



LIGHTHOUSE
WORLDWIDE SOLUTIONS BENELUX BV



C91
1/3

Calibration certificate

Certificate number: LH64057

Revision 3.3

Applicant

: CCSTEC GesmbH
Triesterstrasse 36
A-2512, Oeynhausen
Austria

Instrument

: Description : Airborne particle counter
: Manufacturer : Lighthouse
: Model : Remote 2014
: Serial no. : 180221001

: Customer ID : C91

Date of calibration

: 22 January 2021

Due date calibration

: January 2022

Calibration location

: Lighthouse Benelux Calibration laboratory
in Boven-Leeuwen

Calibration method

: Calibration has been accomplished as described in ISO21501-4:2018. All work performed is in accordance with Lighthouse Worldwide Solutions Benelux, Master Calibration Document: I201 and is recorded and maintained as such.

Results

: The results of the measurements are shown in the appendix.
The unit is readjusted.

Compliance, As left

: All measured values comply with the specification limit(s).

Traceability

: The measurements have been executed using standards for which the traceability to (inter)national standards has been demonstrated towards the Raad voor Accreditatie.

Uncertainty

: The reported expanded uncertainty is based on the standard uncertainty of the measurement multiplied by a coverage factor k, such that the coverage probability corresponds to approximately 95%. The standard uncertainty is determined in accordance with EA-4/02. Compliance statements are given in accordance with ISO21501-4:2018.

Date of issue

: 26 January 2021

Authorized by

: M.A.W. van Boxtel
Head of calibration

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Appendix

Certificate number: LH64057

Date of calibration : 22 January 2021

Calibrated by : A.C.G. Gerritse

Function : Calibration & Service Engineer

Environmental conditions : The ambient temperature was 21,8°C
at a relative humidity of 34,8%

Measurement results, As found

Performance information					
Test	Test result	Expanded uncertainty	Criteria		
ISO21501-4 Flow	2,81l/min	0,08l/min	2,83l/min $\pm 5\%$	Pass	
JIS B 9921 Zero count	0	N/A	≤ 1 in 5 mins	Pass	
ISO21501-4 False count rate	Upper confidence level 212 particles/m ³	N/A	N/A	N/A	
ISO21501-4 Timer check	60,1 seconds	0,40s	$\pm 1\%$	Pass	
ISO21501-4 Size resolution	3,66% used size 0,24 μ m	4,30%SR	$< 15\%$	Pass	
ISO21501-4 Counting efficiency 50%	33,6% used size 0,20 μ m	1,85%CE	(50 ± 20)%	Pass	
ISO21501-4 Counting efficiency 100%	89,7% used size 0,30 μ m	5,05%CE	(100 ± 10)%	Fail	

Size calibration					
Channel	Channel Size	Threshold voltage	Calculated size	Expanded uncertainty	Calculated Sizing error ($\pm 10\%$)
1	0,20 μ m	66mV	0,199 μ m	0,007 μ m	-0,45%
2	0,30 μ m	583mV	0,309 μ m	0,007 μ m	3,03%
3	0,50 μ m	2235mV	0,508 μ m	0,010 μ m	1,63%
4	1,00 μ m	4204mV	1,037 μ m	0,018 μ m	3,69%

Notes

Counting efficiency: used size 0,5 μ m: 83,1 %CE $\pm 4,76\%$ CE
Counting efficiency: used size 1,0 μ m: 75,0 %CE $\pm 4,48\%$ CE

Reference equipment

Model	S/N	Due to	Certificate number
Defender 510	120068	30-Jan-2021	59167
MCA8000D	564	3-Mar-2021	20-13808-3-1
Fluke-175	12170245	6-Apr-2021	20-13808-4-2
Fisher Scientific 0666256	200359247	16-Jun-2022	1042-11351217
Palas	6752 / 6751	23-Nov-2021	235-11058

Particle size standards

Size	Description	Due to	Lot#
0,20 μ m	3200 & 3200A Nanosphere size standards	1-Mar-2022	D20014
0,25 μ m	3240A, Nanosphere size standards	1-Apr-2021	D20024
0,30 μ m	3300A & 3300B, Nanosphere Size Standards	1-Apr-2023	D20015
0,50 μ m	3500 & 3500A, Nanosphere Size Standards	1-Apr-2022	D20017
1,00 μ m	4009A, 4009A & 4009B Microsphere Size Standards	1-Oct-2022	D20020



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Measurement results, As left

Performance information				
Test	Light	Test result	Expanded uncertainty	Criteria
ISO21501-4 Flow		2,81l/min	$\pm 0,08\text{l/min}$	2,83l/min $\pm 5\%$
JIS B 9921 Zero count		0	N/A	≤ 1 in 5 mins
ISO21501-4 False count rate		Upper confidence level 212 particles/m ³	N/A	N/A
ISO21501-4 Timer check		60,1 seconds	0,40s	$\pm 1\%$
ISO21501-4 Size resolution		2,91% used size 0,24 μm	6,24%SR	$< 15\%$
ISO21501-4 Counting efficiency 50%		52,2% used size 0,20 μm	2,75%CE	(50 ± 20)%
ISO21501-4 Counting efficiency 100%		96,6% used size 0,30 μm	5,45%CE	(100 ± 10)%

Size calibration					
Channel	Channel Size	Threshold voltage	Calculated size	Expanded uncertainty	Calculated Sizing error ($\pm 10\%$)
1	0,20 μm	60mV	0,201 μm	0,007 μm	0,70%
2	0,30 μm	544mV	0,300 μm	0,007 μm	0,06%
3	0,50 μm	2233mV	0,501 μm	0,010 μm	0,25%
4	1,00 μm	4203mV	1,000 μm	0,018 μm	0,00%

Notes

Counting efficiency: used size 0,5 μm : 92,6 %CE $\pm 5,31\%$ CE
Counting efficiency: used size 1,0 μm : 91,3 %CE $\pm 5,44\%$ CE

Reference equipment

Model	S/N	Due to	Certificate number
Defender 510	120068	30-Jan-2021	59167
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0,30 μm	3300A & 3300B, Nanosphere Size Standards	1-Apr-2023	D20015
0,50 μm	3500 & 3500A, Nanosphere Size Standards	1-Apr-2022	D20017
1,00 μm	4009A, 4009A & 4009B Microsphere Size Standards	1-Oct-2022	D20020

