

Certificate ID: L1T10718042321



AS Found is not available (INSTALLATION)

Manufacturer Carl Zeiss

Model CentreMax

Serial Number 134123
Customer ID -

Customer Miltera Machining Research Corp.
60 Struck Court
Cambridge, ON N1R 8L2 CA

Job Number T10718

The equipment identified in this certificate was calibrated with standards that are traceable to national metrology institutes (e.g. NIST) through calibration laboratories accredited to ISO 17025. All results are reported in units of measure as defined by the International System of Units (SI).

A2LA is a signatory to several bilateral and multilateral recognition agreements. These agreements facilitate the acceptance of test and calibration data between A2LA-accredited laboratories and 46 economies around the globe. In addition, A2LA has recognition from over 30 federal, state and local government agencies, companies and associations.

The user is responsible for definition of appropriate intervals of calibration.

Please store in a secure location. Elliott-Matsuura Canada Inc. is not responsible for loss of data

UAWT Version 9.6.0.752

Calibration Procedure ISO-10360

Uncertainty of Length Measurement = $0.1 + L/1300$ [μm] Temperature 21.98 °C

Calibration certificates without signature are not valid.

Signature / Name
Matthew Joyce



Date
2021-04-23

The most noteworthy contributor to the uncertainty budget of a CMM is the deviation of temperature away from the standard of 20 degrees Celsius.
This calibration certificate shall not be reproduced, except in full, without written approval of Elliott-Matsuura Canada Inc.
Unless otherwise annotated in protocol results, machine condition is in good working order.
The reported results relate only to the item(s) specified above. All measurements performed at 95% confidence level (K=2).

1. Calibration task

Indication error E_0 for length measurements and probing error P_{FTU} are measured on the coordinate measuring machine for sensor systems with scanning capability, scanning probing error THP and the time for the scanning test are calibrated.

For sensor systems with scanning capability, roundness form measuring error $RONT$ (MZCI) was measured. If a rotary table is installed, the four-axis errors FR , FT and FA were measured if this measurement was ordered.

The coordinate measuring machine had the following configuration at the time of calibration:

Controller:	C99 (1.5Ghz) #AM001677 / FW: 24.08
Probe:	VAST gold D2 #001XRP7M
Measurement SW:	CALYPSO 2020
Reference sphere:	#R7134 r=14.9895
Rotary table:	-
X measuring range:	1100mm
Y measuring range:	1200mm
Z measuring range:	700mm

2. Calibration procedure

Calibration of the metrological features of the coordinate measuring machine was performed according to Carl Zeiss IMT procedure CL-1001. This procedure is established and validated using international metrological methods.

Efforts were made to achieve ISO 10360-2, 6.3.2 which states *"The longest calibrated test length for each position shall be at least 66 % of the maximum travel of the CMM along a measurement line through the calibrated test length."*

When unable, $\geq 66\%$ of each linear axis is measured, via additional measurements if necessary.

The roundness form measurement errors $RONT$ (MZCI) were determined by measuring a master ring in the scanning mode with $D = 50\text{mm}$.

The four-axis measurement deviations FR (radial), FT (tangential) and FA (axial) were determined using two ceramic spheres with $D = 30\text{mm}$. The ceramic spheres were clamped with a horizontal distance from the rotary axis of $r = 206\text{mm}$ and a horizontal distance of $d = 412\text{mm}$ as well as a vertical distance of $h = 206\text{mm}$.

The single stylus form error P_{FTU} as well as the scanning probing error THP and their test duration were determined on a ceramic sphere with $D = 25\text{mm}$.

The customer is identified on page 1. The machine location is specified in section 3.

The calibration standards used are specified in the relevant sections of the measurement result documentation.

3. Ambient conditions

The maximum temperature deviation from 20°C during the measurement was 2.27°C.

The calibration was performed on-site. The coordinate measuring machine is installed at the following location:

Miltera Machining Research Corp.
60 Struck Court
Cambridge, ON N1R 8L2 CA

Shop Floor

4. Measurement results

The measurement results apply only to the specified time of measurement. They also apply only to the relevant installation site and machine settings at the time of calibration. All settings and correction values were documented by the calibration laboratory.

4.1 Indication error for length measurements E_0

The following parallel and stepped gauge blocks are used to determine indication errors:

GCS number: E44 valid to 2021-07-13

The following temperature measuring device was utilized to perform temperature measurement to calculate deviation from a reference temperature of 20°C (if applicable).

GCS number: E32 valid to 2023-01-22

The determined indication errors E_0 and the maximum permissible indication error for length measurements $E_{0, MPE}$ are represented in the following diagrams.

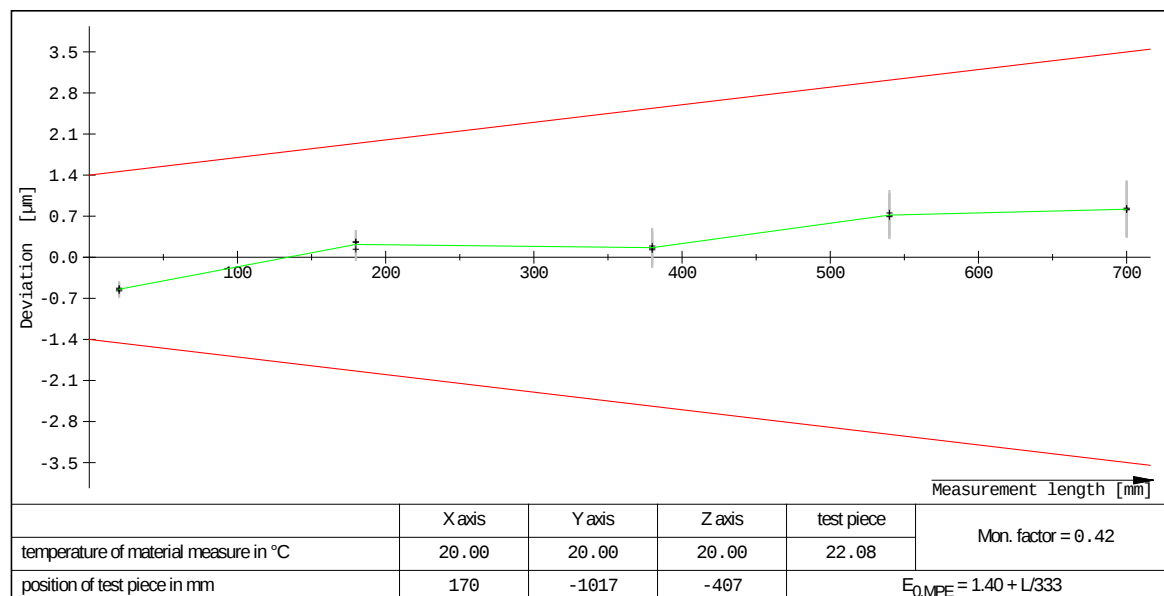
The maximum permissible indication error amounts to:

$$MPE_{E_0} = \pm (A + L/K) \leq B \quad (L \text{ in mm})$$

$$MPE_{E_0} = \pm (1.40 + L/333) \quad \mu\text{m}$$

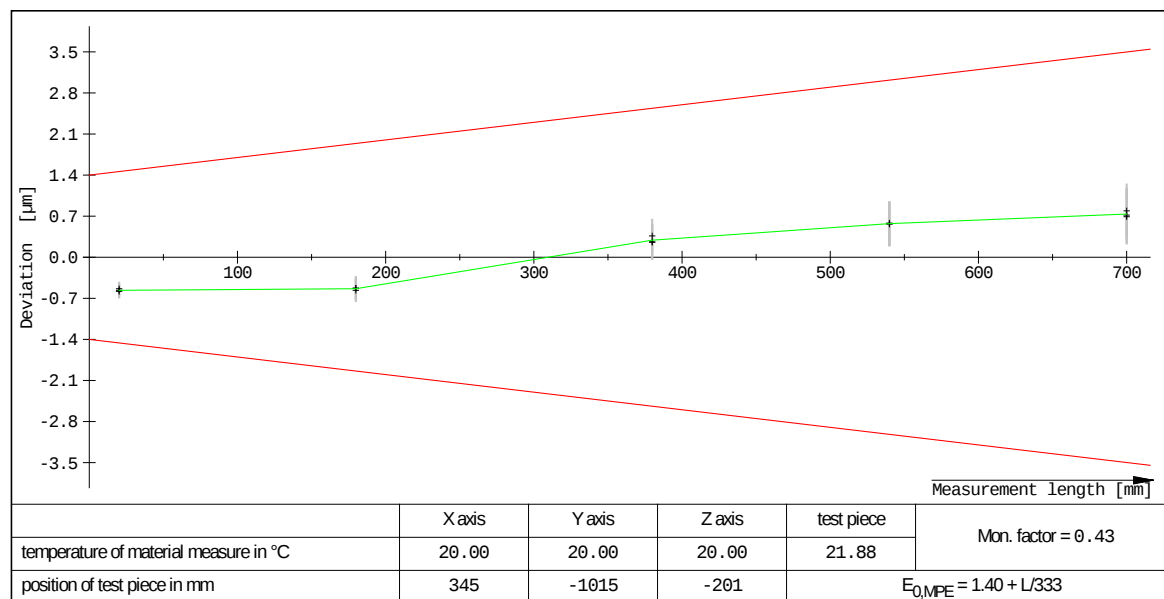
The measured results were determined with a stylus $L = 94 \text{ mm}$ and $D = 12.0 \text{ mm}$.

indication error in pos. 1 (X axis (left-bottom))



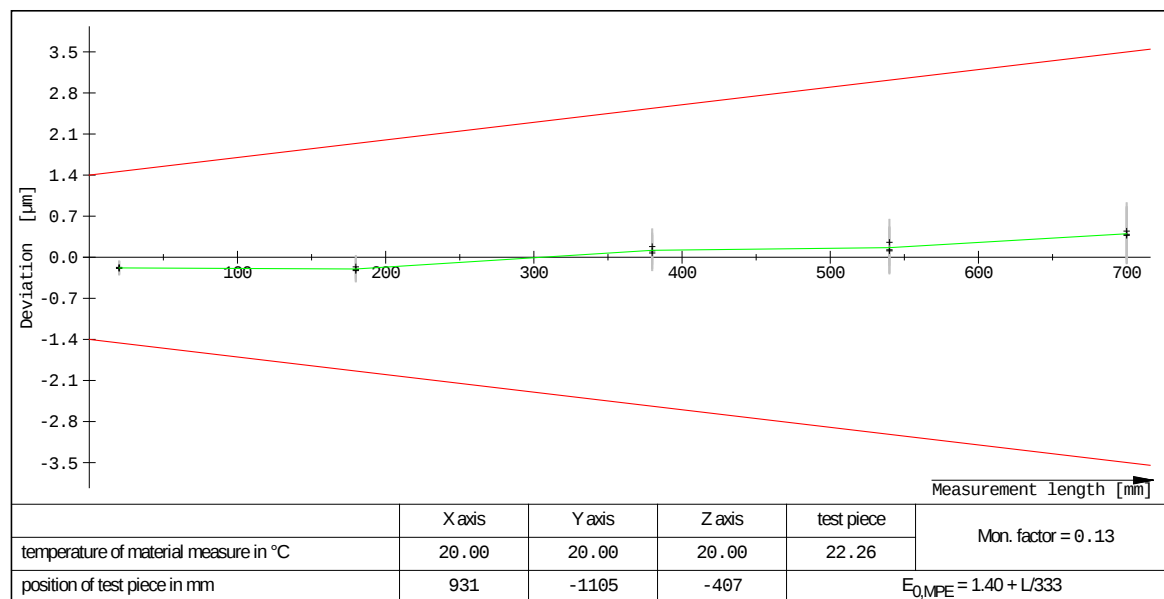
Measuring length L in mm		Deviations in mm		
nominal value	actual value	mean value	minimum	maximum
20.0045	20.0040	-0.0005	-0.0006	-0.0005
179.9338	179.9340	0.0002	0.0001	0.0003
379.9153	379.9155	0.0002	0.0001	0.0002
539.8482	539.8490	0.0007	0.0007	0.0008
699.9049	699.9057	0.0008	0.0008	0.0008

indication error in pos. 2 (X axis (right-top))



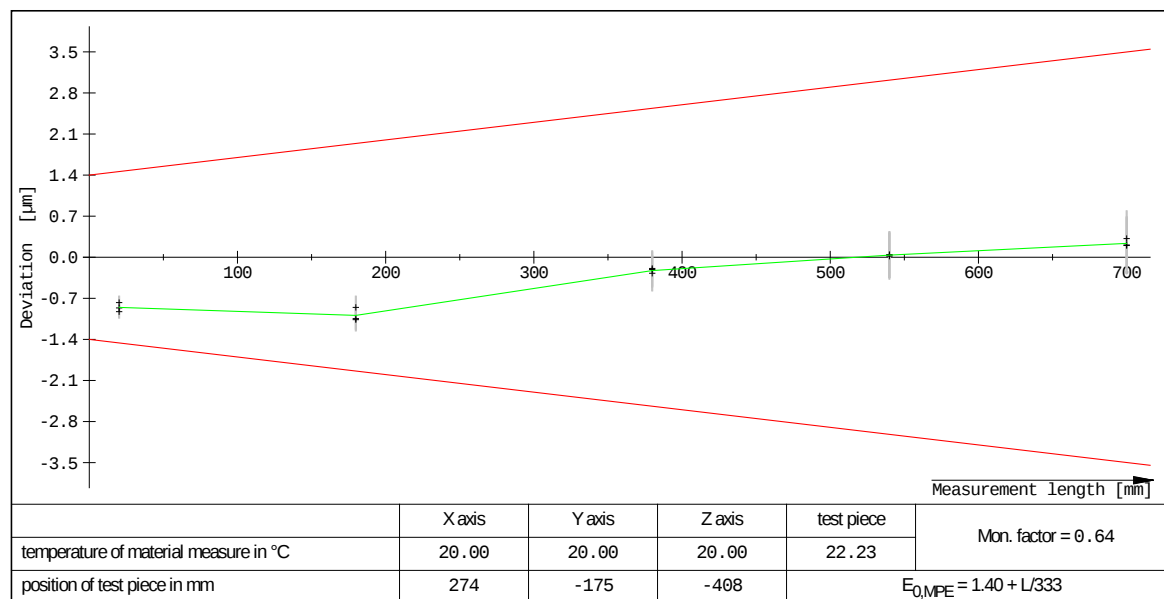
Measuring length L in mm		Deviations in mm		
nominal value	actual value	mean value	minimum	maximum
20.0045	20.0040	-0.0006	-0.0006	-0.0005
179.9338	179.9333	-0.0005	-0.0006	-0.0005
379.9153	379.9156	0.0003	0.0003	0.0004
539.8482	539.8488	0.0006	0.0006	0.0006
699.9049	699.9056	0.0007	0.0007	0.0008

indication error in pos. 3 (Y axis (front-left))



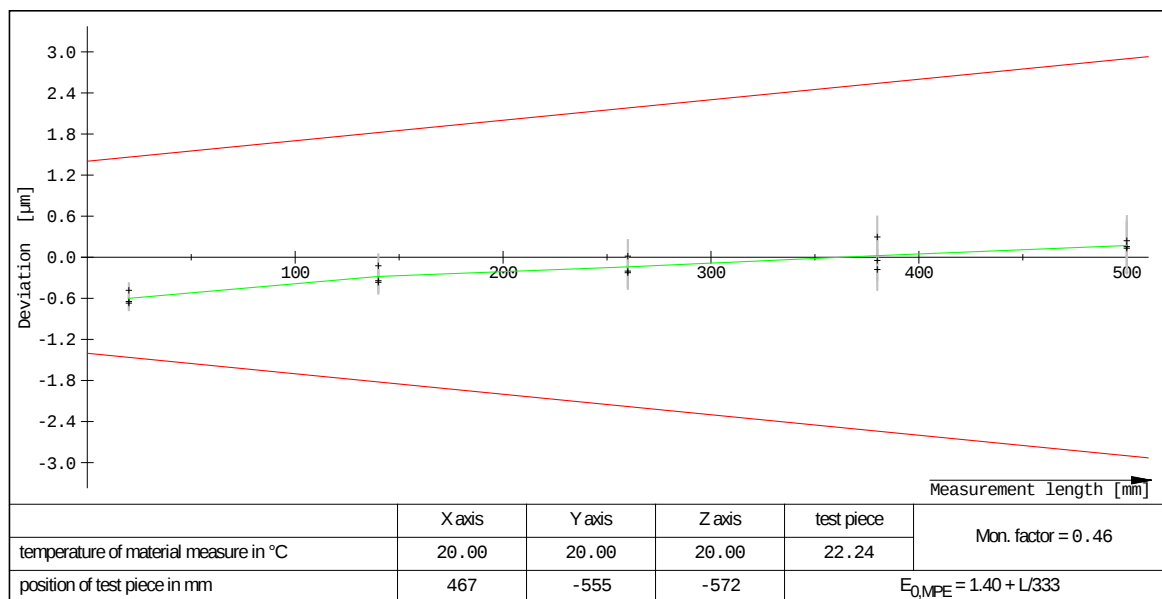
Measuring length L in mm		Deviations in mm		
nominal value	actual value	mean value	minimum	maximum
20.0045	20.0044	-0.0002	-0.0002	-0.0002
179.9338	179.9336	-0.0002	-0.0002	-0.0002
379.9153	379.9154	0.0001	0.0001	0.0002
539.8482	539.8484	0.0002	0.0001	0.0003
699.9049	699.9053	0.0004	0.0004	0.0004

indication error in pos. 4 (Y axis (rear-right))



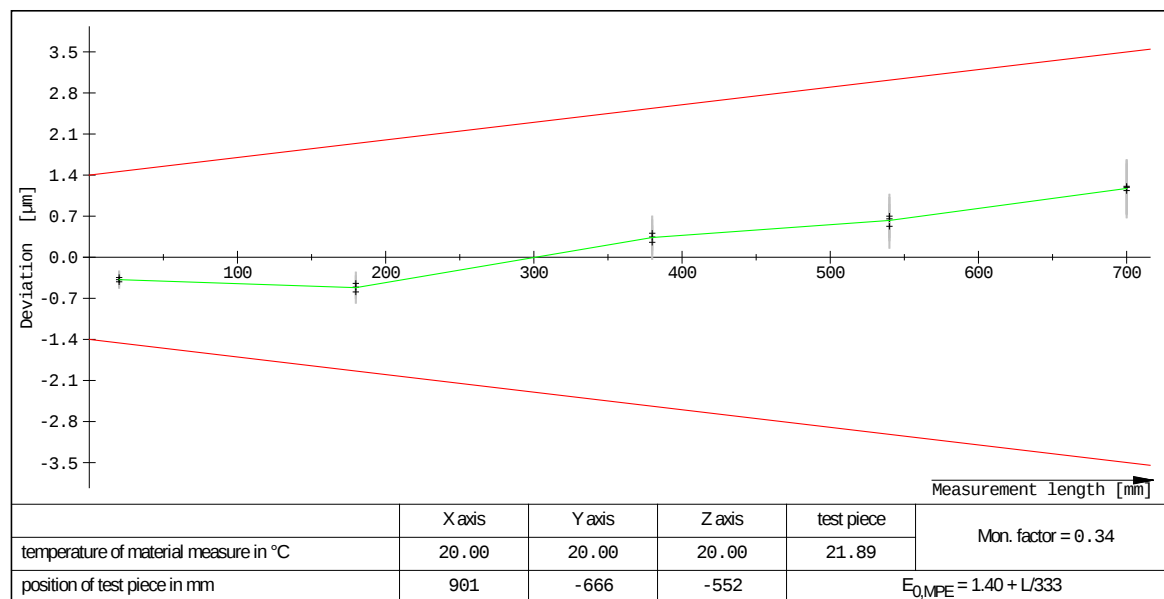
Measuring length L in mm		Deviations in mm		
nominal value	actual value	mean value	minimum	maximum
20.0045	20.0037	-0.0009	-0.0009	-0.0008
179.9338	179.9328	-0.0010	-0.0011	-0.0009
379.9153	379.9151	-0.0002	-0.0003	-0.0002
539.8482	539.8483	0.0000	0.0000	0.0000
699.9049	699.9051	0.0002	0.0002	0.0003

indication error in pos. 5 (Z axis)



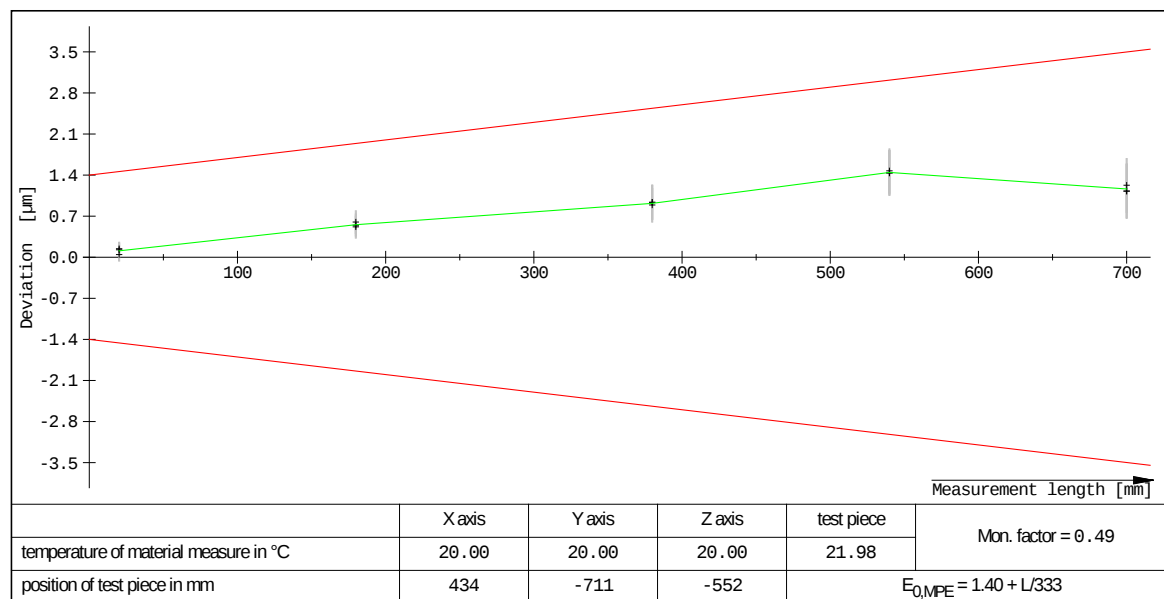
Measuring length L in mm		Deviations in mm		
nominal value	actual value	mean value	minimum	maximum
20.0045	20.0039	-0.0006	-0.0007	-0.0005
139.9404	139.9401	-0.0003	-0.0004	-0.0001
259.9603	259.9601	-0.0001	-0.0002	0.0000
379.9153	379.9153	0.0000	-0.0002	0.0003
499.9018	499.9020	0.0002	0.0001	0.0002

indication error in pos. 6 (Spatial (front-right))



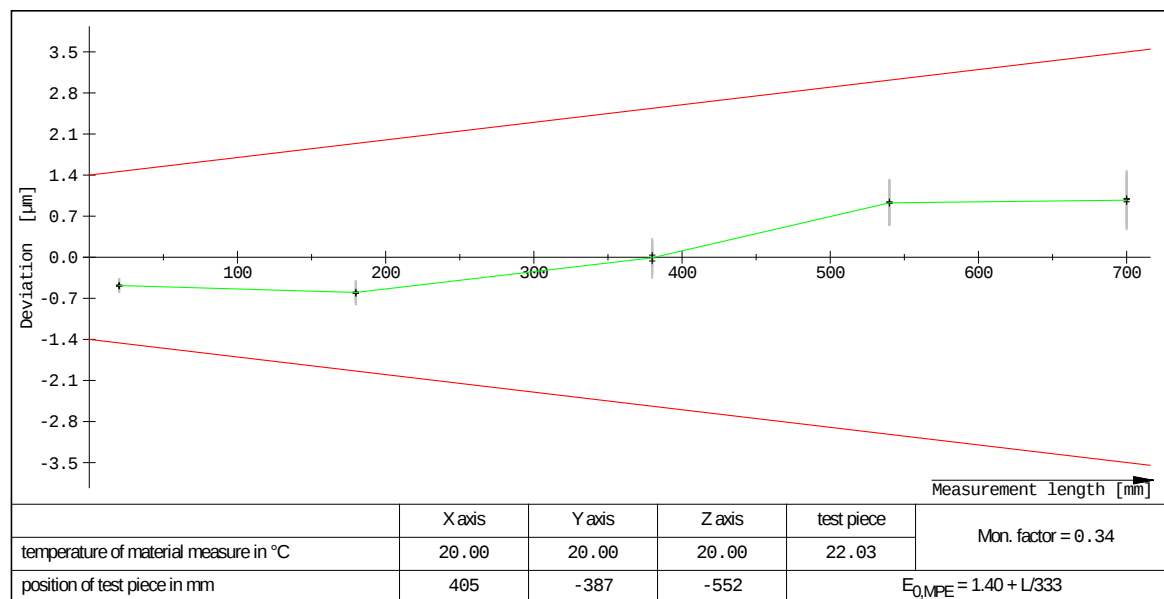
Measuring length L in mm		Deviations in mm		
nominal value	actual value	mean value	minimum	maximum
20.0045	20.0042	-0.0004	-0.0004	-0.0003
179.9338	179.9333	-0.0005	-0.0006	-0.0004
379.9153	379.9157	0.0003	0.0003	0.0004
539.8482	539.8489	0.0006	0.0005	0.0007
699.9049	699.9060	0.0012	0.0011	0.0012

indication error in pos. 7 (Spatial (front-left))



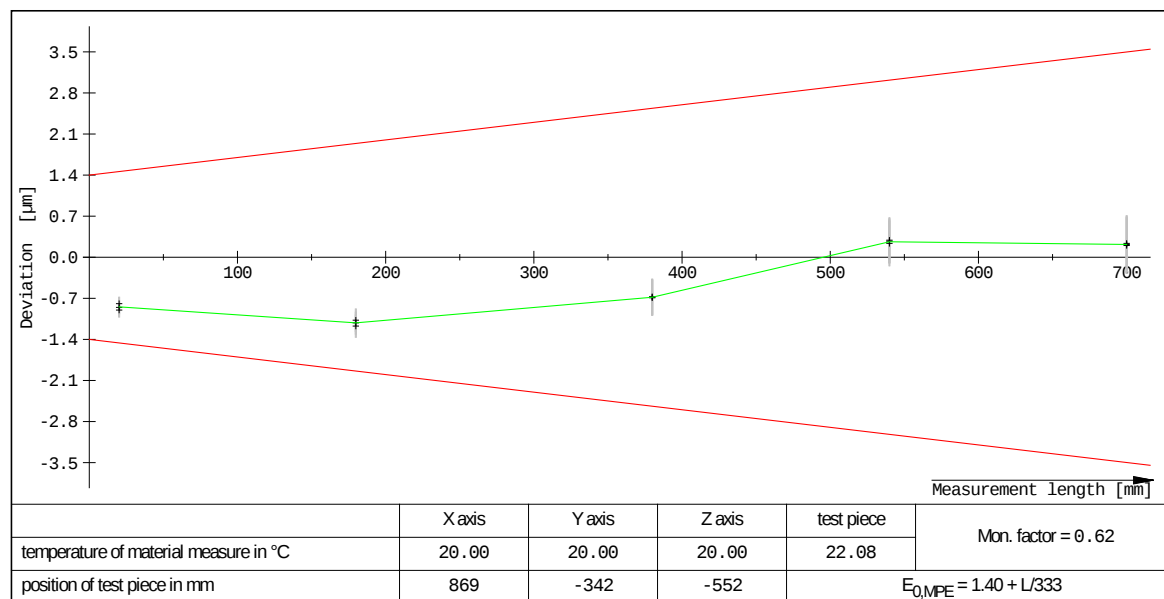
Measuring length L in mm		Deviations in mm		
nominal value	actual value	mean value	minimum	maximum
20.0045	20.0046	0.0001	0.0000	0.0001
179.9338	179.9344	0.0006	0.0005	0.0006
379.9153	379.9162	0.0009	0.0009	0.0009
539.8482	539.8497	0.0014	0.0014	0.0015
699.9049	699.9060	0.0012	0.0011	0.0012

indication error in pos. 8 (Spatial (rear-left))



Measuring length L in mm		Deviations in mm		
nominal value	actual value	mean value	minimum	maximum
20.0045	20.0041	-0.0005	-0.0005	-0.0005
179.9338	179.9332	-0.0006	-0.0006	-0.0006
379.9153	379.9153	0.0000	-0.0001	0.0000
539.8482	539.8492	0.0009	0.0009	0.0009
699.9049	699.9058	0.0010	0.0009	0.0010

indication error in pos. 9 (Spatial (rear-right))



Measuring length L in mm		Deviations in mm		
nominal value	actual value	mean value	minimum	maximum
20.0045	20.0037	-0.0008	-0.0009	-0.0008
179.9338	179.9327	-0.0011	-0.0012	-0.0011
379.9153	379.9146	-0.0007	-0.0007	-0.0007
539.8482	539.8485	0.0003	0.0002	0.0003
699.9049	699.9051	0.0002	0.0002	0.0002

4.2 Probing error P_{FTU}

The following ceramic sphere was used to determine the probing error:

GCS number: E57 valid to 2021-06-12

The max. permissible value : **1.4 μm**

Measured value: **$P_{FTU} = (0.4 \pm 0.09) \mu\text{m}$**

Position of test object: X = 484mm Y = -685mm Z = -494mm

Temperature of test object in °C: 22.25

The measured results were determined with a stylus L = 94 mm and a D of 12.0 mm.

4.3 Scanning probing error THP and scanning test duration

The following ceramic sphere was used to determine scanning probing error THP and the scanning test duration:

GCS number: E57 valid to 2021-06-12

The max. permissible value for scanning probing error THP: **2.4 μm**

The measured value of the : **THP = $(1.7 \pm 0.09) \mu\text{m}$**

The max. permissible value for the scanning test duration is: **29 s^{*)}**

The measured value : **= $(27 \pm 0.90) \text{ s}^*)$**

Position of test object: X = 484mm Y = -685mm Z = -494mm

Temperature of test object in °C: 21.97

The measured results were determined with a stylus L = 50 mm and a D of 3.0 mm.

*) NOTE: This measurement is outside the scope of this laboratory's A2LA scope of accreditation

4.4 Roundness form measurement error $RONT$ (MZCI)

The following master ring is used to determine roundness form measurement error $RONT$ (MZCI):

GCS number: E11 valid to 2023-01-22

Max. permissible roundness error: $t = 1.2 \mu\text{m}$

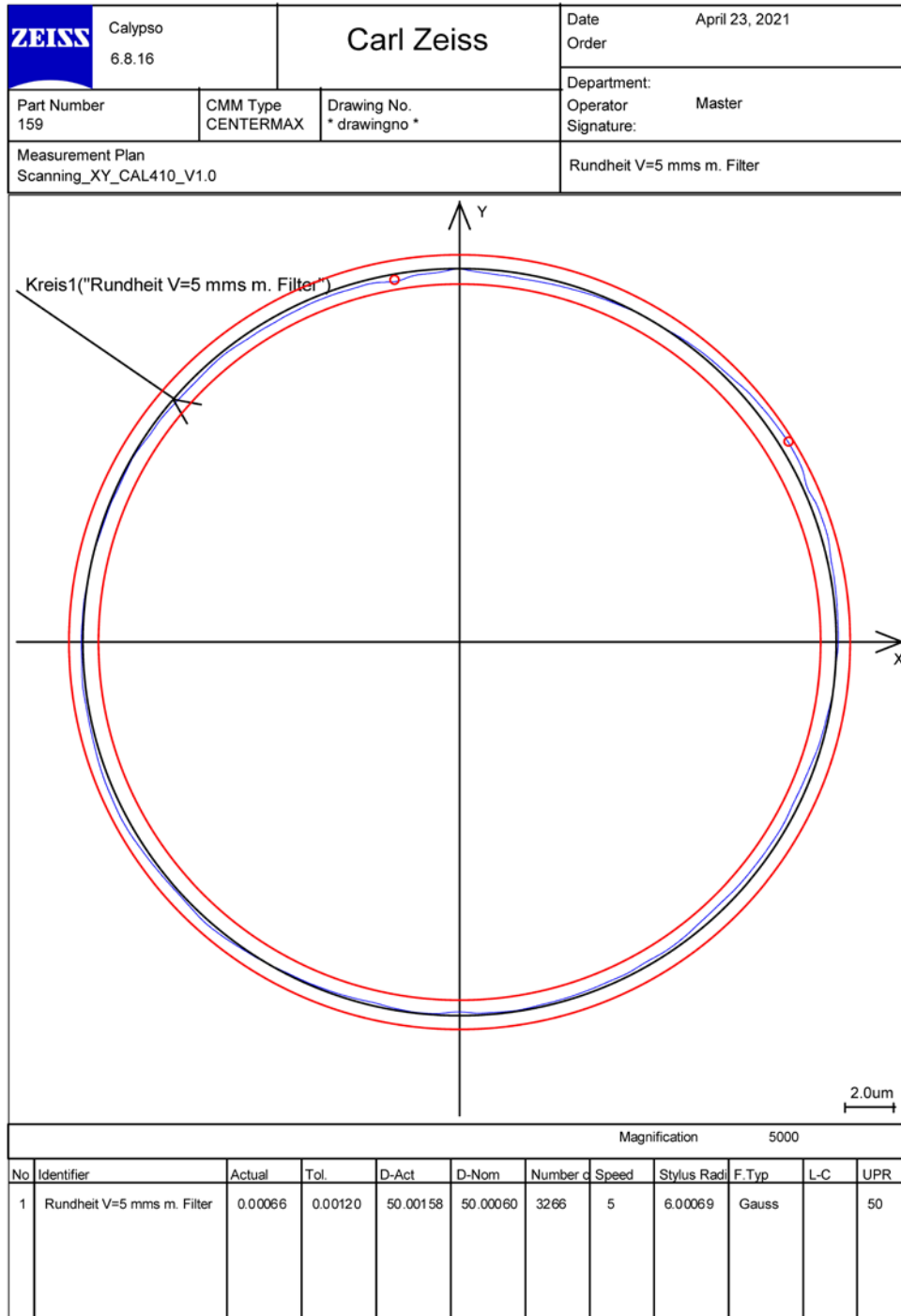
Measurement results:

In the X/Y plane: $t = (0.7 \pm 0.14) \mu\text{m}$ ($T = 22.0^\circ\text{C}$; stylus L = 94mm and D = 12.0mm)

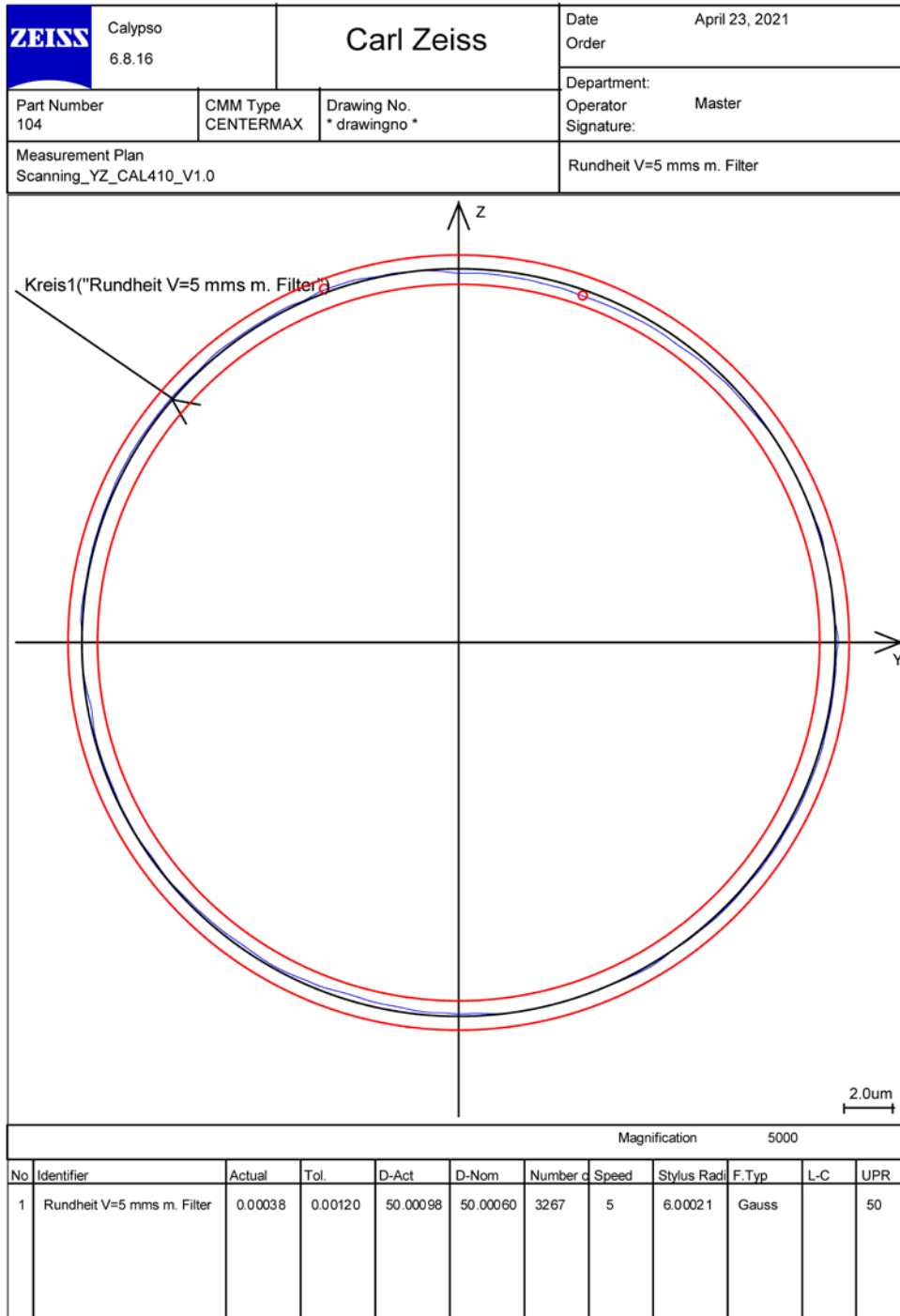
In the X/Z plane: $t = (0.3 \pm 0.14) \mu\text{m}$ ($T = 22.1^\circ\text{C}$; stylus L = 94mm and D = 12.0mm)

In the Y/Z plane: $t = (0.4 \pm 0.14) \mu\text{m}$ ($T = 22.0^\circ\text{C}$; stylus L = 94mm and D = 12.0mm)

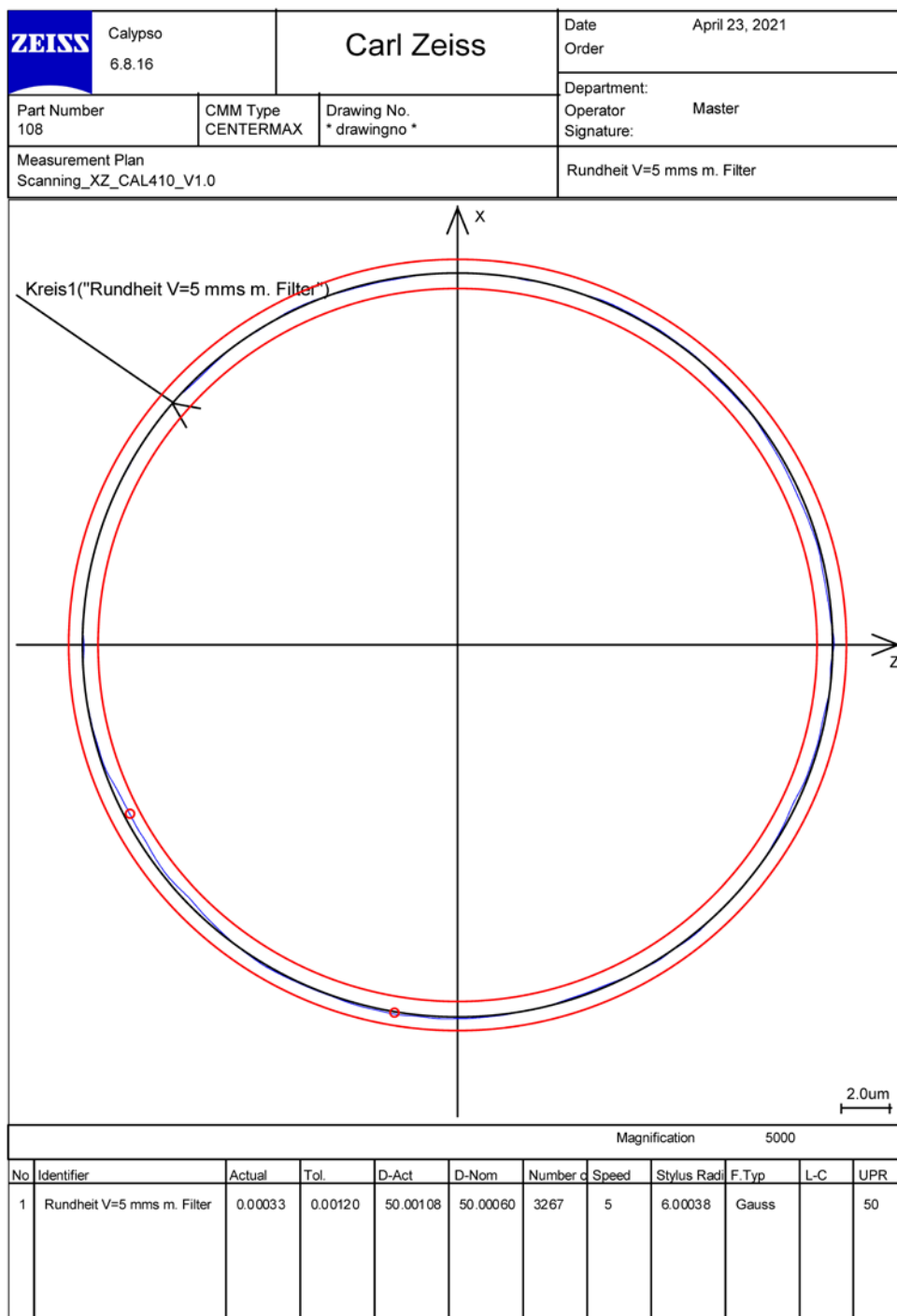
Roundness form measurement error RONt (MZCI) XY-Plane



Roundness form measurement error RONT (MZCI) YZ-Plane



Roundness form measurement error RONT (MZCI) XZ-Plane



5. Measuring uncertainty

The greatest measuring uncertainty experienced during calibration is reported on page 1 of the calibration certificate.

Zero Guard Banding: Uncertainty of measurement was not factored when determining compliance to relevant specifications.

The uncertainty of measurement represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of $K=2$. The probability that the value of the measured variable will lie within the allocated value interval is 95%.

6. Certificate of conformity

If confirmed below, the coordinate measuring machine fulfills the specified requirements. The performance of the coordinate measuring machine has been calibrated according to the relevant specifications.

[The coordinate measuring machine meets the original manufacturer's specification.](#)

7. Opinions / Interpretations resulting from calibration

Refer to the following Appendices:

1. Appendix A for MPE_{PFTU} results
2. Appendix B for MPE_{THP} results



ZEISS CALYPSO

6.8.16

Part name **MPE-P-C44-V070523-DuraMax**

Drawing number

Order number

Appendix A

Variant

Company

Department

CMM Type

CENTERMAX

CMM No.

134123

Operator

Master

Text

Last 1 measurements

► Approval ≠ Blocked

Part ident

n.a87

Time/Date

4/23/2021 12:16 PM

Run

All Characteristics

No. measured values

37

No. values: red

0

Measurement Duration

00:01:37.0

Name	Measured value	Nominal value	+Tol	-Tol	Deviation	+/-
^Temperature Compensation	22.25					
Temperature AVG START	22.24590	0.00000			22.24590	
MPE-P Value	0.00043	0.00000	0.00140	-0.00140	0.00043	
X	484.15762	0.00000			484.15762	
Y	-685.63509	0.00000			-685.63509	
Z	-494.81772	0.00000			-494.81772	
Time	65.00000	65.00000			0.00000	
TimePerProbing	2.60000	2.60000			0.00000	
Minimaler Radius	12.49704	12.49798	0.00250	-0.00250	-0.00094	
Maximaler Radius	12.49746	12.49798	0.00250	-0.00250	-0.00051	
Radii(1)	12.49732	12.49798	0.00140	-0.00140	-0.00066	
Radii(2)	12.49725	12.49798	0.00140	-0.00140	-0.00072	
Radii(3)	12.49746	12.49798	0.00140	-0.00140	-0.00051	
Radii(4)	12.49734	12.49798	0.00140	-0.00140	-0.00064	
Radii(5)	12.49746	12.49798	0.00140	-0.00140	-0.00051	
Radii(6)	12.49731	12.49798	0.00140	-0.00140	-0.00067	
Radii(7)	12.49708	12.49798	0.00140	-0.00140	-0.00089	
Radii(8)	12.49739	12.49798	0.00140	-0.00140	-0.00059	
Radii(9)	12.49732	12.49798	0.00140	-0.00140	-0.00065	
Radii(10)	12.49716	12.49798	0.00140	-0.00140	-0.00082	
Radii(11)	12.49731	12.49798	0.00140	-0.00140	-0.00067	
Radii(12)	12.49726	12.49798	0.00140	-0.00140	-0.00071	
Radii(13)	12.49732	12.49798	0.00140	-0.00140	-0.00066	
Radii(14)	12.49725	12.49798	0.00140	-0.00140	-0.00073	



ZEISS CALYPSO

6.8.16

Part name **MPE-P-C44-V070523-DuraMax**
 Order number Appendix A
 Part ident n.a87
 Operator Master
 Time/Date 4/23/2021 12:16 PM

Name	Measured value	Nominal value	+Tol	-Tol	Deviation	+/-
 Radii(15)	12.49722	12.49798	0.00140	-0.00140	-0.00075	
 Radii(16)	12.49704	12.49798	0.00140	-0.00140	-0.00094	
 Radii(17)	12.49732	12.49798	0.00140	-0.00140	-0.00065	
 Radii(18)	12.49733	12.49798	0.00140	-0.00140	-0.00065	
 Radii(19)	12.49727	12.49798	0.00140	-0.00140	-0.00070	
 Radii(20)	12.49734	12.49798	0.00140	-0.00140	-0.00063	
 Radii(21)	12.49733	12.49798	0.00140	-0.00140	-0.00064	
 Radii(22)	12.49734	12.49798	0.00140	-0.00140	-0.00063	
 Radii(23)	12.49737	12.49798	0.00140	-0.00140	-0.00060	
 Radii(24)	12.49735	12.49798	0.00140	-0.00140	-0.00063	
 Radii(25)	12.49744	12.49798	0.00140	-0.00140	-0.00054	
 Temperature AVG END	22.20420	0.00000			22.20420	
 Roundness1	0.00040	0.00000	0.00140	0.00000	0.00040	



ZEISS CALYPSO

6.8.16

Part name	MPE-THP-C46-V0804010-DuraMax			Last 1 measurements	
Drawing number	VAST __VAST Speed: 25/25			► Approval ≠ Blocked	
Order number	Appendix B				
Variant					
Company				Part ident	270
Department				Time/Date	4/23/2021 12:24 PM
CMM Type	CENTERMAX			Run	All Characteristics
CMM No.	134123			No. measured values	14
Operator	Master			No. values: red	0
Text				Measurement Duration	00:00:56.0

Name	Measured value	Nominal value	+Tol	-Tol	Deviation	+/-
^Temperature Compensation	21.97					
Temperature AVG START	21.95280	0.00000			21.95280	
DIN EN ISO 10360-4						
Result 1: MPE-THP	0.00168	0.00240	0.00000	-0.00240	-0.00072	
Result 2: MPTtau	27.00000	29.00000	0.00000	-29.00000	-2.00000	
DIN EN ISO 10360-4 ► Service Information						
Form error 'Sphere THP' filtered	0.00168	0.00000	0.00240	0.00000	0.00168	
Form error 'Sphere THP' unfiltered	0.00708	0.00000	1000.00000	0.00000	0.00708	
Rnom-Ract	0.00114	0.00000	2.40000		0.00114	
R_min	12.49698	12.49798	0.00240	-0.00240	-0.00099	
R_max	12.49912	12.49798	0.00240	-0.00240	0.00114	
Diameter Sphere THP	24.99547	24.99595			-0.00048	
X-Value 'Sphere THP'	484.15904	0.00000			484.15904	
Y-Value 'Sphere THP'	-685.63697	0.00000			-685.63697	
Z-Value 'Sphere THP'	-494.81396	0.00000			-494.81396	
Temperature AVG - END	21.94260	0.00000			21.94260	