Deutsche WindGuard
Wind Tunnel Services GmbH, Varel

DEUTSCHE WINDGUARD

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Deutsche Akkreditierungsstelle GmbH

as calibration laboratory in the / *als Kalibrierlaboratorium im*

Deutschen Kalibrierdienst DKD

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

1514317
D-K-15140-01-00
08/2015

Calibration certificate
Kalibrierschein

Calibration mark
Kalibrierzeichen

Object *Gegenstand*	Cup Anemometer
Manufacturer *Hersteller*	Windspeed LTD Denbighshire LL18 2AB
Type *Typ*	A100LM
Serial number *Fabrikat/Serien-Nr.*	16790 FEUU
Customer *Auftraggeber*	Ammonit Measurement GmbH D-10997 Berlin
Order No. *Auftragsnummer*	L 23589
Project No. *Projektnummer*	VT150767
Number of pages *Anzahl der Seiten*	4
Date of Calibration *Datum der Kalibrierung*	31.08.2015

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.
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Date *Datum*	Head of the calibration laboratory *Leiter des Kalibrierlaboratoriums*	Person in charge *Bearbeiter*
31.08.2015	Dipl. Phys. Dieter Westermann	Techniker Dirk Henninges

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D-K-15140-01-00
08/2015

Calibration object
Kalibriergegenstand

Cup Anemometer

Calibration procedure
Kalibrierverfahren

- Deutsche WindGuard Wind Tunnel Services: Calibration of anemometers; Version 1.0 (2014)

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 Servies GmbH, Varel

Test conditions
Messbedingungen

wind tunnel area	10000 cm²
anemometer frontal area	200 cm²
diameter of mounting pipe	27 mm
blockage ratio [1)]	0.020 [-]
software version	7.64

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

Ambient conditions
Umgebungsbedingungen

air temperature	22.9 °C ± 0.1 °C
air pressure	1013.8 hPa ± 0.3 hPa
relative air humidity	56.2 % ± 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)

Latest accreditation
Letzte Akkreditierung

04/2014

Additional remarks
Zusätzliche Anmerkungen

Calibrated with 405 Type Single Mount
Anemometer with 3 metre cable

1514317
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Calibration result
Kalibrierergebnis

Sensor out	Tunnel speed	Uncertainty (k=2)
Hz	m/s	m/s
40.223	4.052	0.050
61.269	6.111	0.051
83.410	8.274	0.051
104.530	10.332	0.052
125.948	12.389	0.052
146.266	14.378	0.053
166.359	16.315	0.050
156.457	15.343	0.053
134.627	13.281	0.053
114.519	11.324	0.052
93.015	9.224	0.052
72.659	7.227	0.051
51.735	5.187	0.051

File: 1514317

Linear regression analysis	Slope	0.09719 (m/s)/(Hz) ±0.00014 (m/s)/(Hz)
	Offset	0.1637 m/s ±0.015 m/s
	Standard error (Y)	0.015 m/s
	Correlation coefficient	0.999989

Remarks The calibrated sensor complies with the demanded linearity of MEASNET

1514317
D-K-15140-01-00
08/2015

Graphical representation of the result
Grafische Darstellung des Ergebnises

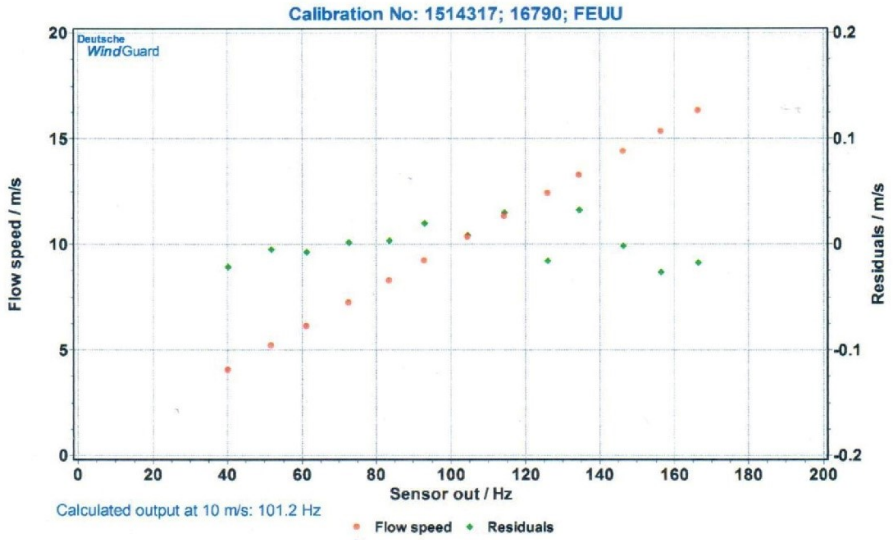

Photo of the measurement setup
Foto des Messaufbaus

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

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Deutschen Kalibrierdienst

DKD

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

Calibration certificate *Kalibrierschein*	1533644
Calibration mark *Kalibrierzeichen*	D-K-15140-01-00 08/2015

Object *Gegenstand*	Cup Anemometer
Manufacturer *Hersteller*	Thies Clima D-37083 Göttingen
Type *Typ*	4.3351.10.000
Serial number *Fabrikat/Serien-Nr.*	07157642
Customer *Auftraggeber*	Ammonit Measurement GmbH D-10997 Berlin
Order No. *Auftragsnummer*	L 23504
Project No. *Projektnummer*	VT150636
Number of pages *Anzahl der Seiten*	4
Date of Calibration *Datum der Kalibrierung*	03.08.2015

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Date *Datum*	Head of the calibration laboratory *Leiter des Kalibrierlaboratoriums*	Person in charge *Bearbeiter*
03.08.2015	Dipl. Phys. Dieter Westermann	Dipl.-Ing. (FH) Peter Busche

1533644
D-K-15140-01-00
08/2015

Calibration object
Kalibriergegenstand

Cup Anemometer

Calibration procedure
Kalibrierverfahren

- Deutsche WindGuard Wind Tunnel Services: Calibration of anemometers; Version 1.0 (2014)

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 Servies 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	22.8 °C ± 0.1 °C
air pressure	1014.7 hPa ± 0.3 hPa
relative air humidity	49.8 % ± 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)

Latest accreditation
Letzte Akkreditierung

04/2014

Additional remarks
Zusätzliche Anmerkungen

-

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Calibration result
Kalibrierergebnis

Sensor out Hz	Tunnel speed m/s	Uncertainty (k=2) m/s
81.698	3.980	0.050
124.640	5.958	0.050
168.057	7.983	0.050
211.252	9.954	0.051
254.446	11.953	0.051
299.017	13.978	0.051
339.870	15.853	0.051
318.061	14.880	0.051
276.958	12.970	0.051
232.954	10.961	0.051
189.921	8.980	0.051
146.391	6.982	0.050
103.702	4.998	0.050

File: 1533644

Linear regression analysis

Slope	0.04600 (m/s)/(Hz) ±0.00004 (m/s)/(Hz)
Offset	0.2352 m/s ±0.010 m/s
Standard error (Y)	0.009 m/s
Correlation coefficient	0.999995

Remarks

The calibrated sensor complies with the demanded linearity of MEASNET

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08/2015

Graphical representation of the result
Grafische Darstellung des Ergebnises

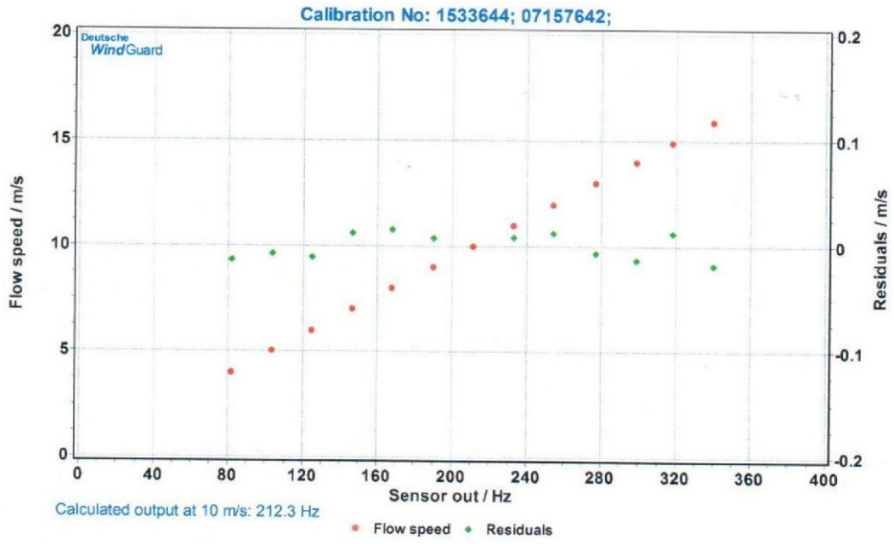
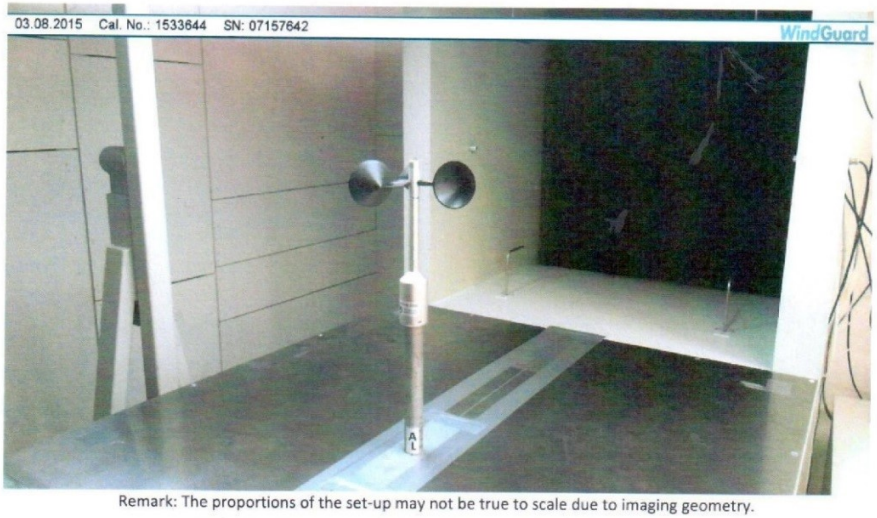


Photo of the measurement setup
Foto des Messaufbaus



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

Deutsche WindGuard
Wind Tunnel Services GmbH, Varel

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Deutschen Kalibrierdienst DKD

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

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D-K-15140-01-00
08/2015

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.*	07157641
Customer *Auftraggeber*	Ammonit Measurement GmbH D-10997 Berlin
Order No. *Auftragsnummer*	L 23504
Project No. *Projektnummer*	VT150636
Number of pages *Anzahl der Seiten*	4
Date of Calibration *Datum der Kalibrierung*	03.08.2015

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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*
03.08.2015	Dipl. Phys. Dieter Westermann	Dipl.-Ing. (FH) Peter Busche

1533645
D-K-15140-01-00
08/2015

Calibration object
Kalibriergegenstand

Cup Anemometer

Calibration procedure
Kalibrierverfahren

- Deutsche WindGuard Wind Tunnel Services: Calibration of anemometers; Version 1.0 (2014)

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 Servies 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	22.9 °C ± 0.1 °C
air pressure	1014.8 hPa ± 0.3 hPa
relative air humidity	49.7 % ± 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)

Latest accreditation
Letzte Akkreditierung

04/2014

Additional remarks
Zusätzliche Anmerkungen

-

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Calibration result
Kalibrierergebnis

Sensor out	Tunnel speed	Uncertainty (k=2)
Hz	m/s	m/s
81.789	3.983	0.050
124.264	5.955	0.050
168.609	7.984	0.050
211.751	9.959	0.051
254.666	11.955	0.051
298.612	13.981	0.051
339.784	15.856	0.051
318.164	14.884	0.051
276.815	12.972	0.051
233.091	10.960	0.051
189.644	8.979	0.051
146.320	6.985	0.050
103.639	5.003	0.050

File: 1533645

Linear regression analysis

Slope	0.04602 (m/s)/(Hz) ±0.00004 (m/s)/(Hz)
Offset	0.2334 m/s ±0.009 m/s
Standard error (Y)	0.009 m/s
Correlation coefficient	0.999996

Remarks

The calibrated sensor complies with the demanded linearity of MEASNET

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D-K-15140-01-00
08/2015

Graphical representation of the result
Grafische Darstellung des Ergebnises

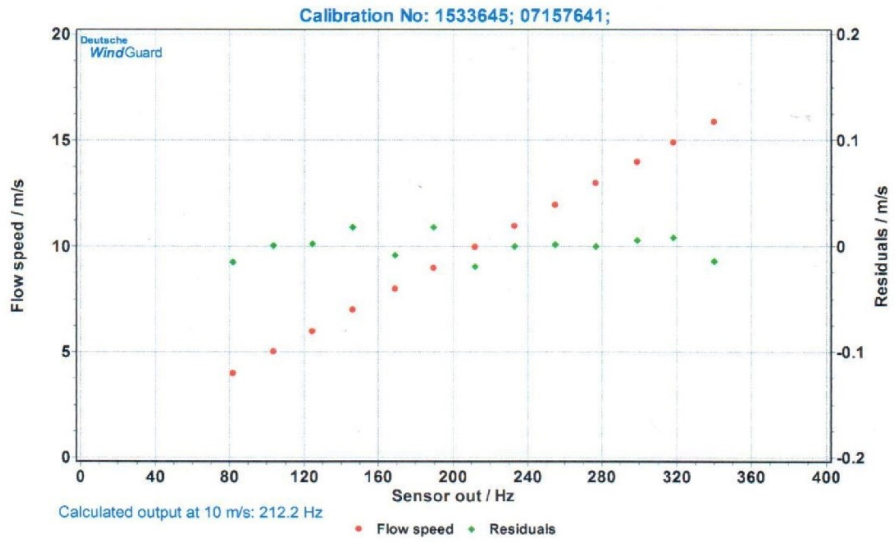
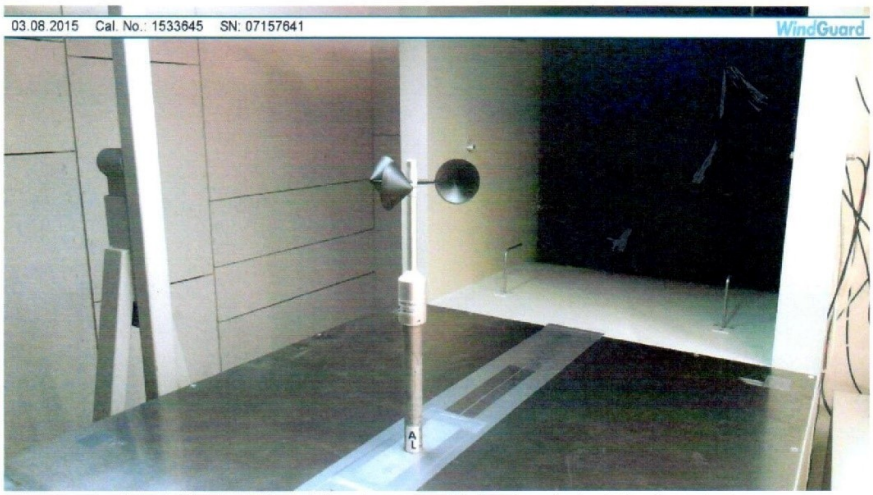


Photo of the measurement setup
Foto des Messaufbaus



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

Deutsche WindGuard
Wind Tunnel Services GmbH, Varel

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as calibration laboratory in the / *als Kalibrierlaboratorium im*

Deutschen Kalibrierdienst DKD

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

Calibration certificate *Kalibrierschein*	1533646
Calibration mark *Kalibrierzeichen*	D-K-15140-01-00 08/2015

Object *Gegenstand*	Cup Anemometer
Manufacturer *Hersteller*	Thies Clima D-37083 Göttingen
Type *Typ*	4.3351.10.000
Serial number *Fabrikat/Serien-Nr.*	07157640
Customer *Auftraggeber*	Ammonit Measurement GmbH D-10997 Berlin
Order No. *Auftragsnummer*	L 23504
Project No. *Projektnummer*	VT150636
Number of pages *Anzahl der Seiten*	4
Date of Calibration *Datum der Kalibrierung*	03.08.2015

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Date *Datum*	Head of the calibration laboratory *Leiter des Kalibrierlaboratoriums*	Person in charge *Bearbeiter*
03.08.2015	Dipl. Phys. Dieter Westermann	Dipl.-Ing. (FH) Peter Busche

1533646
D-K-15140-01-00
08/2015

Calibration object
Kalibriergegenstand

Cup Anemometer

Calibration procedure
Kalibrierverfahren

- Deutsche WindGuard Wind Tunnel Services: Calibration of anemometers; Version 1.0 (2014)

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 Servies 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	23.1 °C ± 0.1 °C
air pressure	1014.8 hPa ± 0.3 hPa
relative air humidity	49.6 % ± 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%.
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Latest accreditation
Letzte Akkreditierung

04/2014

Additional remarks
Zusätzliche Anmerkungen

-

1533646
D-K-15140-01-00
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Calibration result
Kalibrierergebnis

Sensor out	Tunnel speed	Uncertainty (k=2)
Hz	m/s	m/s
81.631	3.979	0.050
124.424	5.955	0.050
168.423	7.981	0.050
211.592	9.955	0.051
254.589	11.948	0.051
299.049	13.978	0.051
339.963	15.851	0.051
318.410	14.879	0.051
277.079	12.969	0.051
232.885	10.958	0.051
189.991	8.979	0.051
146.839	6.983	0.050
103.294	4.992	0.050

File: 1533646

Linear regression analysis	Slope	0.04596 (m/s)/(Hz) ±0.00003 (m/s)/(Hz)
	Offset	0.2379 m/s ±0.007 m/s
	Standard error (Y)	0.002 m/s
	Correlation coefficient	0.999997

Remarks The calibrated sensor complies with the demanded linearity of MEASNET

1533646
D-K-15140-01-00
08/2015

Graphical representation of the result
Grafische Darstellung des Ergebnises

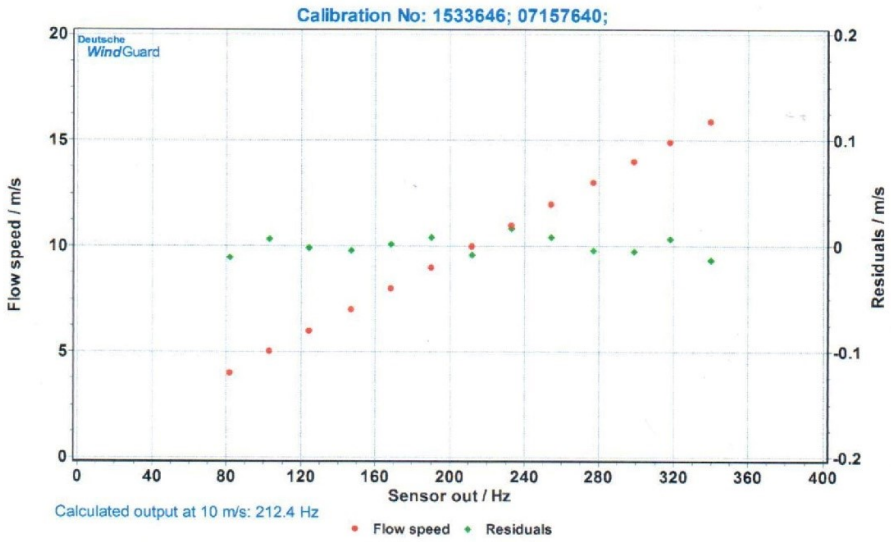
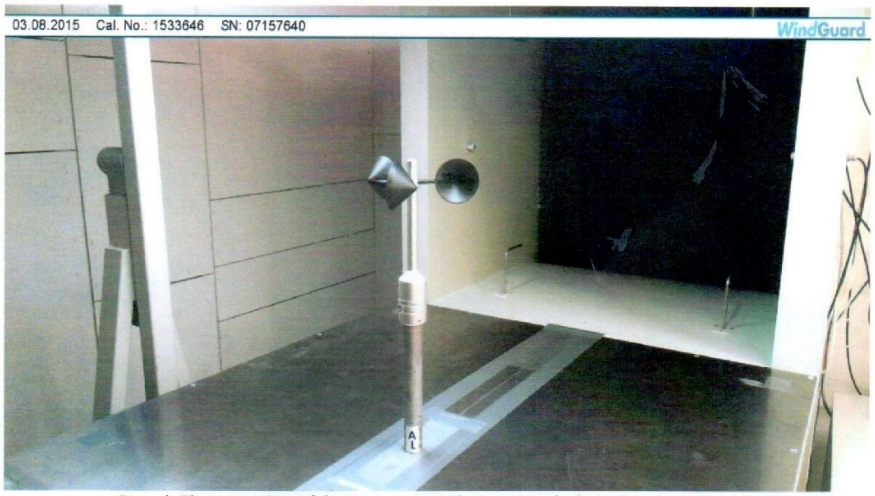


Photo of the measurement setup
Foto des Messaufbaus



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

Deutsche WindGuard
Wind Tunnel Services GmbH, Varel

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Deutschen Kalibrierdienst DKD

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

Calibration certificate *Kalibrierschein*	Calibration mark *Kalibrierzeichen*
	1533647
	D-K-15140-01-00
	08/2015

Object *Gegenstand*	Cup Anemometer
Manufacturer *Hersteller*	Thies Clima D-37083 Göttingen
Type *Typ*	4.3351.10.000
Serial number *Fabrikat/Serien-Nr.*	07157639
Customer *Auftraggeber*	Ammonit Measurement GmbH D-10997 Berlin
Order No. *Auftragsnummer*	L 23504
Project No. *Projektnummer*	VT150636
Number of pages *Anzahl der Seiten*	4
Date of Calibration *Datum der Kalibrierung*	03.08.2015

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Date *Datum*	Head of the calibration laboratory *Leiter des Kalibrierlaboratoriums*	Person in charge *Bearbeiter*
03.08.2015	Dipl. Phys. Dieter Westermann	Kai Schuster, B. Eng.

1533647
D-K-15140-01-00
08/2015

Calibration object
Kalibriergegenstand

Cup Anemometer

Calibration procedure
Kalibrierverfahren

- Deutsche WindGuard Wind Tunnel Services: Calibration of anemometers; Version 1.0 (2014)

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 Servies 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	23.2 °C ± 0.1 °C
air pressure	1014.4 hPa ± 0.3 hPa
relative air humidity	49.6 % ± 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)

Latest accreditation
Letzte Akkreditierung

04/2014

Additional remarks
Zusätzliche Anmerkungen

-

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Calibration result
Kalibrierergebnis

Sensor out Hz	Tunnel speed m/s	Uncertainty (k=2) m/s
81.630	3.981	0.050
124.237	5.952	0.050
168.561	7.986	0.050
211.039	9.957	0.051
255.026	11.955	0.051
298.200	13.979	0.051
339.779	15.848	0.052
318.531	14.882	0.051
276.855	12.969	0.051
233.584	10.958	0.051
190.378	8.978	0.050
146.778	6.988	0.050
103.560	4.995	0.050

File: 1533647

Linear regression analysis

Slope	0.04600 (m/s)/(Hz) ±0.00005 (m/s)/(Hz)
Offset	0.2308 m/s ±0.011 m/s
Standard error (Y)	0.011 m/s
Correlation coefficient	0.999994

Remarks

The calibrated sensor complies with the demanded linearity of MEASNET

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Graphical representation of the result
Grafische Darstellung des Ergebnises

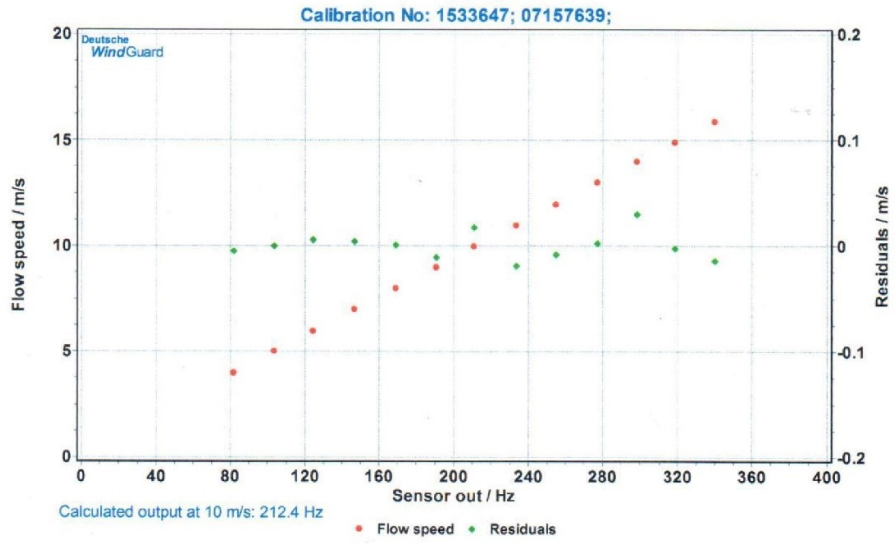
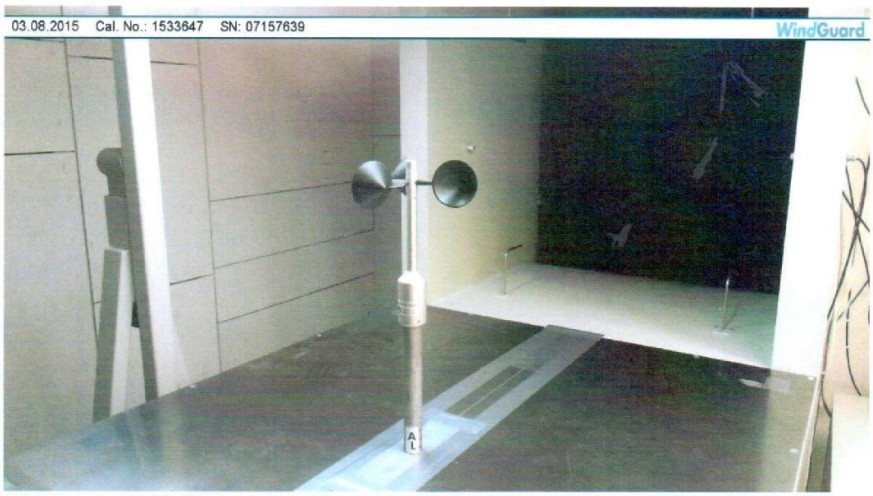


Photo of the measurement setup
Foto des Messaufbaus



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

Deutsche WindGuard
Wind Tunnel Services GmbH, Varel

DEUTSCHE WINDGUARD

accredited by the / *akkreditiert durch die*

Deutsche Akkreditierungsstelle GmbH

as calibration laboratory in the / *als Kalibrierlaboratorium im*

Deutschen Kalibrierdienst DKD

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

Calibration certificate
Kalibrierschein

Calibration mark
Kalibrierzeichen

1521960
D-K-15140-01-00
06/2015

Object *Gegenstand*	Wind Vane
Manufacturer *Hersteller*	Thies Clima D-37083 Göttingen
Type *Typ*	4.3151.00.901
Serial number *Fabrikat/Serien-Nr.*	05150039
Customer *Auftraggeber*	Ammonit Measurement GmbH D-10997 Berlin
Order No. *Auftragsnummer*	L 23473
Project No. *Projektnummer*	VT150598
Number of pages *Anzahl der Seiten*	6
Date of Calibration *Datum der Kalibrierung*	19.06.2015

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*
19.06.2015	Dipl. Phys. Dieter Westermann	Kai Schuster, B. Eng.

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Calibration object
Kalibriergegenstand

Wind Vane

Calibration procedure
Kalibrierverfahren

• Deutsche WindGuard Wind Tunnel Services: Calibration of wind direction sensors - 1.0 (2014)
Based on following standards:
• 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 16622: Meteorology - Sonic anemometers/thermometers
• ASTM 5366-96: Standard Test Method of Measuring the Dynamic Performance of Wind Vanes

Place of calibration
Ort der Kalibrierung

Windtunnel of Deutsche WindGuard WindTunnel Servies GmbH, Varel

Test conditions
Messbedingungen

wind tunnel area	10000 cm²
anemometer frontal area	200 cm²
diameter of mounting pipe	34 mm
blockage ratio [1)]	0.020 [-]
software version	7.64

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

Ambient conditions
Umgebungsbedingungen

air temperature	21.5 °C ± 0.1 °C
air pressure	1014.1 hPa ± 0.3 hPa
relative air humidity	53.7 % ± 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)

Latest accreditation
Letzte Akkreditierung

04/2014

Additional remarks
Zusätzliche Anmerkungen

-

Calibration result (1/3)
Kalibrierergebnis (1/3)

Bin	Flow direction	Sensor out	Uncertainty	Flow speed
-	deg	deg	deg	m/s
1	4.98	6.61	0.8	7.983
2	10.04	11.65	0.8	7.984
3	15.06	16.67	0.8	7.980
4	20.06	21.59	0.8	7.981
5	25.03	26.60	0.8	7.981
6	30.04	31.66	0.8	7.983
7	34.99	36.61	0.8	7.981
8	39.99	41.69	0.8	7.983
9	45.03	46.79	0.8	7.982
10	50.05	51.86	0.8	7.984
11	55.06	56.77	0.8	7.983
12	60.03	61.80	0.8	7.982
13	65.03	66.83	0.8	7.981
14	70.00	71.77	0.8	7.981
15	74.97	76.74	0.8	7.983
16	80.00	81.62	0.8	7.984
17	84.98	86.55	0.8	7.979
18	90.10	91.66	0.8	7.984
19	95.13	96.62	0.8	7.984
20	100.06	101.48	0.8	7.981
21	104.91	106.42	0.8	7.982
22	109.91	111.54	0.8	7.980
23	114.97	116.72	0.8	7.978
24	119.95	121.75	0.8	7.979
25	124.91	126.80	0.8	7.983
26	129.96	131.78	0.8	7.983
27	134.96	136.75	0.8	7.981
28	139.98	141.85	0.8	7.981
29	144.98	147.00	0.8	7.982
30	149.97	152.12	0.8	7.981

Calibration result (2/3)
Kalibrierergebnis (2/3)

Bin	Flow direction	Sensor out	Uncertainty	Flow speed
-	deg	deg	deg	m/s
31	155.06	156.97	0.8	7.979
32	160.07	161.90	0.8	7.981
33	165.06	166.99	0.8	7.980
34	170.00	171.89	0.8	7.982
35	175.04	176.93	0.8	7.984
36	180.08	181.98	0.8	7.987
37	185.05	186.88	0.8	7.980
38	190.05	191.76	0.8	7.978
39	195.08	196.74	0.8	7.985
40	200.02	201.68	0.8	7.980
41	204.95	206.66	0.8	7.988
42	210.02	211.75	0.8	7.977
43	215.02	216.79	0.8	7.981
44	219.98	221.76	0.8	7.985
45	225.05	226.78	0.8	7.984
46	230.06	231.92	0.8	7.985
47	234.95	236.78	0.8	7.982
48	239.99	241.83	0.8	7.979
49	244.99	246.84	0.8	7.981
50	249.93	251.91	0.8	7.982
51	254.94	256.90	0.8	7.986
52	259.95	261.92	0.8	7.979
53	264.98	266.86	0.8	7.983
54	269.97	271.80	0.8	7.978
55	274.92	276.81	0.8	7.983
56	279.91	281.75	0.8	7.981
57	284.95	286.65	0.8	7.982
58	289.95	291.70	0.8	7.980
59	294.96	296.72	0.8	7.986
60	299.99	301.80	0.8	7.985
61	304.96	306.82	0.8	7.982
62	309.93	311.79	0.8	7.981

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Calibration result (3/3)
Kalibrierergebnis (3/3)

Bin	Flow direction	Sensor out	Uncertainty	Flow speed
-	deg	deg	deg	m/s
63	314.97	316.87	0.8	7.985
64	320.01	321.96	0.8	7.982
65	325.00	326.98	0.8	7.986
66	330.02	332.12	0.8	7.983
67	335.01	337.03	0.8	7.981
68	340.01	342.08	0.8	7.984
69	345.06	347.05	0.8	7.982
70	350.00	351.91	0.8	7.984
71	355.00	356.85	0.8	7.978

File: 1521960

Linear regression analysis	Slope	1.00091 deg/deg
	Offset	1.6293 deg

Graphical representation of the result
Grafische Darstellung des Ergebnises

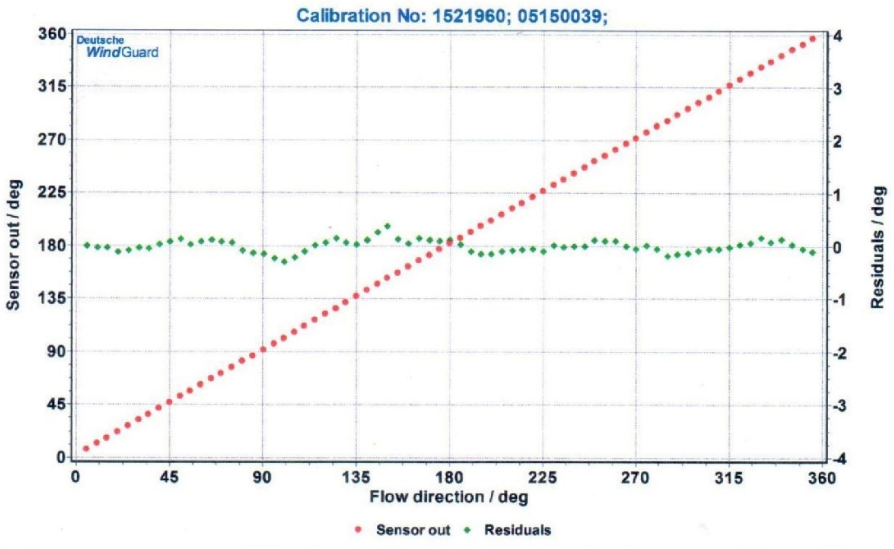
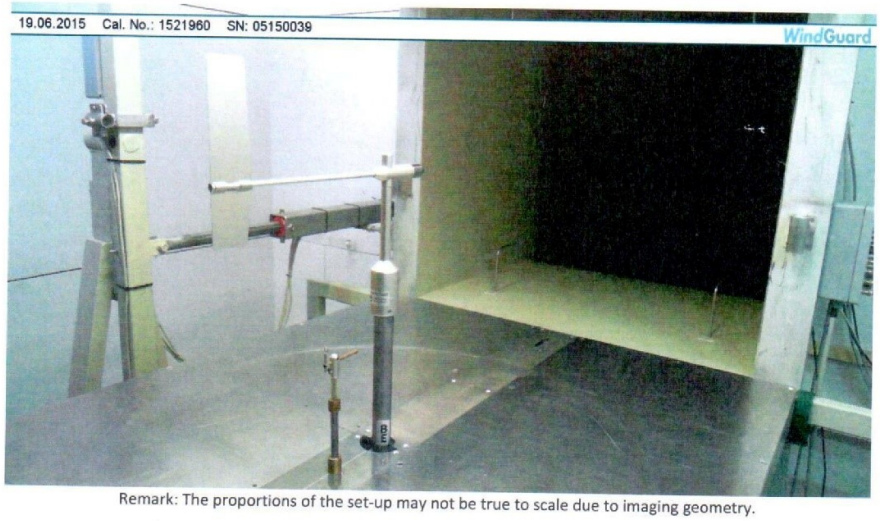


Photo of the measurement setup
Foto des Messaufbaus



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

Deutsche WindGuard
Wind Tunnel Services GmbH, Varel

DEUTSCHE WINDGUARD

accredited by the / *akkreditiert durch die*

Deutsche Akkreditierungsstelle GmbH

as calibration laboratory in the / *als Kalibrierlaboratorium im*

Deutschen Kalibrierdienst DKD

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

Calibration certificate *Kalibrierschein*	1521961
Calibration mark *Kalibrierzeichen*	D-K-15140-01-00 06/2015

Object *Gegenstand*	Wind Vane
Manufacturer *Hersteller*	Thies Clima D-37083 Göttingen
Type *Typ*	4.3151.00.901
Serial number *Fabrikat/Serien-Nr.*	05150038
Customer *Auftraggeber*	Ammonit Measurement GmbH D-10997 Berlin
Order No. *Auftragsnummer*	L 23473
Project No. *Projektnummer*	VT150598
Number of pages *Anzahl der Seiten*	6
Date of Calibration *Datum der Kalibrierung*	19.06.2015

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.
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Date *Datum*	Head of the calibration laboratory *Leiter des Kalibrierlaboratoriums*	Person in charge *Bearbeiter*
19.06.2015	Dipl. Phys. Dieter Westermann	Kai Schuster, B. Eng.

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D-K-15140-01-00
06/2015

Calibration object
Kalibriergegenstand
Wind Vane

Calibration procedure
Kalibrierverfahren
• Deutsche WindGuard Wind Tunnel Services: Calibration of wind direction sensors - 1.0 (2014)
Based on following standards:
• 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 16622: Meteorology - Sonic anemometers/thermometers
• ASTM 5366-96: Standard Test Method of Measuring the Dynamic Performance of Wind Vanes

Place of calibration
Ort der Kalibrierung
Windtunnel of Deutsche WindGuard WindTunnel Servies GmbH, Varel

Test conditions
Messbedingungen

wind tunnel area	10000 cm²
anemometer frontal area	200 cm²
diameter of mounting pipe	34 mm
blockage ratio [1)]	0.020 [-]
software version	7.64

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

Ambient conditions
Umgebungsbedingungen

air temperature	21.6 °C ± 0.1 °C
air pressure	1014.2 hPa ± 0.3 hPa
relative air humidity	53.5 % ± 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)

Latest accreditation
Letzte Akkreditierung
04/2014

Additional remarks
Zusätzliche Anmerkungen
-

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Calibration result (1/3)
Kalibrierergebnis (1/3)

Bin	Flow direction	Sensor out	Uncertainty	Flow speed
-	deg	deg	deg	m/s
1	5.03	5.97	0.8	7.884
2	10.04	10.98	0.8	7.885
3	14.99	15.91	0.8	7.886
4	20.00	20.90	0.8	7.883
5	25.06	25.95	0.8	7.883
6	30.07	30.96	0.8	7.884
7	35.05	35.99	0.8	7.884
8	40.05	41.07	0.8	7.881
9	45.05	46.10	0.8	7.883
10	50.06	51.14	0.8	7.883
11	55.05	56.08	0.8	7.881
12	60.01	61.13	0.8	7.883
13	65.04	66.18	0.8	7.885
14	70.06	71.20	0.8	7.886
15	75.06	76.11	0.8	7.886
16	80.04	81.07	0.8	7.885
17	84.59	85.58	0.8	7.888
18	89.90	90.78	0.8	7.883
19	94.87	95.69	0.8	7.882
20	99.95	100.75	0.8	7.881
21	105.01	105.84	0.8	7.882
22	109.97	110.89	0.8	7.882
23	114.94	115.93	0.8	7.881
24	119.95	120.99	0.8	7.883
25	124.89	125.91	0.8	7.880
26	129.94	130.97	0.8	7.882
27	134.93	135.95	0.8	7.883
28	139.90	140.99	0.8	7.884
29	144.90	146.07	0.8	7.883
30	149.93	151.22	0.8	7.886

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Calibration result (2/3)
Kalibrierergebnis (2/3)

Bin	Flow direction	Sensor out	Uncertainty	Flow speed
-	deg	deg	deg	m/s
31	155.11	156.26	0.8	7.885
32	160.04	161.19	0.8	7.880
33	165.04	166.19	0.8	7.883
34	170.03	171.21	0.8	7.880
35	175.03	176.07	0.8	7.886
36	180.07	180.97	0.8	7.886
37	185.07	185.98	0.8	7.880
38	190.09	190.86	0.8	7.885
39	195.02	195.77	0.8	7.886
40	199.92	200.78	0.8	7.884
41	204.98	205.97	0.8	7.885
42	209.96	210.96	0.8	7.885
43	214.94	216.09	0.8	7.884
44	220.03	221.16	0.8	7.883
45	225.01	226.13	0.8	7.888
46	229.94	231.17	0.8	7.885
47	234.93	236.14	0.8	7.885
48	239.90	241.06	0.8	7.889
49	244.89	246.09	0.8	7.886
50	250.00	251.26	0.8	7.885
51	254.99	256.12	0.8	7.881
52	260.02	261.02	0.8	7.883
53	265.02	266.01	0.8	7.884
54	270.04	270.94	0.8	7.886
55	275.03	275.94	0.8	7.884
56	279.99	280.87	0.8	7.885
57	285.01	285.86	0.8	7.885
58	290.04	291.03	0.8	7.882
59	295.05	296.16	0.8	7.885
60	300.05	301.11	0.8	7.879
61	304.98	306.13	0.8	7.883
62	309.94	311.02	0.8	7.884

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Calibration result (3/3)
Kalibrierergebnis (3/3)

Bin	Flow direction	Sensor out	Uncertainty	Flow speed
-	deg	deg	deg	m/s
63	314.97	316.14	0.8	7.884
64	320.00	321.25	0.8	7.882
65	325.05	326.25	0.8	7.881
66	330.05	331.25	0.8	7.887
67	334.95	336.23	0.8	7.880
68	339.93	341.29	0.8	7.882
69	344.99	346.30	0.8	7.882
70	350.00	351.24	0.8	7.886
71	355.01	356.12	0.8	7.885

File: 1521961

Linear regression analysis	Slope	1.00061 deg/deg
	Offset	0.9398 deg

Graphical representation of the result
Grafische Darstellung des Ergebnises

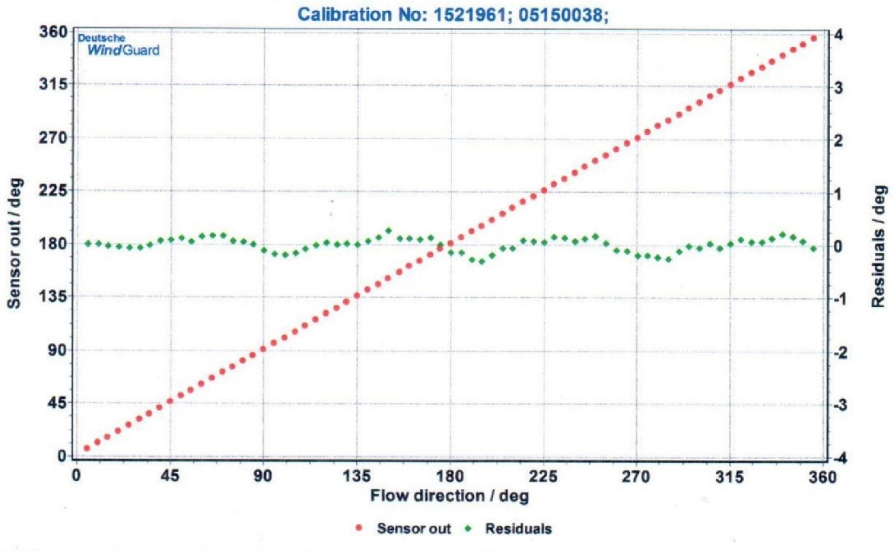
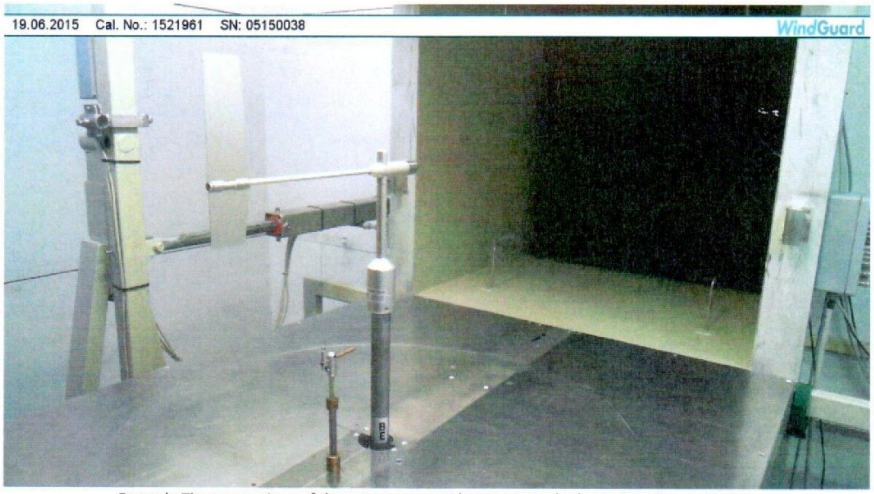


Photo of the measurement setup
Foto des Messaufbaus



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

WERKSZEUGNIS / *Specific report*

nach DIN EN 10 204 - 2.2 *acc. to EN 10 204 - 2.2*

Galltec +mela

zertifiziert nach DIN EN ISO 9001:2008

Benennung	*Name*	Temperatursensor
Typ	*Type*	**TPC1.S/6-ME**
Messbereich	*Measuring range*	-30...70°C
Ausgang	*Electr. Output*	0...1V
Serien-Nr.	*Serial-No.*	154294
Ihre Auftrags-Nr.	*Your Order-No.*	L23354
Unsere Auftrags-Nr.	*Our Confirmation-No.*	A66353A030 (AU18722 78464)

Hiermit bestätigen wir, dass das oben bezeichnete Messgerät unter Beachtung eines dokumentierten Werkstandards gefertigt und geprüft wurde.
- Justage im Konstantklima
- Warenausgangsprüfung im Konstantklima

Die für die Prüfung verwendeten Referenz-Prüfmittel unterliegen einer regelmäßigen Kalibrierung und sind rückführbar auf nationale und internationale Normale. Wo keine nationalen Normale existieren, entspricht das Messverfahren den derzeit gültigen technischen Regeln.

We hereby confirm that the above-mentioned instrument was produced and tested according to the manufaction standard.
- *Adjustment at constant climate*
- *End products are checked at constant climate*

The measuring installations used for testing are regularly calibrated and are based on the national or international standards. Should no national standards exist, the measuring procedure corresponds with the technical regulations and norms valid at the time of the measurement.

Bestätigung

Die standardisierte Bauform des Gerätes führt zu einem Standardverhalten dieses Messgerätes, bei Einhaltung der Produktinformation A1.

Confirmation

The standard reaction of the transmitter is caused by the standardized type of the measuring instrument, in compliance with Product Information A1.

Messgenauigkeit

Temperatur: (MB 10...40°C) ± **0,2 K**
Weiteres siehe Datenblatt.

Measurement accuracy

*Temperature: (MR 10...40°C) ± **0,2 K***
Further information at data sheet.

21.07.2015
Datum/
Date

Unterschrift/*Signature*
-Qualitätssicherung-/
- Quality assurance -

Mela Sensortechnik GmbH
Raasdorfer Str. 18
07987 Mohlsdorf-Teichwolframsdorf
Tel. (0 36 61) 62 70 40

WERKSZEUGNIS / *Specific report*

nach DIN EN 10 204 - 2.2 *acc. to EN 10 204 - 2.2*

Galltec +mela

zertifiziert nach DIN EN ISO 9001:2008

Benennung	*Name*	Klimasensor
Typ	*Type*	**KPC1.S/6-ME**
Messbereich	*Measuring range*	0...100% r.F. / -30...70°C
Ausgang	*Electr. Output*	2 x 0...1 V
Serien-Nr.	*Serial-No.*	154 280
Ihre Auftrags-Nr.	*Your Order-No.*	L23213
Unsere Auftrags-Nr.	*Our Confirmation-No.*	A65630A110(AU18076 78461)

Hiermit bestätigen wir, dass das oben bezeichnete Messgerät unter Beachtung eines dokumentierten Werkstandards gefertigt und geprüft wurde.
- Justage im Konstantklima
- Warenausgangsprüfung im Konstantklima

We hereby confirm that the above-mentioned instrument was produced and tested according to the manufaction standard.
- *Adjustment at constant climate*
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The measuring installations used for testing are regularly calibrated and are based on the national or international standards. Should no national standards exist, the measuring procedure corresponds with the technical regulations and norms valid at the time of the measurement.

Bestätigung

Die standardisierte Bauform des Gerätes führt zu einem Standardverhalten dieses Messgerätes, bei Einhaltung der Produktinformation A1.

Confirmation

The standard reaction of the transmitter is caused by the standardized type of the measuring instrument, in compliance with Product Information A1.

Messgenauigkeit

Feuchte: (MB 5...95% r.F. bei 10...40°C) ± **2% r.F.**

Temperatur: (MB 10...40°C) ± **0,2 K**
Weiteres siehe Datenblatt.

Measurement accuracy

*Humidity: (MR 5...95% r.h. at 10...40°C) ± **2% r.h.***

*Temperature: (MR 10...40°C) ± **0,2 K***
Further information at data sheet.

21.07.2015
Datum/
Date

Unterschrift/*Signature*
-Qualitätssicherung-/
- Quality assurance -

Mela Sensortechnik GmbH
Raasdorfer Str. 18
07987 Mohlsdorf-Teichwolframsdorf
Tel. (0 36 61) 62 70 40

Quality Certificate - Declarations

for Ammonit pressure sensor AB100

Ammonit

We **Ammonit Measurement GmbH**
Wrangelstr. 100
10997 Berlin – Germany

for the Ammonit pressure sensor AB100 with serial number: **B14-0486**

declare under our sole responsibility:

1. CE Confirmation

It is confirmed that the products

Type: **Air pressure sensor**
Name: **AB100**

to which this declaration relates are in accordance with the following standards:

Imissions	EN 50082-1	Group standard
	IEC 1000-4-2	IEC 801-2
	IEC 1000-4-3	IEC 801-3
	IEC 1000-4-4	IEC 801-4
Emissions	EN 50081-1	Group standard
	EN 55014	
	EN 55022	

CE

2. Warranty

The products:

Type: **Air pressure sensor**
Name: **AB100**
including accessories manufactured by Ammonit

obtain the warranty for 12 months from the date of dispatch
and further 12 months on all repairs carried out by the supplier.

3. DIN EN ISO 9001:2008

We established and applied a

Quality Management System according to
DIN EN ISO 9001:2008

for development, manufacture, sales and distribution of Data Loggers and sensors for measuring and evaluating meteorological and wind measurand. The certificate is valid until 16 June 2012 and listed in the certificate register number E 00/03/01.

Ammonit Measurement GmbH
Wrangelstrasse 100; D-10997 Berlin; T: +49-30-6003188-0; E: info@ammonit.com; www.ammonit.com

Quality Certificate - Declarations
for Ammonit pressure sensor AB100

Ammonit

4. Measuring Accuracy

Operating range (-40 to +85°C, 0-98% r.h.)
Uncertainties of signal inputs are defined as (in the range -10 to +60°C))

Reference pressure hPa	Uncertainty hPa
650	± 5,00
800	± 5,00
1050	± 5,00

Berlin, September 2015
Ammonit Measurement GmbH

V Camier

Vincent Camier (Managing Director)
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Ammonit Measurement GmbH
Wrangelstraße 100; 10997 Berlin – Germany

Amtsgericht Berlin-Charlottenburg
HRB: 31099 VAT-ID No. DE 136 567 928
Geschäftsführer: Vincent Camier
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