ABSOLUTE MEASUREMENT SYSTEMS
CMM Calibration & Service
3986 Bentridge Road
Mississauga, ON L5N 7V7
Phone: (905) 785-7600

LABORATORY ACCREDITATION BUREAU
ACCREDITED ISO/IEC 17025
Certificate # L2196 Calibration

Certificate Number: C-0208

Reissue Number: _____ if applicable

Calibration Certificate

Company:	Windsor Machine & Stamping (2009) Ltd.	CMM:	IMS Impact II	Procedure:	B89.4.1b-2001
Address:	7084 Smith Industrial Drive	CMM Software:	Virtual DMIS	Units:	Millimeters
City:	McGregor	Serial No.:	600072	Temp. Range:	20.8 °C - Max 20.2 °C - Min
Province:	Ontario	Gauge No.:		Date Calibrated:	March 12 2013
Postal Code:	N0R 1J0	Technician:	Robert Scharff	Date Issued:	May 8 2013

Repeatability

Specification		As Found	After Correction	Uncertainty
X	N/A	0.001	N/A	1.2 µm
Y	N/A	0.001	N/A	1.2 µm
Z	N/A	0.001	N/A	1.2 µm

Linear Accuracy

Specification		As Found	After Correction	Uncertainty
X	N/A	0.001	N/A	(0.3 + 2.5L) µm
Y	N/A	0.001	N/A	(0.3 + 2.5L) µm
Z	N/A	0.001	N/A	(0.3 + 2.5L) µm

Linear accuracy is measured in 1 m increments as per AMS procedure.

Squareness**

Specification		As Found	After Correction	Uncertainty
XY	N/A	-0.0003 degrees	N/A	(0.8 + 1.5L) µm
YZ	N/A	0 degrees	N/A	(0.8 + 1.5L) µm
ZX	N/A	-0.0002 degrees	N/A	(0.8 + 1.5L) µm

Volumetric Performance

Specification	As Found	After Correction	Uncertainty
N/A	0.010	N/A	(0.8 + 1.5L) µm

This Calibration Certificate certifies that the instrument listed above has been calibrated in accordance with applicable national, international, and AMS specifications and standards. This Certificate of Calibration is issued in accordance with the applicable requirements of ISO/IEC 17025:2005. Calibration results are traceable to the National Research Council (NRC), the National Institute of Standards and Technology (NIST), or the National Physical Laboratory (NPL), where applicable. The above noted CMM was calibrated at the Customer's location. The calibration results relate only to the CMM noted above, and for the environmental and instrument conditions at the time of calibration.
This Calibration Certificate is part of a multi-page document containing 8 pages.

Traceability Information:

Length Reference Standard:	Optodyne Laser (MCV 500) - S.N. 0807003080, S.N. 0807002607
Environmental Thermometer:	Fluke Digital Thermometer - S.N. 97690209
Ballbar Spheres:	Renishaw 25.000 mm - S.N. 138481, S.N. 138485
Ball bar length:	366.8 mm

*After Correction results are only reported for coordinate measuring machines whose volumetric parameters have been adjusted.

** Squareness measurements are not part of AMS' scope of accreditation, but are taken for reference purposes (if requested).

*The results relate only to this CMM, environmental and instrument conditions at the time of calibration.
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Measurement Uncertainty:

The stated expanded uncertainties are given at a coverage factor of k=2 for a level of confidence of approximately 95% assuming a normal distribution.

Name: Robert Scharff
Title: Service Manager
Signature: _____

Form: 1.0ISOCALCERT Rev. 1.10
Date: January 29, 2012
Prepared by: Sarah Sullivan Approved by: Thomas Pegios

Company: Windsor Machine & Stamping (2009) Lt

Serial Number: 600072

Certificate Number: C-0208

Date Calibrated: March 12 2013

Units: Millimeters

Repeatability 'As Found'

Meas. #	X Axis	Y Axis	Z Axis
1	0.0018	-0.0009	-0.0008
2	0.0014	-0.0010	-0.0008
3	0.0017	-0.0009	-0.0005
4	0.0018	-0.0008	-0.0008
5	0.0016	-0.0009	-0.0009
6	0.0012	-0.0011	-0.0006
7	0.0016	-0.0006	-0.0010
8	0.0016	-0.0008	-0.0011
9	0.0016	-0.0008	-0.0008
10	0.0018	-0.0005	-0.0009
Max:	0.0018	-0.0005	-0.0005
Min:	0.0012	-0.0011	-0.0011
Repeatability:	0.0006	0.0006	0.0006

Repeatability 'After Correction'

Meas. #	X Axis	Y Axis	Z Axis
1	N/A	N/A	N/A
2	N/A	N/A	N/A
3	N/A	N/A	N/A
4	N/A	N/A	N/A
5	N/A	N/A	N/A
6	N/A	N/A	N/A
7	N/A	N/A	N/A
8	N/A	N/A	N/A
9	N/A	N/A	N/A
10	N/A	N/A	N/A
Max:	N/A	N/A	N/A
Min:	N/A	N/A	N/A
Repeatability:	N/A	N/A	N/A

Volumetric Performance 'As Found'

Position	Trial 1	Trial 2	Trial 3	Average
1	366.801	N/A	N/A	366.801
2	366.802	N/A	N/A	366.802
3	366.799	N/A	N/A	366.799
4	366.799	N/A	N/A	366.799
5	366.794	N/A	N/A	366.794
6	366.796	N/A	N/A	366.796
7	366.800	N/A	N/A	366.800
8	366.801	N/A	N/A	366.801
9	366.802	N/A	N/A	366.802
10	366.792	N/A	N/A	366.792
11	366.793	N/A	N/A	366.793
12	366.801	N/A	N/A	366.801
13	N/A	N/A	N/A	N/A
14	N/A	N/A	N/A	N/A
15	N/A	N/A	N/A	N/A
16	N/A	N/A	N/A	N/A
17	N/A	N/A	N/A	N/A
18	N/A	N/A	N/A	N/A
19	N/A	N/A	N/A	N/A
20	N/A	N/A	N/A	N/A
21	N/A	N/A	N/A	N/A
22	N/A	N/A	N/A	N/A
23	N/A	N/A	N/A	N/A
24	N/A	N/A	N/A	N/A
25	N/A	N/A	N/A	N/A
26	N/A	N/A	N/A	N/A
27	N/A	N/A	N/A	N/A
28	N/A	N/A	N/A	N/A
29	N/A	N/A	N/A	N/A
30	N/A	N/A	N/A	N/A
31	N/A	N/A	N/A	N/A
32	N/A	N/A	N/A	N/A
33	N/A	N/A	N/A	N/A
34	N/A	N/A	N/A	N/A
35	N/A	N/A	N/A	N/A
Max:	366.802			
Min:	366.792			
Volumetric:	0.010			

Volumetric Performance 'After Correction'

Position	Trial 1	Trial 2	Trial 3	Average
1	N/A	N/A	N/A	N/A
2	N/A	N/A	N/A	N/A
3	N/A	N/A	N/A	N/A
4	N/A	N/A	N/A	N/A
5	N/A	N/A	N/A	N/A
6	N/A	N/A	N/A	N/A
7	N/A	N/A	N/A	N/A
8	N/A	N/A	N/A	N/A
9	N/A	N/A	N/A	N/A
10	N/A	N/A	N/A	N/A
11	N/A	N/A	N/A	N/A
12	N/A	N/A	N/A	N/A
13	N/A	N/A	N/A	N/A
14	N/A	N/A	N/A	N/A
15	N/A	N/A	N/A	N/A
16	N/A	N/A	N/A	N/A
17	N/A	N/A	N/A	N/A
18	N/A	N/A	N/A	N/A
19	N/A	N/A	N/A	N/A
20	N/A	N/A	N/A	N/A
21	N/A	N/A	N/A	N/A
22	N/A	N/A	N/A	N/A
23	N/A	N/A	N/A	N/A
24	N/A	N/A	N/A	N/A
25	N/A	N/A	N/A	N/A
26	N/A	N/A	N/A	N/A
27	N/A	N/A	N/A	N/A
28	N/A	N/A	N/A	N/A
29	N/A	N/A	N/A	N/A
30	N/A	N/A	N/A	N/A
31	N/A	N/A	N/A	N/A
32	N/A	N/A	N/A	N/A
33	N/A	N/A	N/A	N/A
34	N/A	N/A	N/A	N/A
35	N/A	N/A	N/A	N/A
Max:	N/A			
Min:	N/A			
Volumetric:	N/A			

Squareness** 'As Found'

	XY		YZ		ZX	
	+X +Y	+X -Y	+Y +Z	+Y -Z	+Z +X	+Z -X
Trial 1	366.801	366.799	366.799	366.799	366.799	366.798
Trial 2	N/A	N/A	N/A	N/A	N/A	N/A
Trial 3	N/A	N/A	N/A	N/A	N/A	N/A
Average:	366.801	366.799	366.799	366.799	366.799	366.798
Angle:	-0.0003 degrees		0 degrees		-0.0002 degrees	
Squareness:	1.57080 arc sec.		1.57080 arc sec.		1.57080 arc sec.	
Range:	0.002		0.000		0.001	

Squareness** 'After Correction'

	XY		YZ		ZX	
	+X +Y	+X -Y	+Y +Z	+Y -Z	+Z +X	+Z -X
Trial 1	N/A	N/A	N/A	N/A	N/A	N/A
Trial 2	N/A	N/A	N/A	N/A	N/A	N/A
Trial 3	N/A	N/A	N/A	N/A	N/A	N/A
Average:	N/A	N/A	N/A	N/A	N/A	N/A
Angle:	N/A		N/A		N/A	
Squareness:	N/A arc sec.		N/A arc sec.		N/A arc sec.	
Range:	N/A		N/A		N/A	

Reissue Number: _____
if applicable

Form: 1.0ISOCALCERT Rev. 1.10
Date: January 29, 2012
Prepared by: Sarah Sullivan Approved by: Thomas Pegios

ABSOLUTE MEASUREMENT SYSTEMS
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Certificate Number: C-0208

Company: Windsor Machine & Stamping (2009) Ltd.

Serial Number: 600072

Reissue Number: _____ if applicable

Date Calibrated: March 12 2013

Linear Displacement - As Found

X Axis

Cell	Location	Trial 1	Trial 2	Trial 3	Average
1	0	0.000	0.000	0.000	0.000
2	75	0.001	0.001	0.001	0.001
3	150	0.001	0.000	0.001	0.001
4	225	0.001	0.001	0.001	0.001
5	300	0.000	0.001	0.000	0.000
6	375	0.001	0.001	0.001	0.001
7	450	0.001	0.001	0.001	0.001
8	525	0.001	0.001	0.001	0.001
9	600	0.000	0.000	0.000	0.000
10	675	0.000	0.000	0.000	0.000
11	750	0.001	0.001	0.001	0.001

Range								
Axis	Trial 1		Trial 2		Trial 3		Average	
	Max	Min	Max	Min	Max	Min	Max	Min
X Axis	0.001	0.000	0.001	0.000	0.001	0.000	0.001	0.000

Linear Displacement Summary	
As Found	
Axis	Result
X Axis	0.001

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Linear Displacement - As Found

Y Axis

Cell	Location	Trial 1	Trial 2	Trial 3	Average
1	0	0.000	0.000	0.000	0.000
2	75	0.000	0.001	0.000	0.000
3	150	0.000	0.000	0.000	0.000
4	225	0.000	0.000	0.000	0.000
5	300	0.000	0.001	0.000	0.000
6	375	0.001	0.001	0.001	0.001
7	450	0.000	0.001	0.000	0.000
8	525	0.000	0.000	0.000	0.000
9	600	0.000	0.000	0.000	0.000
10	675	0.000	0.000	0.000	0.000
11	750	0.001	0.001	0.001	0.001

Range								
Axis	Trial 1		Trial 2		Trial 3		Average	
	Max	Min	Max	Min	Max	Min	Max	Min
Y Axis	0.001	0.000	0.001	0.000	0.001	0.000	0.001	0.000

Linear Displacement Summary	
As Found	
Axis	Result
Y Axis	0.001

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Linear Displacement - As Found

Z Axis

Cell	Location	Trial 1	Trial 2	Trial 3	Average
1	0	0.000	0.000	0.000	0.000
2	55	0.000	0.000	0.000	0.000
3	110	0.000	0.000	0.000	0.000
4	165	0.000	0.000	0.000	0.000
5	220	0.000	0.000	0.000	0.000
6	275	0.001	0.000	0.000	0.000
7	330	-0.001	-0.001	-0.001	-0.001
8	385	0.001	0.000	0.000	0.000
9	440	0.001	0.000	-0.001	0.000
10	495	0.001	0.000	0.000	0.000

Range								
Axis	Trial 1		Trial 2		Trial 3		Average	
	Max	Min	Max	Min	Max	Min	Max	Min
Z Axis	0.001	-0.001	0.000	-0.001	0.000	-0.001	0.000	-0.001

Linear Displacement Summary	
As Found	
Axis	Result
Z Axis	0.001

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Linear Displacement - After Correction

X Axis	Cell	Location	Trial 1	Trial 2	Trial 3	Average
	1	0				
	2	75				
	3	150				
	4	225				
	5	300				
	6	375				
	7	450				
	8	525				
	9	600				
	10	675				
	11	750				

Range								
Axis	Trial 1		Trial 2		Trial 3		Average	
X Axis	Max	Min	Max	Min	Max	Min	Max	Min
	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Linear Displacement Summary	
After Correction	
Axis	Result
X Axis	N/A

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Linear Displacement - After Correction

Y Axis	Cell	Location	Trial 1	Trial 2	Trial 3	Average
	1	0				
	2	75				
	3	150				
	4	225				
	5	300				
	6	375				
	7	450				
	8	525				
	9	600				
	10	675				
	11	750				

Range								
Axis	Trial 1		Trial 2		Trial 3		Average	
Y Axis	Max	Min	Max	Min	Max	Min	Max	Min
	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Linear Displacement Summary	
After Correction	
Axis	Result
Y Axis	N/A

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Linear Displacement - After Correction

Z Axis	Cell	Location	Trial 1	Trial 2	Trial 3	Average
	1	0				
	2	55				
	3	110				
	4	165				
	5	220				
	6	275				
	7	330				
	8	385				
	9	440				
	10	495				

Range								
Axis	Trial 1		Trial 2		Trial 3		Average	
Z Axis	Max	Min	Max	Min	Max	Min	Max	Min
	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Linear Displacement Summary	
After Correction	
Axis	Result
Z Axis	N/A

*The results relate only to this CMM, environmental and instrument conditions at the time of calibration.
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