Deutsche WindGuard
Wind Tunnel Services GmbH, Varel

DEUTSCHE WINDGUARD

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Deutsche Akkreditierungsstelle GmbH

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Deutschen Kalibrierdienst

DKD

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Deutsche
Akkreditierungsstelle
D-K-15140-01-00

1536180
D-K-15140-01-00
12/2015

Calibration certificate
Kalibrierschein

Calibration mark
Kalibrierzeichen

Object / *Gegenstand*	Cup Anemometer
Manufacturer / *Hersteller*	Thies Clima D-37083 Göttingen
Type / *Typ*	4.3351.10.000
Serial number / *Fabrikat/Serien-Nr.*	11159435
Customer / *Auftraggeber*	Ammonit Measurement GmbH D-10997 Berlin
Order No. / *Auftragsnummer*	L 23677
Project No. / *Projektnummer*	VT150935
Number of pages / *Anzahl der Seiten*	4
Date of Calibration / *Datum der Kalibrierung*	05.12.2015

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*
05.12.2015	Dipl. Phys. Dieter Westermann	Techniker Dirk Henninges

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	230 cm²
diameter of mounting pipe	34 mm
blockage ratio [1]	0.023 [-]
software version	7.64

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

Ambient conditions
Umgebungsbedingungen

air temperature	20.9 °C ± 0.1 °C
air pressure	1016.7 hPa ± 0.3 hPa
relative air humidity	42.1 % ± 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

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Calibration result
Kalibrierergebnis

Sensor out	Tunnel speed	Uncertainty (k=2)
Hz	m/s	m/s
81.987	3.986	0.050
125.017	5.980	0.050
168.538	7.980	0.050
211.578	9.945	0.051
254.043	11.942	0.051
299.097	13.970	0.051
339.123	15.829	0.051
318.650	14.869	0.051
276.805	12.957	0.051
233.243	10.954	0.051
189.984	8.978	0.051
147.002	6.987	0.050
103.865	5.008	0.050

File: 1536180

Linear regression analysis	Slope	0.04599 (m/s)/(Hz) ±0.00004 (m/s)/(Hz)
	Offset	0.2277 m/s ±0.010 m/s
	Standard error (Y)	0.010 m/s
	Correlation coefficient	0.999995

Remarks — The calibrated sensor complies with the demanded linearity of MEASNET

Graphical representation of the result
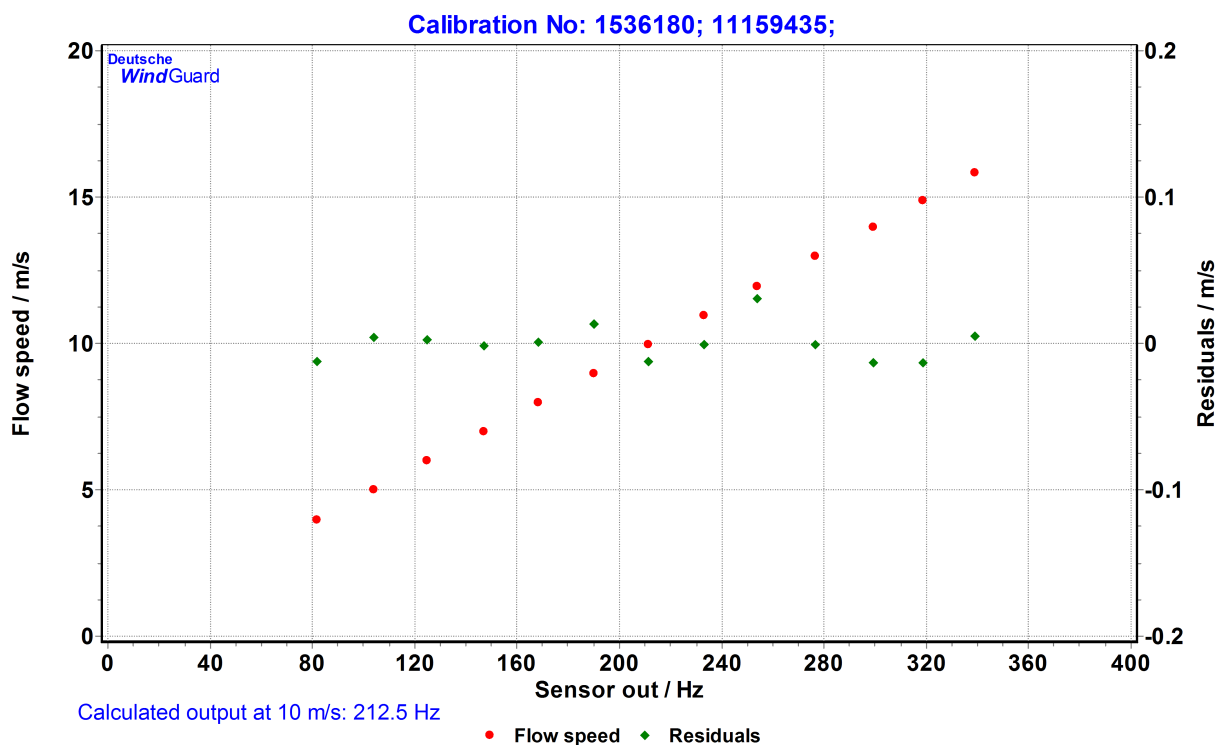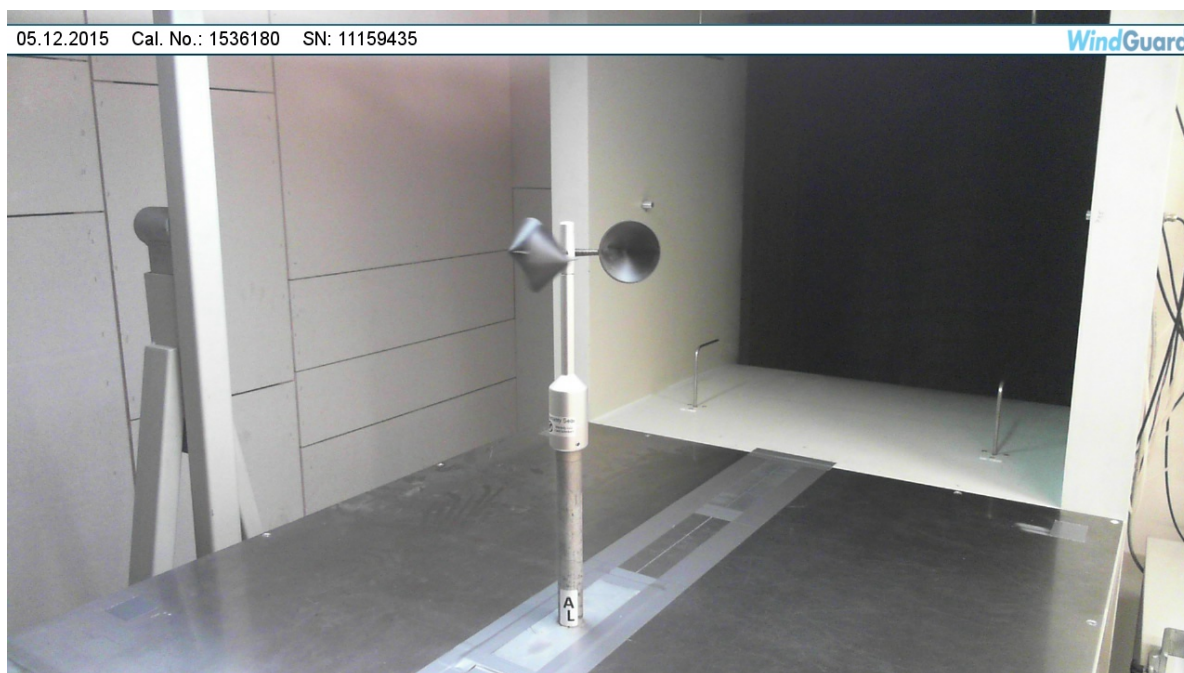*Grafische Darstellung des Ergebnisses*

Calibration No: 1536180; 11159435;

Calculated output at 10 m/s: 212.5 Hz

● Flow speed ◆ Residuals

Photo of the measurement setup
Foto des Messaufbaus

05.12.2015 Cal. No.: 1536180 SN: 11159435

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

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