

CONFIRMATION

of Product Conformity (QAL1)

Approved AMS: ACF5000 LCS for CO, NO, NO₂, NO_x, N₂O, SO₂, HCl, HF, NH₃, CH₄, CH₂O, TOC, O₂, H₂O and CO₂

Manufacturer: ABB AG
Stierstädter Str. 5
60488 Frankfurt/Main
Germany

Test Institute:: TÜV Rheinland Energy & Environment GmbH

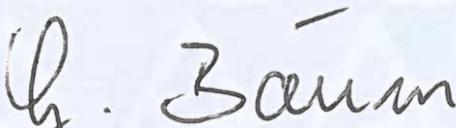
**This is to certify that the AMS has been tested
according to the standards**

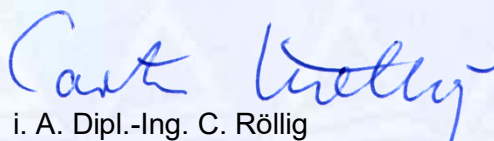
**EN 15267-1 (2009), EN 15267-2 (2023), EN 15267-3 (2023),
EN 12619 (2013) as well as EN 14181 (2014).**

The AMS underwent independent expert testing and was accepted.
This confirmation is valid up to the publication of the certificate,
but no longer than 9 months from the date of issue
(this document contains 7 pages).

This confirmation is valid until: 31 December 2026

TÜV Rheinland Energy & Environment GmbH
Cologne, 10 April 2026


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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 certificate D-PL-11120-02-00.

Confirmation:
10 April 2026

Test Report: EuL/21269395/A dated 21 October 2025

Expiry date: 31 December 2026

Approved application

The tested AMS is suitable for use at plants according to Directive 2010/75/EC, chapter III (combustion plants / 13th BImSchV:2021), Directive 2010/75/EC, chapter IV (waste incineration plants / 17th BImSchV:2024), Directive 2015/2193/EC (44th BImSchV:2022), TA Luft:2021 and 30th BImSchV:2019. 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.

The AMS is approved for an ambient temperature range of +5 °C to 45 °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 emission limit values and oxygen concentration relevant to the application.

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

Note

The legal regulations mentioned do not correspond to the current state of legislation in every case. Each user should, if necessary, in consultation with the competent authority, ensure that this AMS meets the legal requirements for the intended use. In addition, it cannot be ruled out that legal regulations governing the use of a measuring device for emission monitoring may change during the lifetime of the certificate.

Basis of the confirmation

This confirmation is based on:

- Test report EuL/21269395/A dated 21 October 2025 issued by TÜV Rheinland Energy & Environment GmbH
- The ongoing surveillance of the product and the manufacturing process
- Expert testing and approval by an independent body

Confirmation:
10 April 2026

AMS designation:

ACF5000 LCS for CO, NO, NO₂, NO_x, SO₂, HCl, HF, NH₃, CH₂O, N₂O, CH₄, H₂O, TOC, CO₂ and O₂

Manufacturer:

ABB AG, Frankfurt am Main, Germany

Field of application:

For installations requiring approval under the 13th BImSchV, the 17th BImSchV, the 30th BImSchV, the TA Luft and the 44th BImSchV

Measuring ranges during performance testing:

Component	Certification range	Supplementary measuring range	Unit
CO	0 – 15	0 – 150	mg/m ³
NO	0 – 50	0 – 400	mg/m ³
NO ₂	0 – 60	0 – 600	mg/m ³
NO _x as NO ₂	0 – 60	0 – 615	mg/m ³
SO ₂	0 – 7,5	0 – 300	mg/m ³
HCl	0 – 3	0 – 90	mg/m ³
HF	0 – 1.35	0 – 6	mg/m ³
NH ₃	0 – 3	0 – 22.5	mg/m ³
CH ₂ O	0 – 12.5	0 – 20	mg/m ³
N ₂ O	0 – 50	0 – 300	mg/m ³
CH ₄	0 – 5	0 – 200	mg/m ³
H ₂ O	0 – 40	-	Vol.-%
TOC	0 – 15	0 – 30	mg/m ³
CO ₂	0 – 30	-	Vol.-%
O ₂	0 – 25	-	Vol.-%

Software version:

Syscon3: V5.5.0
AMC: V3.9.8
FTIR: V3.0.0.146
FTIR-Model Standard: V1.9.9.39

Restrictions:

none

Confirmation:
10 April 2026

Notes:

1. When testing HF, HCl, NH₃ and CH₂O, humid test gases must be used.
2. For the reference point check (QAL3) of the components measured by the FTIR, the internal automatic validation unit may be used as an alternative to test gases.
3. The measuring system may be operated within a temperature range of 5 to 45 °C.
4. The maintenance interval is four weeks.
5. The measuring system has a digital interface for data transmission in accordance with VDI Guideline 4201, Part 1 (General Requirements), Part 2 (Profibus) and Part 3 (Modbus EIA485 and TCP/IP).
6. The CEM-DAS data acquisition and evaluation unit can be optionally integrated into the system cabinet.
7. The work involved in investigating availability must be spread over several days in order to meet the requirements of the 13th and 17th BImSchV.

Test Institute: TÜV Rheinland Energy & Environment GmbH, Cologne
Report No.: EuL/21269395/A dated 21 October 2025

Tested product

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

The ACF5000 LCS measurement system is a multi-component measurement system comprising a Fourier-transform infrared spectrometer (FTIR spectrometer) for the determination of the components CO, NO, NO₂, N₂O, SO₂, HCl, HF, NH₃, H₂O, CO₂, CH₂O and CH₄, a flame ionisation detector (FID) for determining the total C component, and a zirconium dioxide probe for determining the O₂ component. The NO_x component is calculated from the measurement data for NO and NO₂.

Fourier transform infrared spectrometer (FTIR spectrometer)

The concentrations of a wide range of exhaust gas components exhibiting absorption bands in the mid-infrared region are determined.

Each gas absorbs infrared radiation in a spectral range specific to it. The absorption of radiation at the respective wavelength is a function of the gas concentration. The FTIR analyser measures how much radiation has been absorbed at specific wavelengths.

The information regarding the absorption processes is processed by the system electronics and converted into measured values. The spectra of all components are recorded simultaneously.

Optionally, an internal test device can be installed in the spectrometer's optical path to validate the accuracy of the spectrometer's calibration. The so-called validation unit allows the automated, sequential insertion of gas-filled validation cuvettes and special validation foils (depending on the measurement component) into the optical path (in front of the FTIR cuvette) of the FTIR spectrometer. The optical path is identical to that used in normal measurement mode. The validation foils are characterised by the fact that they exhibit specific absorption spectra precisely within the spectral ranges in which the respective FTIR measurement components are identified and determined on the basis of their absorption spectra during measurement operation. Measurement values for all FTIR measurement components can therefore be determined directly from the absorption spectra of the validation foils during automatic validation operation. These are then automatically recorded in a control chart and monitored with regard to drift and precision requirements. For the measurement of the validation foils and cuvettes, the evaluation model is modified, as different reference spectra are stored for the validation media. In addition to the automatic QAL3 check at the endpoint, an automated QAL3 check at the zero point is also performed during the cycle for all FTIR components using purified instrument air (zero air).

The validation wheel can be swivelled in at freely selectable intervals and does not affect availability. For example, if the validation wheel is swivelled in daily, problems can be detected much more quickly.

The validation unit thus enables QAL3 checks of the FTIR components without test gas in accordance with EN 14181:2014 Chapter 7.3. As test gases must be available for the FID and the O₂ sensor, which are automatically introduced at regular intervals, leaks can be detected.

Flame Ionisation Detector (FID)

In the flame ionisation detector, the ionisation of hydrocarbons in a hydrogen flame can be utilised as a measuring effect. The test gas is fed into the combustion chamber alongside hydrogen as the fuel gas and the combustion air (hydrocarbon-free). The ring electrode is located above the burner nozzle over which the flame burns. An electric field forms between the electrode sleeve and the burner nozzle. In the flame, the hydrocarbons are broken down and ionised. The ions are collected in the electric field and converted into a measurement signal. The ion current is proportional to the carbon content (unoxidised) of the organic substances. Carbon atoms that are already partially oxidised are only detected proportionally. CO₂ and CO have no influence on the measurement. Component-specific measurement is not possible with the FID; the total of all hydrocarbon atoms contained in the gas is determined. The different response factors for the FID indicate the varying sensitivity to the hydrocarbon atoms.

During the proficiency test, the measuring system was operated in such a way that the zero (nitrogen) and reference points (test gas) were automatically adjusted with test gas every 21 days.

Zirconium dioxide probe

The sensor generates a millivolt signal between the measuring and reference electrodes. This voltage is caused by a potential difference resulting from different oxygen partial pressures at the electrodes. The measuring electrode is exposed to the smoke or exhaust gas, whilst the reference electrode is surrounded by a reference gas (ambient air with 20.95% by volume O₂). When different oxygen concentrations occur on the measuring and reference sides of the measuring cell, oxygen ions migrate from the side with the higher partial pressure to the side with the lower partial pressure. The output signal of the cell is inversely proportional to the oxygen concentration of the measuring gas. As the oxygen concentration in the measuring gas decreases, the corresponding signal from the measuring cell increases.

During the suitability test, the measuring device was operated in such a way that the zero point (test gas; 2% by volume) and reference point (instrument air) were automatically adjusted with test gas every 14 days.

The zirconium dioxide principle is based on the Nernst equation for galvanic oxygen concentration cells:

$$U_{eq} = R T / z_r F \ln [p(O_2') / p(O_2'')]$$

- R Universal gas constant (8.31446 J/(mol K))
- T Kelvin temperature (273.15 °C)
- z_r Reaction charge number (4)
- F Faraday constant (96485.3 C/mol)
- p(O₂') Partial pressure of oxygen in the process gas
- p(O₂'') Partial pressure of oxygen in the reference gas

Modbus/Profibus interface

The ACF5000 LCS can be connected to a PROFIBUS network as a PROFIBUS slave via the PROFIBUS module. The PROFIBUS module provides an RS485 and an MBP interface. Information from the ACF5000 LCS gas analysers is transmitted via PROFIBUS to a PC, a PLC or a process control system. Measured values, status signals and the signals from the analogue and digital inputs are thus made available for further processing. No additional hardware is required for the Modbus interface.

Scope and configuration of the measuring system

The gas to be measured is sampled in the gas duct using a gas sampling probe and routed to the analysis cabinet via a heated sample gas line. The probe contains a particle filter which removes dust from the gas. The control system of the analysis system offers, as standard, the option of automatically switching on zero gas and test gas at the probe upstream of the filter element. Automatic cleaning of the probe filter is available as an option. The FTIR analyser, the FID and the zirconium dioxide sensor are all fed simultaneously; the sample gas is split and fed to all three analysers.

The gas path from the sampling point to the analyser is continuously heated (180°C) and regulated and monitored by the system electronics to prevent the flue gas falling below the dew point or condensing.

For process measurements, a heated measurement point switchover can be configured as an option.

The sample is fed to the analyser according to the injector principle via an air jet injector, which is integrated into the heated conditioning block (ASP block). This, in turn, is directly connected to the heated gas cell.

Test gases can be introduced both automatically and manually; both at the gas sampling probe and directly at the analyser. All current concentrations of the individual measurement components and status signals are displayed on the system display.

The system controller is tailored to the requirements of both emissions and process measurement and offers interfaces such as an internal CAN bus and fieldbus systems like Modbus and Profibus. An Ethernet interface is available for remote monitoring of the entire analysis system and for data transmission via internal or external TCP/IP networks. Remote control of the analysis system via a UMTS router is possible. Analogue outputs for the measurement components and relay contacts for fault/status messages are standard.

The measured values are output at a cycle time of approx. 30 seconds.

The measurement system tested here consists of:

- Heated (180 °C) Sampling probe with filter ABB GAC125 and probe tube ABB Type 40 or ABB Type 42
- Heated measurement gas line (180 °C) ABB TBL01, internal diameter 6 mm, Teflon material, max. 60 m length
- Analysis cabinet with:
 - Interferometer (including internal test device for validating the spectrometer adjustment (validation unit))
 - FID
 - O₂ sensor
 - Air conditioner
 - Cooling unit
 - CEMS DAS (DAHS)