Measurement Standards Laboratory of New Zealand

Report on the Measurement of 16 Tube Samples

Report No. Length/2021/1202, 27 May 2021

ISSUED BY:

Measurement Standards Laboratory of New Zealand.

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All results quoted in this report are directly traceable to the national measurement standards held by the Measurement Standards Laboratory of New Zealand (MSL). MSL is New Zealand's national metrology institute and operates within Callaghan Innovation.

This certificate is consistent with the capabilities that are included in Appendix C of the MRA drawn up by the CIPM. Under the MRA, all participating institutes recognise the validity of each other's calibration and measurement certificates for the quantities, ranges and measurement uncertainties specified in Appendix C.
For details see www.bipm.org

Accreditation Number 1

All measurements reported herein, unless otherwise noted, have been performed in accordance with the laboratory's scope of accreditation. *For details see www.ianz.govt.nz*

69 Gracefield Road, Lower Hutt 5010
PO Box 31310, Lower Hutt 5040, New Zealand

www.measurement.govt.nz

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Description

There are sixteen cylindrical tube samples manufactured by We Can Precision Engineering Ltd. using a variety of manufacturing techniques. All samples are approximately 40 mm long with an inner diameter of approximately 32 mm. The odd numbered cylinders have an outer diameter of approximately 40 mm and the even numbered samples have an outer diameter of approximately 50 mm.

Identification

Each tube is stamped on one end with a number from 1 to 16.

Client

We Can Precision Engineering Ltd, 303 Wilson Road, Hastings 4120.

Dates of Calibration

23 April 2021 to 5 May 2021.

Conditions

Ambient temperature was maintained within ±1 °C of 20 °C.

Method

Measurements of the total run out and coaxiality of the inner and outer cylindrical surfaces of the tubes were measured on a Mitutoyo RA-2200 Roundness Machine according to MSLT.L.011.007 Roundness Measurement. Each cylinder was measured over a section extending between approximately 2.5 mm and 36.5 mm from the unstamped end of the tube.

Total run-out is defined for a cylindrical surface with respect to a datum axis. It is defined as the radial separation between two cylinders which are coaxial to the datum axis and where all measured surface points are between the two cylinders. It includes contributions from variations such as circularity, cylindricity, straightness, and coaxiality of the cylindrical surface.

Coaxiality is determined form the greater of double the distances between the axis of the inner cylinder and the axis of the outer cylinder assessed at each end of the measurement section.

Results

The measured total run-out of each surface with respect to the axis of the other is given in Table 1. The measured coaxiality of the two axes is also given in Table 1.

Sample ID	Total Run-out		Coaxiality
	surface: outer datum: inner μm	surface: inner datum: outer μm	μm
1	5.9	6.8	1.53
2	7.7	8.3	6.84
3	10.6	11.0	4.75
4	13.5	12.2	9.17
5	27.2	35.7	27.26
6	13.2	24.6	9.30
7	411.3	412.4	411.72
8	17.4	28.5	16.78
9	61.2	59.0	59.41
10	30.6	33.0	32.54
11	14.8	20.4	8.50
12	148.9	13.4	4.55
13	28.1	53.4	33.46
14	52.1	52.8	55.90
15	14.4	37.8	5.56
16	24.5	23.6	23.24

Uncertainty

The expanded uncertainty for the measured total run-out is $2.0\,\mu m$. The expanded uncertainty for the measured coaxiality is $0.62\,\mu m$. The expanded uncertainty have been calculated using a coverage factor of 2.2.

Note: For information about uncertainty terminology, see: BIPM, IEC, IFCC, ISO, IUPAC, IUPAP and OIML, *"Evaluation of measurement data—Guide to the expression of uncertainty*

in measurement", BIPM Joint Committee for Guides in Metrology, Paris, Sèvres, edition 1, JCGM 100:2008, 2008. A PDF version is available on-line:

http://www.bipm.org/utils/common/documents/jcgm/JCGM_100_2008_E.pdf

E F Howick	C M Young	T J Stewart For the Chief Metrologist