CERTIFICADO DE CALIBRACION

Certificate of Calibration

Número **29165AC**
Number

Instituto Universitario de Microgravedad "Ignacio Da Riva"
Laboratorio de Calibración en Túnel Aerodinámico, LAC, IDR/UPM
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OBJETO *Item*	Cup Anemometer
MARCA *Mark*	THIES CLIMA
MODELO *Model*	4.3351.10.000
IDENTIFICACION *Identification*	02195266
SOLICITANTE *Applicant*	KINTECH INGENIERIA, S.L. Avda. Anselmo Clavé, nº 37-45, local bajo 50004 Zaragoza
FECHA DE CALIBRACION *Date of Calibration*	March 25, 2019

Signatarios autorizados
Authorized signatories

Fecha de emisión:
Date of issue
March 28, 2019

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Fecha: 2019.03.28 15:02:17 +01'00'

Dirección Técnica
Technical Direction

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1. ORDER IDENTIFICATION

Order reference number: 2019090080
Arrival date: 08/03/2019

2. MEASUREMENTS

Measurements were made at the Wind Tunnel of LAC, IDR/UPM following procedure PE-02 of LAC, IDR/UPM, according to the guidelines set by the MEASNET network.
The reference velocity was measured using a Pitot tube ISO3966.
The anemometer was placed on the mounting pilar of the wind tunnel test section which is rectangular of 0.9 m height and 0.9 m width. Before calibration, the anemometer was run at a steady wind tunnel velocity of 10 m/s for 5 minutes in order to avoid the effect that the temperature variations may have on the mechanical friction of the anemometer bearings. Calibration was performed under both rising and falling wind speed in the range of 4 to 16 m/s. The sampling frequency was 10 Hz and the sampling interval was 30 s. Before collecting data at each wind speed, 1 minute delay was allowed for stable conditions to become established.
The calibration campaign is described in Report "ANEMOMETER CALIBRATION REPORT. CAMPAIGN 2000".

3. LIST OF EQUIPMENT USED

Instrument	Manufacturer	Type	Serial Number	Code	Calibration	
					Date	Traceability
Pitot Tube	AIRFLOW	0.48	N.A.	9410009	12/16/2015	PTB-1.41-4074947
Pressure Transducer	MKS	120A-23139	017688068	7111009	18/04/2018	EUROPASCAL S 8767
Digital Multimeter	KEITHLEY	2000	0653686	1011002	05/04/2017	ENAC 1250-307083246
Barometer Transmitter	VAISALA	PTU200	Z1110002	9711002	27/11/2018	ESTEM-MAD-CI-18029194
Temp.-humid. Sensor		PTU200	Z1110021		27/11/2018	ESTEM-MAD-CI-18029284
Universal Counter	HP	53131A	3736A22513	2011002	03/04/2017	ENAC 1250-3070783248

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4. AMBIENT CONDITIONS

		Mean	Min.	Max.
Air temperature:	[ºC]	24.51	24.32	24.72
Air pressure:	[hPa]	941.17	940.75	941.48
Air humidity:	[%]	27.1	26.6	27.5

5. RESULTS

The results included in this certificate are only applicable to the calibrated instrument and to the time instant and conditions at which the calibration was carried out.

Table 1. Calibration Results

Anemometer Output F [Hz]	Reference Wind Speed V [m/s]	Uncertainty of V (k=2) [m/s]	Residuals* [m/s]
86.003	4.18	0.10	-0.0251
126.994	6.10	0.10	0.0019
170.220	8.09	0.10	0.0045
213.898	10.10	0.10	0.0025
257.424	12.12	0.12	0.0134
302.446	14.14	0.14	-0.0354
342.281	16.00	0.16	-0.0139
323.358	15.14	0.15	0.0011
280.130	13.14	0.13	-0.0085
234.153	11.08	0.11	0.0511
190.900	9.08	0.10	0.0376
148.723	7.06	0.10	-0.0329
104.147	5.04	0.10	0.0035

* Residuals: difference between the anemometer output and the linear regression result.

"The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k = 2, which for a normal distribution corresponds to a coverage probability of approximately 95%. The standard uncertainty of measurement has been determined in accordance with EAL Publication EA -4/02".

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Linear Regression Results

The statistical uncertainty is given by

$$\sigma(y_a) = \left\{ x_a^2 \ \sigma_A^2 + \sigma_B^2 + 2x_a \ \mathrm{COV}(A,B) \right\}^{1/2}.$$

For 10 m/s wind speed the statistical uncertainty $\sigma(y_a)$ is 0.0072 [m/s].

Table 2. Linear Regression Results

V [m/s] = A ([m/s]/[Hz])*F [Hz]+B [m/s]

Parameter	Value	sd	Comments
A	0.04607	0.00009	Slope
B	0.24207	0.02038	Offset
r	0.99998		Regression Coefficient
sd(V)	0.02607		Standard Deviation

The linear regression has been carried out by using a least squares fitting.

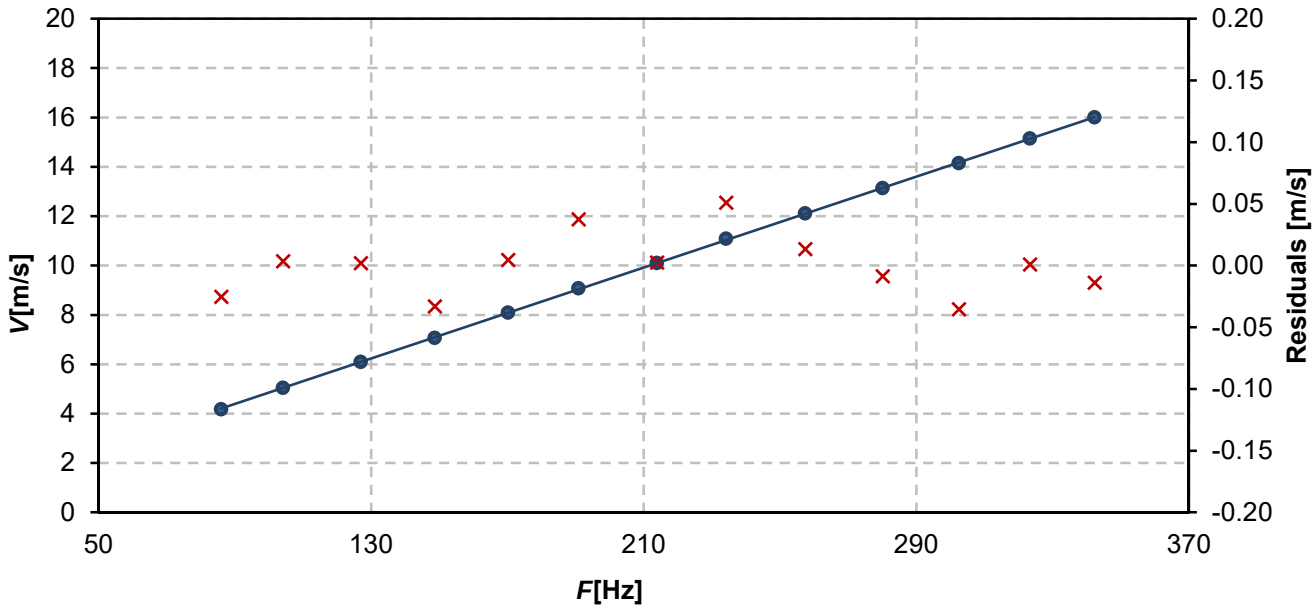

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Photo of the Anemometer in the Wind Tunnel

Remarks:
The photo does not correspond to the actual calibration but shows a representative arrangement of the mounting of that type of anemometers.
Mast Diameter: 35 mm

References

Nikolai A. Bezdenejnykh, "Anemometer Calibration Report. Campaign 2000", Ref. T/ICC/C0011

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Test Report issued under the responsibility of:

TEST REPORT
IEC 61400-12-1:2017 Annex F
Anemometer Calibration Certificate

IECRE Report Number.....:	**IECRE.WE.TR.AC.19.01395-R0**
RETL Calibration Certificate.....:	**29165AC**
Date of issue.....:	March 28, 2019
RE Testing Laboratory.....: (Name & Address)	LAC, IDR/UPM Instituto Universitario de Microgravedad "Ignacio Da Riva" E.T.S.I. Aeronáutica y del Espacio Plaza del Cardenal Cisneros, 3, E-28040 Madrid
Applicant.....: (Name & Address)	KINTECH INGENIERIA, S.L. Avda. Anselmo Clavé, nº 37-45, local bajo 50004 Zaragoza
Test item description.....:	Cup Anemometer
Manufacturer.....:	THIES CLIMA
Model/Type reference.....:	4.3351.10.000
Ratings / Serial number.....:	02195266

Tested by (name, function, signature)	Printed name/function	Signature
.....:	Jose A. Matías Technical Assistant	
Approved by (name, function, signature).....:	Printed name/function Enrique Vega Technical Direction	Signature

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