DEUTSCHE WINDGUARD

Deutsche WindGuard Wind Tunnel Services GmbH

IECRE and MEASNET approved test laboratory

accredited by the / *akkreditiert durch die*

Deutsche Akkreditierungsstelle GmbH

as calibration laboratory in the / *als Kalibrierlaboratorium im*

Deutschen Kalibrierdienst

DAkkS Deutsche Akkreditierungsstelle D-K-15140-01-00

1721107
D-K-15140-01-00
04/2017

Calibration certificate
Kalibrierschein

Calibration mark
Kalibrierzeichen

Object *Gegenstand*	Cup Anemometer
Manufacturer *Hersteller*	Navis Elektronika d.o.o. SI-1241 Kamnik
Type *Typ*	WSS100-PS-FC
Serial number *Fabrikat/Serien-Nr.*	S1646
Customer *Auftraggeber*	Navis Elektronika d.o.o. SI-1241 Kamnik
Order No. *Auftragsnummer*	1091
Project No. *Projektnummer*	VT170497
Number of pages *Anzahl der Seiten*	4
Date of Calibration *Datum der Kalibrierung*	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).
The DAkkS is signatory to the multilateral agreements of the European co-operation for Accreditation (EA) and of the International Laboratory Accreditation Cooperation (ILAC) for the mutual recognition of calibration certificates.
The user is obliged to have the object recalibrated at appropriate intervals.
Dieser Kalibrierschein dokumentiert die Rückführung auf nationale Normale zur Darstellung der Einheiten in Übereinstimmung mit dem Internationalen Einheitensystem (SI).
Die DAkkS ist Unterzeichner der multilateralen Übereinkommen der European co-operation for Accreditation (EA) und der International Laboratory Accreditation Cooperation (ILAC) zur gegenseitigen Anerkennung der Kalibrierscheine.
Für die Einhaltung einer angemessenen Frist zur Wiederholung der Kalibrierung ist der Benutzer verantwortlich.

Date *Datum*	Head of the calibration laboratory *Leiter des Kalibrierlaboratoriums*	Person in charge *Bearbeiter*
05.05.2017	Dipl. Phys. Dieter Westermann	Heiko Westermann, B. Sc.

Calibration object
Kalibriergegenstand

Cup Anemometer

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 cm²
anemometer frontal area	150 cm²
diameter of mounting pipe	20 mm
blockage ratio [1)]	0.015 [-]
software version	7.7

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

Ambient conditions
Umgebungsbedingungen

air temperature	23.2 °C ± 0.1 °C
air pressure	1005.1 hPa ± 0.3 hPa
relative air humidity	31.5 % ± 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 25.04.2017)

Calibration result
Kalibrierergebnis

Sensor out	Tunnel Speed	Uncertainty (k=2)
Hz	m/s	m/s
7.554	1.891	0.050
19.271	4.793	0.050
39.179	9.822	0.050
59.986	15.051	0.050
79.046	19.764	0.100
99.346	24.857	0.100
117.734	29.446	0.100
150.130	37.570	0.100

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Statistical analysis	Slope	0.25022 (m/s)/(Hz) ±0.00018 (m/s)/(Hz)
	Offset	0.0008 m/s ±0.015 m/s
	Standard error (Y)	0.018 m/s
	Correlation coefficient	0.999998

Graphical representation of the result
Grafische Darstellung des Ergebnisses

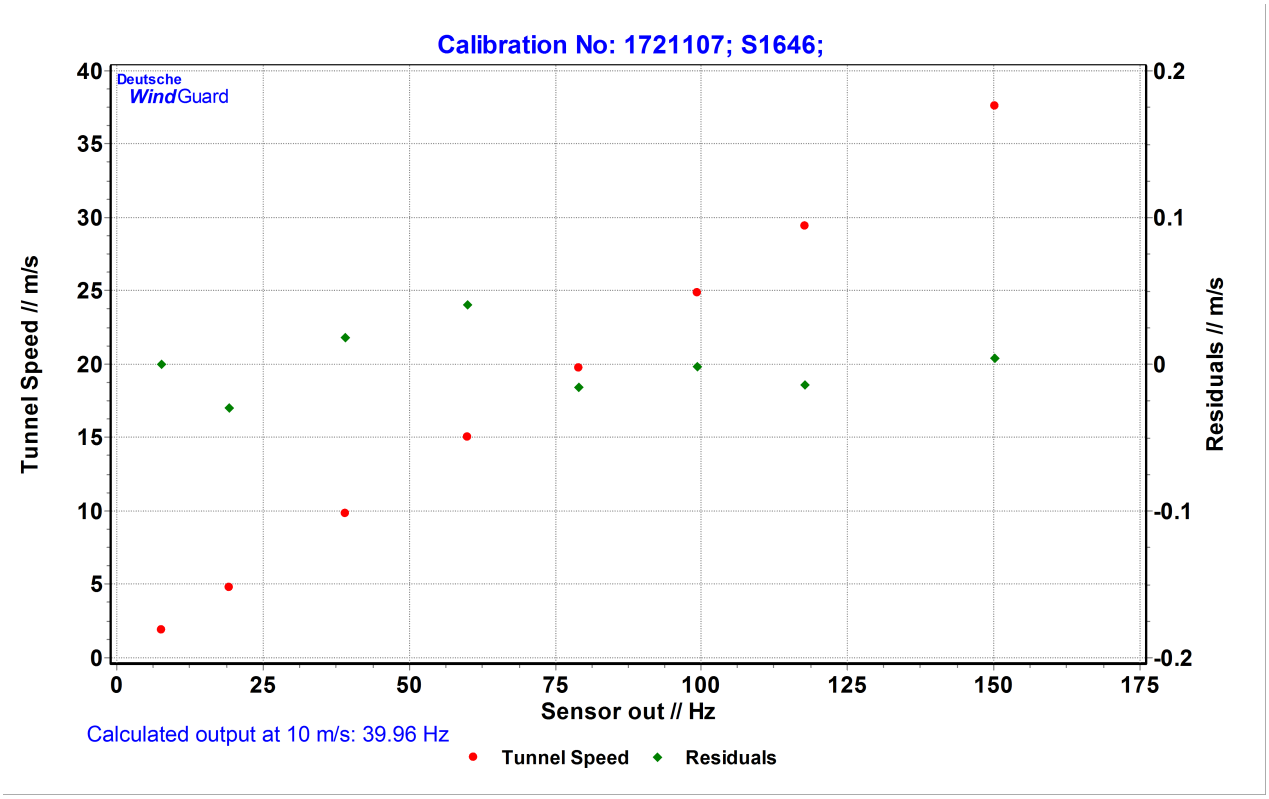

Photo of the measurement setup
Foto des Messaufbaus

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