ENAC
CALIBRACIÓN
N° 217-LC/10.175

CERTIFICADO DE CALIBRACIÓN

Certificate of calibration

Número **ISM 2019-03-17-04**
Number

ISM3D

Ingeniería y Servicios Metrología Tridimensional S.L.
33203 Gijón Asturias
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OBJETO : **Dumbbell with random black and white pattern**
Item

MARCA : **Trapet PE**
Mark

MODELO : **Dumbbell L125 D75**
Model

IDENTIFICACIÓN : **10-2019**
Identification

SOLICITANTE : **PHOTOGAUGE**
Applicant **Chennai 600042**
India

FECHA/S DE CALIBRACIÓN : **17.3.2019**
Date/s of calibration

Signatario/s autorizado/s
Authorized signatory/ies

Dr.-Ing. Eugen Trapet
Jefe de Laboratorio

TRAPET --- EUGEN HERBERT - X2920987X

Firmado digitalmente por TRAPET --- EUGEN HERBERT - X2920987X
Nombre de reconocimiento (DN): c=ES, serialNumber=X2920987X, sn=TRAPET ---, givenName=EUGEN HERBERT, cn=TRAPET --- EUGEN HERBERT - X2920987X
Fecha: 2019.04.30 23:38:55 +02'00'

Fecha de emisión
Date of issue
17.3.2019

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Method

The dumbbell (2-ball ball bar) was measured according to the procedure T 03-01 of ISM3D using a coordinate measuring machine (CMM).

The dumbbell was measured by probing each ball with 29 equally distributed points on a hemisphere. The dumbbell was measured in 4 different orientations in the measuring volume of the CMM, with the dumbbell between each orientation rotated 90° around its axis so that the probing points lay in different but overlapping areas/hemispheres; these independent measurements were corrected for temperature and averaged in case of the measurands “length” and “diameter”. In case of the measurand “form error”, the worst (biggest) range of radial deviations is reported as result.

Linear scale factor and probe tip diameter were not corrected, as the above specified procedure does not require a correction.

Coordinate system und alignment

No coordinate system is required to state the results.

Ball 1 is the one closest to the dot mark on the stem.

Environmental conditions

The reference temperature is 20ºC. All measured lengths are referred to 20ºC. The temperature of the environment was kept at 20.3ºC +/- 0.3K during the calibration. For the linear thermal expansion coefficient of the dumbbell length a value of 0.0000152 has been used, for the sphere diameters a value of 0.000022 1/K. The value is based on calculation from nominal values: steel shaft in aluminium spheres, 20 mm deep.

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Uncertainty

The uncertainty U (for k=2) of the center to center distance is U = 1.70 µm and of the diameters U = 2.00 µm. The uncertainty of the deviations from the substitute (ideal form) Gaussian sphere is 1.80 µm (note: the uncertainty of the range of deviations is thus 2.55 µm).

This uncertainty of length and diameter are limited due to the form error of the object. They are bigger than the accredited scope of ISM3D. The analysis of the uncertainty of the deviations of form has been performed according to the Method of the Virtual CMM as described in procedure T3-01 “Calibración de piezas patrón con MMC Virtual” and T1-06 “Calibración de los parámetros de la MMC Vitual”.

The expanded uncertainty of the measurement results has been obtained by multiplying the standard uncertainty by the coverage factor *k*>2, due to the small number of measurements, which for a standard distribution of values results approximately in a probability of coverage of 95%. The standard uncertainty has been determined in accordance with A-4/02 M: 2013 and ILAC-P14.

The uncertainties associated with the results correspond to the moment of the calibration, they don´t contain provisions for long term variations of the object. They are only valid for the object identified on the first page of this certificate.

Results

Center distance of the balls: **123.84185 mm**
Diameter of ball 1 (near the white dot): **75.58414 mm**
Diameter of ball 2: **75.72714 mm**
Range of radial deviations from Gaussian Substitute Sphere of ball 1: **0.00996 mm**
Range of radial deviations from Gaussian Substitute Sphere of ball 2: **0.00971 mm**