

CERTIFICATE

of Product Conformity (QAL1)

Certificate No.: 0000040333_04

AMS designation: AR602Z/NHg for NO, NO₂, SO₂, NH₃ and Hg as well as
AR602Z/N for NO, NO₂, SO₂ and NH₃

Manufacturer: Opsis AB
Skytteskogsvägen 16
244 02 Furulund
Sweden

Test Laboratory: 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 (2004)**

Certification is awarded in respect of the conditions stated in this certificate
(this certificate contains 12 pages).
The present certificate replaces certificate 0000040333_03 of 01 April 2019.



Suitability Tested
EN 15267
QAL1 Certified
Regular Surveillance

www.tuv.com
ID 0000040333

Publication in the German Federal Gazette
(BAnz) of 02 April 2015

German Federal Environment Agency
Dessau, 01 July 2020



Dr. Marcel Langner
Head of Section II 4.1

This certificate will expire on:
30 June 2025

TÜV Rheinland Energy GmbH
Cologne, 30 June 2020



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TÜV Rheinland Energy GmbH
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51105 Köln

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.

Test Report:	936/21222333/C dated 8 September 2014
Initial certification:	01 April 2014
Expiry date:	30 June 2025
Certificate:	Renewal (of previous certificate 0000040333_03 dated 01 April 2019 valid until 30 June 2020)
Publication:	BAnz AT 02.04.2015 B5, chapter I number 3.2 and chapter IV notification 36

Approved application

The tested AMS is suitable for use at combustion plants according to Directive 2010/75/EU, chapter III (13th BImSchV), chapter IV (17th BImSchV), 30th BImSchV, plants in compliance with TA Luft and plants according to the 27th BImSchV. 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 12-months field test at a municipal waste incinerator.

The AMS is approved for an ambient temperature range of +5 °C to +40 °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 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 no. 936/21222333/C dated 8 September 2014 issued by TÜV Rheinland Energie und Umwelt 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 02.04.2015 B5, chapter I number 3.2 and chapter IV notification 36, UBA announcement dated 25 February 2015:

AMS designation:

AR602Z/NHg for NO, NO₂, SO₂, NH₃ and Hg as well as AR602Z/N for NO, NO₂, SO₂ and NH₃

Manufacturer: OPSIS AB, Furulund, Sweden

Field of application:

For plants requiring official approval and for plants according to the 27th BImSchV

Measuring ranges during performance testing:

Component	Certification range	supplementary range	Unit
NO	0–150*	0–500*	mg/m ³
NO ₂	0–20*	0–500*	mg/m ³
SO ₂	0–75*	0–500*	mg/m ³
NH ₃	0–10*	0–50*	mg/m ³
Hg	0–45	0–100	µg/m ³

* at a measurement path length of 1.0 meter

Software version: 7.21

Restrictions:

1. During performance testing, the requirement of EN 15267-3 with regard to response time was not met for the component Hg.
2. During performance testing in accordance with EN 15267-3, the requirement for the degree of protection provided by the enclosure was not fulfilled.

Notes:

1. The maintenance interval is three months for the AR602Z/NHg measuring system and six months for the AR602Z/N measuring system.
2. The measurement path length was 1 m during the lab test and 2 m during the field test.
3. The components NO, NO₂, SO₂ and NH₃ are determined in-situ. The component Hg can also be measured by using the external measurement cell EX060H module (the measurement path length being 2 m) and the MX004 multiplexer module. In this set-up, the measuring system is named AR602Z/NHg. If the component Hg is not included (AR602Z/N), the light path shall remain unchanged.
4. In order to perform regular span point checks for the component Hg, a test gas generator (e. g. HovaCal) must be available.
5. In order to compensate for cross-sensitivity as regards component Hg, the SO₂ content (displayed as XXX) in the heated measuring cell has to be determined.
6. During the laboratory and field tests, the length of the heated test gas line for the component Hg was 10 m.
7. If the component Hg is included in the measurements (AR602Z/NHg), the filters within the sampling probe shall be checked and, if necessary, replaced after revision or malfunctions occurring during waste gas scrubbing.
8. Supplementary testing (extension of the maintenance interval) as regards Federal Environment Agency notices of 17 July 2014 (BAnz AT 05.08.2014 B11, chapter I number 4.2).

Test Report:

TÜV Rheinland Energie und Umwelt GmbH, Cologne
Report no.: 936/21222333/C dated 8 September 2014

Publication in the German Federal Gazette: BAnz AT 02.04.2015 B5, chapter I number 3.2 and chapter IV notification 36, UBA announcement dated 25 February 2015:

36 Notification as regards Federal Environment Agency (UBA) notice of 17 July 2014 (BAnz AT 05.08.2014 B11, chapter I number 4.2)

The step motor for the automatic grid finding, Type RDM 543/100A manufactured by BERGER LAHR in the measuring system AR602Z/N for NO, NO₂, SO₂ and NH₃ as well as AR602Z/NHg for NO, NO₂, SO₂, NH₃ and Hg of the company Opsis AB was discontinued and therefore replaced by the step motor for the automatic grid finding of Type RDM 545/100A manufactured by BERGER LAHR.

Statement issued by TÜV Rheinland Energie und Umwelt GmbH dated 20 September 2014

Publication in the German Federal Gazette: BAnz AT 26.08.2015 B4, chapter V notification 15, UBA announcement dated 22 July 2015:

15 Notification as regards Federal Environment Agency (UBA) notices of 17 July 2014 (BAnz AT 05.08.2014 B11, chapter I number 4.2) and of 25 February 2015 (BAnz AT 02.04.2015 B5, chapter IV 36th notification)

The AR602Z/N measuring system for SO₂, NO, NO₂ and NH₃ and AR602Z/NHg for SO₂, NO, NO₂, NH₃ and Hg manufactured by Opsis AB may be equipped with the option "ER060/062AUTO with automatic QAL3 test system" for the purpose of automatic and regular functional tests on the basis of the key component NO. The option "ER060/062AUTO with automatic QAL3 test system" is not used for checking the measuring system and does not replace the necessary manual zero and span checks in the maintenance interval. It merely delivers additional information on the AMS status in between external test gas applications.

Statement issued by TÜV Rheinland Energie und Umwelt GmbH dated 23 March 2015

Certified product

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

The AMS AR602Z/NHg for NO, NO₂, SO₂, NH₃ and Hg, as well as its variant the AR602Z/N for NO, NO₂, SO₂ and NH₃ is an in-situ measuring system, which operates according to the principle of DOAS measurement. The tested measuring system consists of a light source, a receiver, a fibre optic cable and an analyser. With the Differential Optical Absorption Spectroscopy (DOAS), the measuring components are determined in the analyser by way of the characteristic absorption of radiation in the UV range by gaseous components.

The measuring path consists of a light path between a light emitter and a light receiver. The light source in the emitter is a high-pressure xenon lamp.

The light beam generated by the emitter is directed towards the receiver. On its path through the medium, the intensity of the light beam is affected by scattering and absorption by molecules and particles.

The light collected by the receiver is led to the analyser via a fibre optic cable. This cable merely serves as a means to facilitate the installation of the analyser at a location where it is protected from dust, excessive moisture, variations in temperature etc.

The measuring system consists of:

- Analyser (AR602Z/N)
- Emitter unit (EM062)
- Receiver unit (RE062)
- Fibre optic cable (OF60 R3)
- Manual

The module for measuring mercury also comprises:

- Sample gas probe SP2000 (manufacturer M&C) in Opsis yellow
- Heated sample gas pipe with interior diameter of 6 mm (length 10 m)
- Heated sample gas cell with an active measuring path length of 2.0 m, including emitter/receiver unit, converter, suction jet pump, flow monitoring, power pack and temperature control (EX060)
- Multiplexer (MX004)

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 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 AR602Z/NHg 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. 0000040333: 29 April 2014
Expiry date of the certificate: 31 March 2019
Test Report: 936/21222333/A dated 10 October 2013
TÜV Rheinland Energie und Umwelt GmbH, Cologne
Publication: BAnz AT 01.04.2014 B12, chapter I number 3.2
UBA announcement dated 27 February 2014

Supplementary testing according to EN 15267

Certificate no. 0000040333_01: 09 September 2014
Expiry date of the certificate: 31 March 2019
Test Report: 936/21222333/B dated 17 February 2014
TÜV Rheinland Energie und Umwelt GmbH, Cologne
Publication: BAnz AT 05.08.2014 B11, chapter I number 4.2
UBA announcement dated 17 July 2014

Certificate no. 0000040333_02: 30 April 2015
Expiry date of the certificate: 31 March 2019
Test Report: 936/21222333/C dated 8 September 2014
TÜV Rheinland Energie und Umwelt GmbH, Cologne
Publication: BAnz AT 02.04.2015 B5, chapter I number 3.2
UBA announcement dated 25 February 2015

Notifications in accordance with EN 15267

Statement issued by TÜV Rheinland Energie und Umwelt GmbH dated 20 September 2014
Publication: BAnz AT 02.04.2015 B5, chapter IV notification 36
UBA announcement dated 25 February 2015
(new step engine)

Statement issued by TÜV Rheinland Energie und Umwelt GmbH dated 23 March 2015
Publication: BAnz AT 26.08.2015 B4, chapter V notification 15
UBA announcement dated 22 July 2015
(software updates)

Renewal of the certificate

Certificate no. 0000040333_03: 01 April 2019
Expiry date of the certificate: 30 June 2020

Renewal of the certificate

Certificate no. 0000040333_04: 01 July 2020
Expiry date of the certificate: 30 June 2025

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

Measuring system

Manufacturer	Opsis AB
AMS designation	AR602Z/NHg
Serial number of units under test	1759 / 1760
Measuring principle	UV-DOAS

Test report

Test laboratory	TÜV Rheinland
Date of report	2014-09-08

Measured component

Certification range	Hg	0 - 45 µg/m³
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Evaluation of the cross-sensitivity (CS)

(system with largest CS)

Sum of positive CS at zero point	0.00 µg/m³
Sum of negative CS at zero point	-0.50 µg/m³
Sum of positive CS at span point	1.00 µg/m³
Sum of negative CS at span point	-1.10 µg/m³
Maximum sum of cross-sensitivities	1.20 µg/m³
Uncertainty of cross-sensitivity	0.694 µg/m³

Calculation of the combined standard uncertainty

Tested parameter

		u^2
Repeatability standard deviation at set point *	u_r 0.450 µg/m³	0.203 (µg/m³)²
Lack of fit	u_{lof} 0.404 µg/m³	0.163 (µg/m³)²
Zero drift from field test	$u_{d,z}$ 0.260 µg/m³	0.068 (µg/m³)²
Span drift from field test	$u_{d,s}$ -0.546 µg/m³	0.298 (µg/m³)²
Influence of ambient temperature at span	u_t 0.153 µg/m³	0.023 (µg/m³)²
Influence of supply voltage	u_v 0.208 µg/m³	0.043 (µg/m³)²
Cross-sensitivity (interference)	u_i 0.694 µg/m³	0.481 (µg/m³)²
Influence of sample gas flow	u_p -0.049 µg/m³	0.002 (µg/m³)²
Uncertainty of reference material at 70% of certification range	u_{rm} 0.364 µg/m³	0.132 (µg/m³)²

* The larger value is used :

"Repeatability standard deviation at span" or

"Standard deviation from paired measurements under field conditions"

Combined standard uncertainty (u_c)	$u_c = \sqrt{\sum (u_{max,j})^2}$	1.19 µg/m³
Total expanded uncertainty	$U = u_c * k = u_c * 1.96$	2.33 µg/m³

Relative total expanded uncertainty

Requirement of 2010/75/EU	U in % of the ELV 30 µg/m³	7.8
Requirement of EN 15267-3	U in % of the ELV 30 µg/m³	40.0
	U in % of the ELV 30 µg/m³	30.0

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

Measuring system

Manufacturer	OP SIS AB
AMS designation	AR602Z/N
Serial number of units under test	1759 / 1760
Measuring principle	UV-DOAS

Test report

Test laboratory	936/21222333/C TÜV Rheinland
Date of report	2014-09-08

Measured component

Certification range	NH ₃ 0 - 10 mg/m ³
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Evaluation of the cross-sensitivity (CS)

(system with largest CS)

Sum of positive CS at zero point	0.18 mg/m ³
Sum of negative CS at zero point	-0.10 mg/m ³
Sum of positive CS at span point	0.23 mg/m ³
Sum of negative CS at span point	-0.10 mg/m ³
Maximum sum of cross-sensitivities	0.23 mg/m ³
Uncertainty of cross-sensitivity	0.133 mg/m ³

Calculation of the combined standard uncertainty

Tested parameter

			u ²
Repeatability standard deviation at set point *	u _r	0.090 mg/m ³	0.008 (mg/m ³) ²
Lack of fit	u _{lof}	0.040 mg/m ³	0.002 (mg/m ³) ²
Zero drift from field test	u _{d,z}	0.069 mg/m ³	0.005 (mg/m ³) ²
Span drift from field test	u _{d,s}	0.110 mg/m ³	0.012 (mg/m ³) ²
Influence of ambient temperature at span	u _t	0.058 mg/m ³	0.003 (mg/m ³) ²
Influence of supply voltage	u _v	0.071 mg/m ³	0.005 (mg/m ³) ²
Cross-sensitivity (interference)	u _i	0.133 mg/m ³	0.018 (mg/m ³) ²
Influence of sample gas pressure	u _p	0.088 mg/m ³	0.008 (mg/m ³) ²
Uncertainty of reference material at 70% of certification range	u _{rm}	0.081 mg/m ³	0.007 (mg/m ³) ²
Excursion of measurement beam	u _{mb}	0.115 mg/m ³	0.013 (mg/m ³) ²

* The larger value is used :

"Repeatability standard deviation at span" or

"Standard deviation from paired measurements under field conditions"

Combined standard uncertainty (u _c)	$u_c = \sqrt{\sum (u_{max,j})^2}$	0.28 mg/m ³
Total expanded uncertainty	$U = u_c * k = u_c * 1.96$	0.55 mg/m ³

Relative total expanded uncertainty

Requirement of 2010/75/EU	U in % of the ELV 10 mg/m ³	5.5
Requirement of EN 15267-3	U in % of the ELV 10 mg/m ³	40.0 **
	U in % of the ELV 10 mg/m ³	30.0

** The EU-directive 2010/75/EU on industrial emissions provides no requirements for this component.
A value of 40 % was used for this.

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

Measuring system

Manufacturer	Opsis AB
AMS designation	AR602Z/N
Serial number of units under test	1759 / 1760
Measuring principle	UV-DOAS

Test report

Test laboratory	TÜV Rheinland
Date of report	2014-09-08

Measured component

Certification range	NO 0 - 150 mg/m ³
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Evaluation of the cross-sensitivity (CS)

(system with largest CS)

Sum of positive CS at zero point	0.00 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	0.00 mg/m ³
Maximum sum of cross-sensitivities	0.00 mg/m ³
Uncertainty of cross-sensitivity	0.000 mg/m ³

Calculation of the combined standard uncertainty

Tested parameter

		u^2	
Repeatability standard deviation at set point *	u_r 0.600 mg/m ³	0.360	(mg/m ³) ²
Lack of fit	u_{lof} -0.635 mg/m ³	0.403	(mg/m ³) ²
Zero drift from field test	$u_{d,z}$ 0.779 mg/m ³	0.607	(mg/m ³) ²
Span drift from field test	$u_{d,s}$ -1.386 mg/m ³	1.921	(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 0.123 mg/m ³	0.015	(mg/m ³) ²
Cross-sensitivity (interference)	u_i 0.000 mg/m ³	0.000	(mg/m ³) ²
Influence of sample gas pressure	u_o 0.367 mg/m ³	0.135	(mg/m ³) ²
Uncertainty of reference material at 70% of certification range	u_{rm} 1.212 mg/m ³	1.470	(mg/m ³) ²
Excursion of measurement beam	u_{mb} -0.537 mg/m ³	0.288	(mg/m ³) ²

* The larger value is used :

"Repeatability standard deviation at span" or

"Standard deviation from paired measurements under field conditions"

Combined standard uncertainty (u_c)

$$u_c = \sqrt{\sum (u_{max,j})^2} \quad 2.28 \text{ mg/m}^3$$

Total expanded uncertainty

$$U = u_c * k = u_c * 1.96 \quad 4.47 \text{ mg/m}^3$$

Relative total expanded uncertainty

U in % of the ELV 100 mg/m³ 4.5

Requirement of 2010/75/EU

U in % of the ELV 100 mg/m³ 20.0

Requirement of EN 15267-3

U in % of the ELV 100 mg/m³ 15.0

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

Measuring system

Manufacturer	Opsis AB
AMS designation	AR602Z/N
Serial number of units under test	1759 / 1760
Measuring principle	UV-DOAS

Test report

Test laboratory	936/21222333/C TÜV Rheinland
Date of report	2014-09-08

Measured component

Certification range	NO ₂ 0 - 20 mg/m ³
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Evaluation of the cross-sensitivity (CS)

(system with largest CS)

Sum of positive CS at zero point	0.52 mg/m ³
Sum of negative CS at zero point	-0.13 mg/m ³
Sum of positive CS at span point	0.46 mg/m ³
Sum of negative CS at span point	-0.57 mg/m ³
Maximum sum of cross-sensitivities	-0.57 mg/m ³
Uncertainty of cross-sensitivity	-0.329 mg/m ³

Calculation of the combined standard uncertainty

Tested parameter

			u ²
Standard deviation from paired measurements under field conditions *	u _D	0.053 mg/m ³	0.003 (mg/m ³) ²
Lack of fit	u _{lof}	0.081 mg/m ³	0.007 (mg/m ³) ²
Zero drift from field test	u _{d,z}	0.150 mg/m ³	0.023 (mg/m ³) ²
Span drift from field test	u _{d,s}	0.185 mg/m ³	0.034 (mg/m ³) ²
Influence of ambient temperature at span	u _t	0.058 mg/m ³	0.003 (mg/m ³) ²
Influence of supply voltage	u _v	0.058 mg/m ³	0.003 (mg/m ³) ²
Cross-sensitivity (interference)	u _i	-0.329 mg/m ³	0.108 (mg/m ³) ²
Influence of sample gas pressure	u _p	0.088 mg/m ³	0.008 (mg/m ³) ²
Uncertainty of reference material at 70% of certification range	u _{rm}	0.162 mg/m ³	0.026 (mg/m ³) ²
Excursion of measurement beam	u _{mb}	0.144 mg/m ³	0.021 (mg/m ³) ²

* The larger value is used :

"Repeatability standard deviation at span" or

"Standard deviation from paired measurements under field conditions"

Combined standard uncertainty (u_c)

$$u_c = \sqrt{\sum (u_{max,j})^2} \quad 0.49 \text{ mg/m}^3$$

Total expanded uncertainty

$$U = u_c * k = u_c * 1.96 \quad 0.95 \text{ mg/m}^3$$

Relative total expanded uncertainty

U in % of the range 20 mg/m³ 4.8

Requirement of 2010/75/EU

U in % of the range 20 mg/m³ 20.0

Requirement of EN 15267-3

U in % of the range 20 mg/m³ 15.0

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

Measuring system

Manufacturer	Opsis AB
AMS designation	AR602Z/N
Serial number of units under test	1759 / 1760
Measuring principle	UV-DOAS

Test report

Test laboratory	936/21222333/C TÜV Rheinland
Date of report	2014-09-08

Measured component

Certification range	SO ₂ 0 - 75 mg/m ³
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Evaluation of the cross-sensitivity (CS)

(system with largest CS)

Sum of positive CS at zero point	0.00 mg/m ³
Sum of negative CS at zero point	-0.27 mg/m ³
Sum of positive CS at span point	0.73 mg/m ³
Sum of negative CS at span point	-1.47 mg/m ³
Maximum sum of cross-sensitivities	-1.47 mg/m ³
Uncertainty of cross-sensitivity	-0.849 mg/m ³

Calculation of the combined standard uncertainty

Tested parameter

			u ²
Standard deviation from paired measurements under field conditions *	u _D	0.189 mg/m ³	0.036 (mg/m ³) ²
Lack of fit	u _{lof}	0.271 mg/m ³	0.073 (mg/m ³) ²
Zero drift from field test	u _{d,z}	0.520 mg/m ³	0.270 (mg/m ³) ²
Span drift from field test	u _{d,s}	0.390 mg/m ³	0.152 (mg/m ³) ²
Influence of ambient temperature at span	u _t	0.208 mg/m ³	0.043 (mg/m ³) ²
Influence of supply voltage	u _v	0.085 mg/m ³	0.007 (mg/m ³) ²
Cross-sensitivity (interference)	u _i	-0.849 mg/m ³	0.720 (mg/m ³) ²
Influence of sample gas pressure	u _p	0.184 mg/m ³	0.034 (mg/m ³) ²
Uncertainty of reference material at 70% of certification range	u _{rm}	0.606 mg/m ³	0.368 (mg/m ³) ²
Excursion of measurement beam	u _{mb}	-0.277 mg/m ³	0.077 (mg/m ³) ²

* The larger value is used :

"Repeatability standard deviation at span" or

"Standard deviation from paired measurements under field conditions"

Combined standard uncertainty (u_c)

$$u_c = \sqrt{\sum (u_{max,j})^2} \quad 1.33 \text{ mg/m}^3$$

Total expanded uncertainty

$$U = u_c * k = u_c * 1.96 \quad 2.62 \text{ mg/m}^3$$

Relative total expanded uncertainty

U in % of the ELV 50 mg/m³ 5.2

Requirement of 2010/75/EU

U in % of the ELV 50 mg/m³ 20.0

Requirement of EN 15267-3

U in % of the ELV 50 mg/m³ 15.0