Umwelt Bundesamt

TÜVRheinland®
Precisely Right.

CERTIFICATE

of Product Conformity (QAL1)

Certificate No.: 0000074626

Certified AMS:	AGAM Q1 for Temperature in combustion gases
Manufacturer:	Bonnenberg & Drescher GmbH Industriepark Emil Mayrisch 52457 Aldenhoven Germany
Test Institute:	TÜV Rheinland Energy GmbH

This is to certify that the AMS has been tested and found to comply with the standards: EN 15267-1 (2009), EN 15267-2 (2009), EN 15267-3 (2007) and EN 14181 (2014) as well as the uniform practice in monitoring emissions 2017.

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

TÜVRheinland® CERTIFIED

Suitability Tested
EN 15267
QAL1 Certified
Regular
Surveillance

www.tuv.com
ID 0000074626

Publication in the German Federal Gazette (BAnz.) of 03 May 2021

This certificate will expire on: 02 May 2026

German Federal Environment Agency
Dessau, 02 June 2021

Dr. Marcel Langner
Head of Section II 4.1

TÜV Rheinland Energy GmbH
Cologne, 01 June 2021

ppa. Dr. Peter Wilbring

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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:	936/21247465/A of 17 August 2020
Initial certification:	03 May 2021
Expiry date:	02 May 2026
Publication:	BAnz AT 03.05.2021 B9, chapter II number 4.1

Approved application
The tested AMS is suitable for use at combustion plants according to Directive 2010/75/EU, chapter III (13th BImSchV), at waste incineration plants according to Directive 2010/75/EU, chapter IV (17th BImSchV), 27th BImSchV, 30th BImSchV, 44th BImSchV and TA Luft. The measured ranges have been selected so as to ensure as broad a field of application as possible.

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

The AMS is 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 temperatures 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 936/21247465/A of 17 August 2020 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 03.05.2021 B9, chapter II number 4.1
Announcement by UBA dated 31 March 2021:

AMS designation:
AGAM Q1 for Temperature in combustion gases

Manufacturer:
Bonnenberg & Drescher GmbH**,** Aldenhoven

Field of application:
For measurements at plants requiring official approval and plants according to 27. BImSchV

Measuring ranges during the performance test:

Component	Certification range	Unit
Temperature	50 - 1500	°C

Software version:
4.3

Restrictions:
None

Notes:

1. The maintenance interval is four weeks.
2. The manufacturer must provide a transmission cone that is individually adapted to the respective installation situation. If, for example, the transfer cone has to be installed by the boiler manufacturer, the equipment manufacturer must send a corresponding technical drawing and check that the installation is correct.
3. A computer with an up-to-date web browser is required to display measured values and status messages.

Test report:
TÜV Rheinland Energy GmbH, Cologne
Report No.: 936/21247465/A of 17 August 2020

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

The measuring system consists of transmitter and receiver units, transmission cones and the control unit.
Each unit can act as a transmitter and / or receiver. Compressed air serves as the sound source. The transmission signal is generated by opening a solenoid valve in the compressed air line. The transfer cones form the connection between the sound horn and the combustion chamber. The control unit switches the 24 V solenoid valves of the units acting as transmitters, records and digitizes the preamplifier signals and calculates and visualizes path and zone temperatures as well as the tomography image.
This process data is processed and displayed via the CPU module. The user accesses the CPU module directly via the web UI and can, for example, display the current process data.

Transmitter and receiver units
The transmitter and receiver units on the boiler are used to generate and record the sound signals generated with compressed air. The units are identical, they differ in their function for the respective path.
A transmitter and receiver unit consists of:

- Preamplifier box with preamplifier, terminal block and on / off switch
- Sound horn with flange for connection to the transmission cone
- Piezo microphone at the end of the horn
- Solenoid valve with nozzle at the beginning of the horn
- Transfer cone

Sound horn
The sound horn is a conical socket made of cast high-quality stainless steel. A DN80 / PN6 socket is used to connect to the combustion chamber. In front of the flange there are two R ¾ " pipe tapped holes for the piezo microphone and a dummy plug. At the end of the horn there are tapped holes for the valve / sound nozzle connection and a G 1 ¼" dummy plug for inspection.

Piezo microphone
The piezo microphone is a robust pressure transducer made of stainless steel (Hastelloy C276) that is screwed into one of two threaded holes just before the flange. The signal line is protected against damage by a metal hose and is connected to the preamplifier in the preamplifier box.

Solenoid valve with sound nozzle
The transmission signal is generated by opening the solenoid valve (24 V DC). The valve is connected to the acoustic horn via a sonic nozzle, through which the generated signal is transmitted to the boiler. Due to the geometry of the sound horn - the design of a built-in funnel in the nozzle - a white noise signal with high intensity is generated by compressed air.

Preamplifier box
In addition to the preamplifier, the 24 V control cable for the solenoid valve is placed in the preamplifier box and routed over a switch. This switch can stop the transmission process, the energization of the solenoid valve. In addition, the switch is coupled to the control unit, which can recognize the switch position. The preamplifier converts the charge delivered by the microphone into voltage and passes this on to the control unit. The send / receive signals are tapped at the "out" contact of the preamplifier. A sound horn can be connected to each preamplifier box.

Transmission cone
The transmission cone is used to connect the sound horn to the boiler opening. This is manufactured individually for each AGAM measuring system. The flange, the cone diameter and the cone length are varied on the customer side.
The transmission cone does not apply to the conical design of the wall duct.

Control unit
The control unit is placed in a separate control cabinet and contains the IPC, which undertakes all central tasks.
The control of the solenoid valves, the acquisition and digitization of the preamplifier signals and the calculation and visualization of the path temperatures, zone temperatures and the tomography image.

CPU module with hard disk extension and power supply unit
The CPU module undertakes all relevant tasks in the AGAM Q1 measuring system. This includes the control of the solenoid valves via the I / O modules, the processing of the preamplified received signals and the processing, display and saving of the raw and process data. The operator accesses the CPU module directly via the web UI and can thus access current or historical data and displays.
All programs and functions are saved together with the operating system (Windows 10 IOT) on a CFast card. All process data are saved on a separate hard disk.

User interface Web UI
All work steps required for operation are carried out via the browser-based network user interface (web UI). After starting the control unit, all necessary processes are started automatically. The prerequisite for operating the AGAM measuring system is the Ethernet connection between PC and CPU module in the same IP address range.

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 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. 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**.

History of documents

Certification of AGAM Q1 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. 0000074626: 02 June 2021
Expiry date of the certificate: 02 May 2026
Test report 936/21247465/A dated 17 August 2020
TÜV Rheinland Energy GmbH, Cologne
Publication: BAnz AT 03.05.2021 B9, chapter II number 4.1
Announcement by UBA dated 31 March 2021

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

Measuring system			
Manufacturer		Bonnenberg & Drescher GmbH	
AMS designation		AGAM Q1	
Serial number of units under test		PCU-G3-QAL-2019-P780-1910I-1 / PCU-G3-QAL-2019-P780-1910I-2	
Measuring principle		sound velocity	
Test report		936/21247465/A	
Test laboratory		TÜV Rheinland	
Date of report		2020-08-17	
Measured component		Temperature	
Certification range		50 - 1500	°C
Evaluation of the cross-sensitivity (CS)			
(system with largest CS)			
Sum of positive CS at zero point		0.00	°C
Sum of negative CS at zero point		0.00	°C
Sum of postive CS at span point		0.00	°C
Sum of negative CS at span point		0.00	°C
Maximum sum of cross-sensitivities		0.00	°C
Uncertainty of cross-sensitivity	u_i	0.000	°C

Calculation of the combined standard uncertainty

Tested parameter				u^2	
Standard deviation from paired measurements under field conditions *	u_D	7.600	°C	57.760	(°C)²
Lack of fit	u_{lof}	3.464	°C	11.999	(°C)²
Zero drift from field test	$u_{d,z}$	0.000	°C	0.000	(°C)²
Span drift from field test	$u_{d,s}$	0.866	°C	0.750	(°C)²
Influence of ambient temperature at span	u_t	1.097	°C	1.203	(°C)²
Influence of supply voltage	u_v	0.000	°C	0.000	(°C)²
Cross-sensitivity (interference)	u_i	0.000	°C	0.000	(°C)²
Uncertainty of reference material at 70% of certification range	u_{rm}	12.124	°C	147.000	(°C)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)	$u_c = \sqrt{\sum (u_{max,j})^2}$	14.79	°C
Total expanded uncertainty	$U = u_c * k = u_c * 1.96$	28.99	°C

Relative total expanded uncertainty	**U in % of the LV 850 °C**	**3.4**
Requirement of 2010/75/EU	**U in % of the LV 850 °C**	**10.0**
Requirement of EN 15267-3	U in % of the LV 850 °C	7.5