2.450				
		≤ 5.0 nmol/mol (Span)	4.630	u _{int,neg}			
9	Averaging effect	≤ 7.0% of measured value	-6.400	u _{av}	-4.43	19.6608	
18	Difference sample/calibration port	≤ 1.0%	0.080	u _{ssc}	0.10	0.0092	
21	Uncertainty of test gas	≤ 3.0%	2.000	u _{cg}	1.20	1.4400	
				Combined standard uncertainty		u _c	
				Expanded uncertainty		U	
				Relative expanded uncertainty		W	
				Maximum allowed expanded uncertainty		W _{req}	
						7.1267 nmol/mol	
						14.2534 nmol/mol	
						11.88 %	
						15 %	

Combined uncertainty, laboratory and field, system 1

Measuring device:		49IQ		Serial-No.: 1180540009		120		nmol/mol		
Measured component:		O ₃		1h-alert threshold:		0.05		-		
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}	0.0024					
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 _{r,h}	1.30	1.6965				
4	Sensitivity coefficient of sample gas pressure at 1h-alert threshold	≤ 2.0 nmol/mol/kPa	0.200	u _{sp}	2.28	5.1939				
5	Sensitivity coefficient of sample gas temperature at 1h-alert threshold	≤ 1.0 nmol/mol/K	0.090	u _{st}	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				
8b	Interferent Toluene with 0.5 µmol/mol	≤ 10 nmol/mol (Span)	-1.670	u _{int,pos} or	5.21	27.1201				
		≤ 5.0 nmol/mol (Zero)	1.460							
8c	Interferent Xylene with 0.5 µmol/mol	≤ 5.0 nmol/mol (Span)	4.270	u _{int,neg}	-3.74	13.9968				
		≤ 5.0 nmol/mol (Zero)	2.300							
9	Averaging effect	≤ 7.0% of measured value	-5.400	u _{av}	2.90	8.4332				
10	Reproducibility standard deviation under field conditions	≤ 5.0% of average over 3 months	2.420	u _{r,f}	1.09	1.1907				
11	Long term drift at zero level	≤ 5.0 nmol/mol	1.890	u _{d,t,z}	-1.87	3.4992				
12	Long term drift at span level	≤ 5.0% of max. of certification range	-2.700	u _{d,t,h}	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}						
Combined standard uncertainty			U _c							nmol/mol
Expanded uncertainty			U							nmol/mol
Relative expanded uncertainty			W							%
Maximum allowed expanded uncertainty			W _{req}							%

Combined uncertainty, laboratory and field, system 2

Measuring device:		49IQ		Serial-No.: 1180540010		nmol/mol	
Measured component:		O ₃		1h-alert threshold:		120	
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 _{l,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)	-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 _{tol,pos}			
		≤ 5.0 nmol/mol (Span)	4.050	or	5.01	25.1141	
8c	Interferent Xylene with 0.5 µmol/mol	≤ 5.0 nmol/mol (Zero)	2.450	U _{tol,reg}			
		≤ 5.0 nmol/mol (Span)	4.630				
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 _{d,z}	0.95	0.9075	
12	Long term drift at span level	≤ 5.0% of max. of certification range	1.810	U _{d,h}	1.25	1.5725	
18	Difference sample/calibration port	≤ 1.0%	0.080	U _{ssc}	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 %