Svend Ole Hansen ApS

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WIND
ENGINEERING
FLUID
DYNAMICS

CERTIFICATE FOR CALIBRATION OF CUP ANEMOMETER

Certificate number: 12.02.09553 **Date of issue:** December 20, 2012

Type: Thies 4.3351.10.000 **Serial number:** 12121712

Manufacturer: ADOLF THIES GmbH & Co.KG, Hauptstrasse 76, 37083 Göttingen, Germany

Client: Sky Power Int'l LLC, 260 Sawdust Road, 29657-8521 Liberty SC, USA

Anemometer received: December 13, 2012 **Anemometer calibrated:** December 15, 2012

Calibrated by: mdp **Calibration procedure:** IEC 61400-12-1, MEASNET

Certificate prepared by: ca **Approved by:** Calibration engineer, mlp

Calibration equation obtained: v [m/s] = 0.04665 · f [Hz] + 0.19653

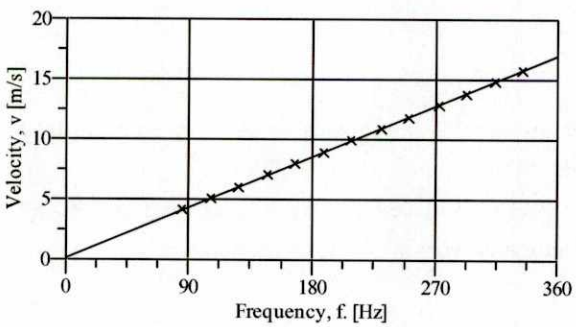
Standard uncertainty, slope: 0.00127 **Standard uncertainty, offset:** 0.06711

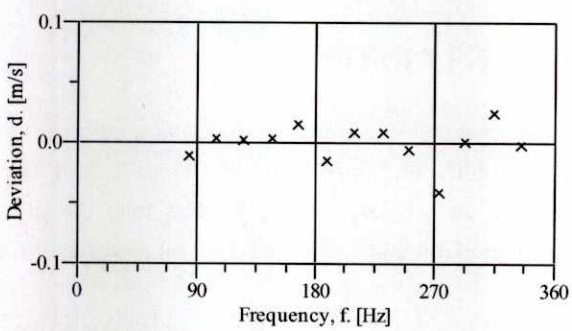
Covariance: -0.0000007 (m/s)²/Hz **Coefficient of correlation:** $\rho = 0.999991$

Absolute maximum deviation: -0.040 m/s at 12.892 m/s

Barometric pressure: 998.4 hPa **Relative humidity:** 18.8%

Succession	Velocity pressure, q. [Pa]	Temperature in wind tunnel [°C]	Temperature in control room [°C]	Wind velocity, v. [m/s]	Frequency, f. [Hz]	Deviation, d. [m/s]	Uncertainty u_c (k=2) [m/s]
2	9.91	28.2	21.2	4.148	84.9205	-0.010	0.021
4	15.09	28.0	21.2	5.119	105.4325	0.004	0.025
6	21.24	27.9	21.2	6.072	125.8773	0.003	0.029
8	28.87	27.8	21.1	7.078	147.4259	0.004	0.033
10	36.84	27.7	21.1	7.994	166.7882	0.016	0.037
12	46.41	27.7	21.1	8.971	188.3920	-0.014	0.042
13-last	57.00	27.6	21.1	9.942	208.6815	0.009	0.046
11	69.25	27.7	21.1	10.959	230.4936	0.009	0.051
9	81.35	27.8	21.1	11.880	250.5428	-0.005	0.055
7	95.76	27.9	21.1	12.892	272.9860	-0.040	0.060
5	110.50	28.0	21.2	13.851	292.6350	0.002	0.064
3	127.23	28.1	21.2	14.866	313.9078	0.024	0.069
1-first	143.36	28.3	21.2	15.786	334.1806	-0.002	0.073





ilac-MRA

DANAK
CAL Reg.nr. 452
Accreditation to ISO 17025

Denmark - Svend Ole Hansen ApS - Wind Engineering - measnet

EQUIPMENT USED

Serial number	Description
-	Boundary layer wind tunnel.
1256	Control cup anemometer.
-	Mounting tube, D = 35 mm
t1	PT100 temperature sensor, wind tunnel.
t2	PT100 temperature sensor, control room.
9904031	PPC500 Furness pressure manometer
X4650038	HMW71U Humidity transmitter
X4350042	PTB100AVaisala analogue barometer.
P11	Pitot tube
HB2835279	Computer Board. 16 bit A/D data acquisition board.
-	PC dedicated to data acquisition.

Traceable calibrations of the equipment are carried out by external accredited institutions: Furness (PPC500) and Saab Metech. A real-time analysis module within the data acquisition software detects pulse frequency.

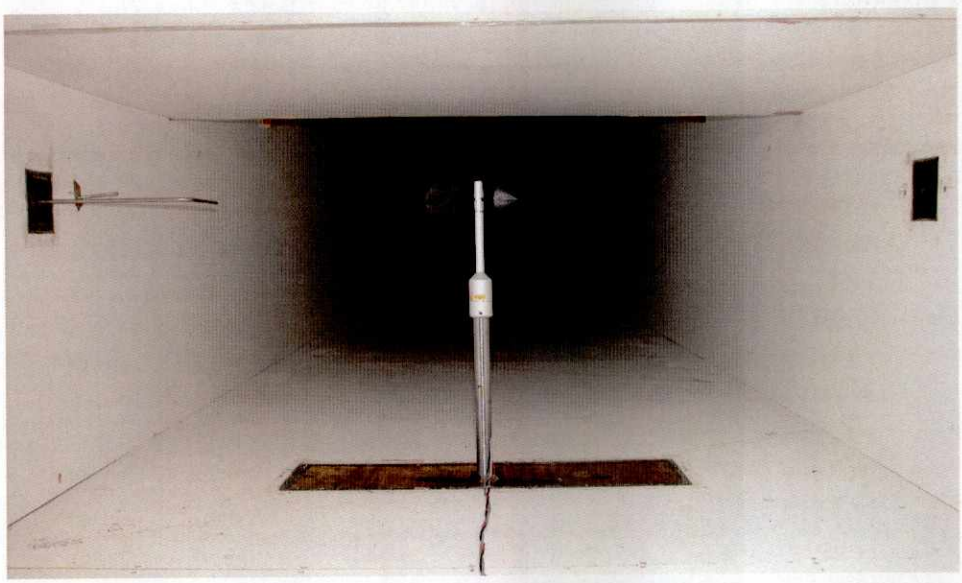


Photo of the wind tunnel setup (hxb = 0.85x1.75 m). The shown anemometer is of the same type as the calibrated one.

UNCERTAINTIES

The documented uncertainty is the total combined uncertainty at 95% confidence level (k=2) in accordance with EA-4/02. The uncertainty at 10 m/s comply with the requirements in the MEASNET procedure that prescribes an absolute uncertainty less than 0.1 m/s at a mean wind velocity of 10 m/s, that is 1%. See Document 97.00.004 "MEASNET - Test report on the calibration campaign" for further details.

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