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Deutsche
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D-K-15140-01-00

Calibration certificate
Kalibrierschein

Calibration mark
Kalibrierzeichen

1721108
D-K-
15140-01-00
04/2017

Object <i>Gegenstand</i>	Combined Wind Sensor
Manufacturer <i>Hersteller</i>	BARANI DESIGN, s.r.o. Slovakia
Type <i>Typ</i>	Elliptic Anemometer 3 / MeteoWind 2
Serial number <i>Fabrikat/Serien-Nr.</i>	-
Customer <i>Auftraggeber</i>	BARANI DESIGN, s.r.o. Slovakia
Order No. <i>Auftragsnummer</i>	Email 2017-03-29, Jeneiova
Project No. <i>Projektnummer</i>	VT170471
Number of pages <i>Anzahl der Seiten</i>	4
Date of Calibration <i>Datum der Kalibrierung</i>	25.04.2017

This calibration certificate documents the traceability to national standards, which realize the units of measurement according to the International System of Units (SI).

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Date
Datum

23.06.2017

Head of the calibration laboratory
Leiter des Kalibrierlaboratoriums



Dipl. Phys. Dieter Westermann

Person in charge
Bearbeiter



Heiko Westermann, B. Sc.

Calibration object
Kalibriergegenstand

Combined Wind Sensor

Calibration procedure
Kalibrierverfahren

- Deutsche WindGuard Wind Tunnel Services: QM-KL-AK-VA
- Based on following standards:
- MEASNET: Anemometer calibration procedure
 - IEC 61400-12-1: Power performance measurements of electricity producing wind turbines
 - IEC 61400-12-2: Power performance of electricity producing wind turbines based on nacelle anemometry
 - ISO 3966: Measurement of fluid in closed conduits
 - ISO 16622: Meteorology - Sonic anemometers/thermometers

Place of calibration
Ort der Kalibrierung

Windtunnel of Deutsche WindGuard WindTunnel Services GmbH, Varel

Test conditions
Messbedingungen

wind tunnel area	10000 cm ²
anemometer frontal area	200 cm ²
diameter of mounting pipe	34 mm
blockage ratio ¹⁾	0.020 [-]
software version	7.7

¹⁾ Due to the special construction of the test section no blockage correction is necessary.

Ambient conditions
Umgebungsbedingungen

air temperature	25.8 °C ± 0.1 °C
air pressure	1006.7 hPa ± 0.3 hPa
relative air humidity	27.0 % ± 2.0 %

Measurement uncertainty
Messunsicherheit

The expanded uncertainty assigned to the measurement results is obtained by multiplying the standard uncertainty by the coverage factor $k = 2$. It has been determined in accordance with DAkkS-DKD-3. The value of the measurand lies within the assigned range of values with a probability of 95%.
The reference flow speed measurement is traceable to the German NMI (Physikalisch-Technische Bundesanstalt) standard for flow speed. It is realized by using a PTB owned and calibrated Laser Doppler Anemometer (Standard Uncertainty 0.2 %, $k=2$)

Additional remarks
Zusätzliche Anmerkungen

Revision 1.0 (replaces certificate dated 08.06.2017)

Calibration result
Kalibrierergebnis

Sensor out	Tunnel Speed	Uncertainty (k=2)
Hz / 2	m/s	m/s
2.037	1.982	0.050
4.227	3.926	0.050
6.461	5.896	0.050
8.631	7.814	0.050
10.905	9.803	0.051
13.323	11.888	0.052
15.686	13.894	0.052
17.806	15.763	0.052
24.112	21.101	0.102
27.418	23.884	0.102
43.646	37.506	0.104
40.481	34.826	0.104
37.348	32.128	0.105
33.131	28.625	0.104
29.670	25.857	0.103
20.375	18.000	0.101
16.812	14.881	0.051
14.458	12.853	0.051
12.144	10.861	0.051
9.754	8.815	0.051
7.543	6.870	0.050
5.239	4.857	0.050
3.101	2.963	0.050
1.020	1.088	0.050
0.360	0.518	0.050

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Statistical analysis	Slope	0.85390 (m/s)/(Hz/2) ±0.00200 (m/s)/(Hz/2)
	Offset	0.4073 m/s ±0.041 m/s
	Standard error (Y)	0.043 m/s
	Correlation coefficient	0.999937

Graphical representation of the result
Grafische Darstellung des Ergebnisses

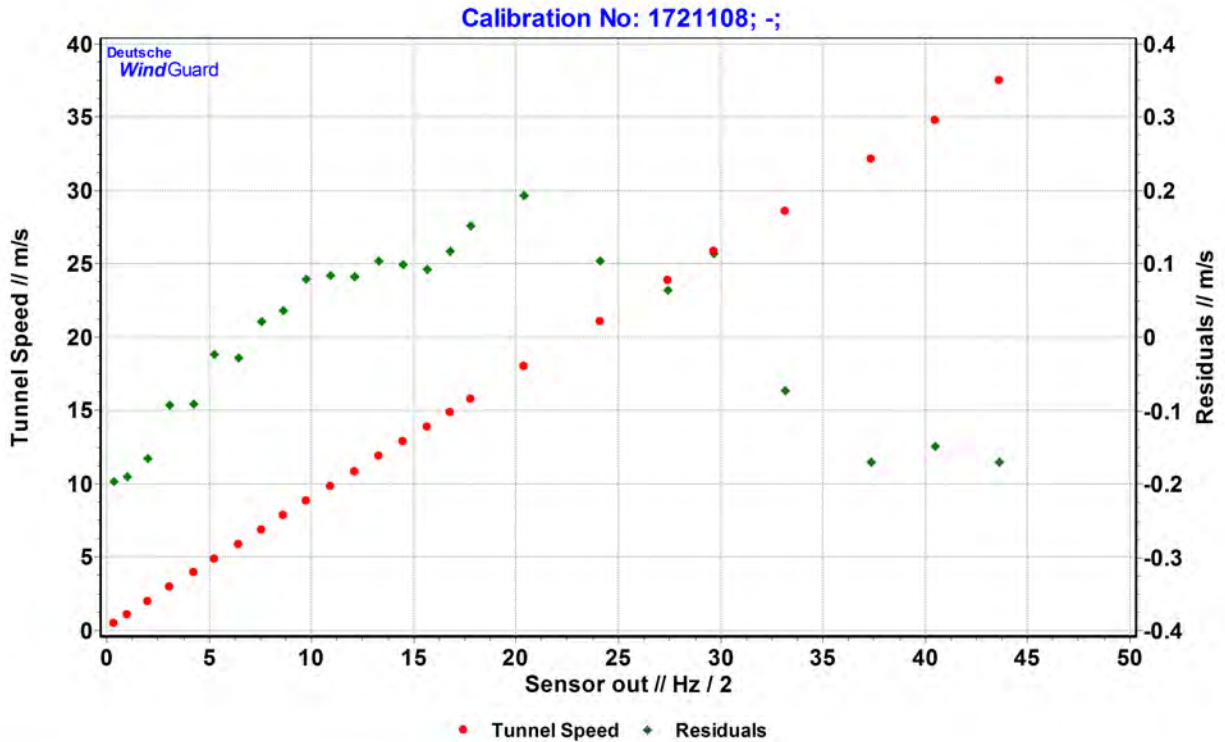
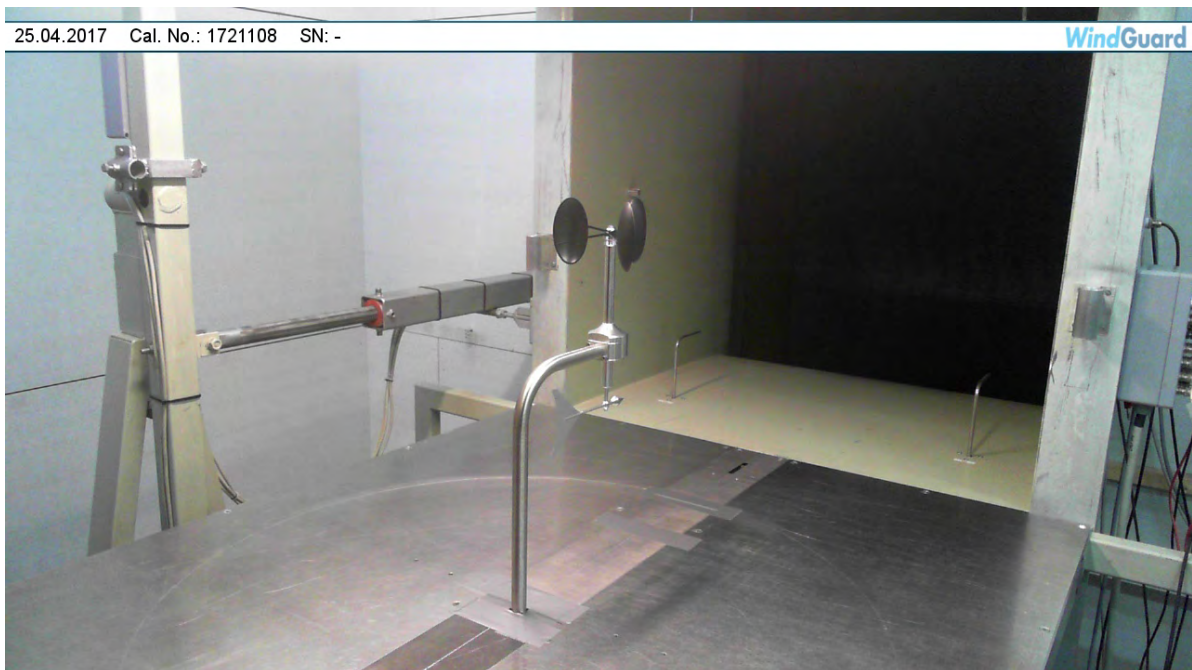


Photo of the measurement setup
Foto des Messaufbaus



Remark: The proportions of the set-up may not be true to scale due to imaging geometry.