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

Certificate Number: C-0172

Reissue Number: _____ if applicable

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

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:	22.7 °C - Max 21.3 °C - Min
Province:	Ontario	Gauge No.:		Date Calibrated:	March 1 2012
Postal Code:	N0R 1J0	Technician:	Robert Scharff	Date Issued:	April 19 2012

Repeatability

Specification		As Found	After Correction	Uncertainty
X	N/A	0.001	0.001	1.2 µm
Y	N/A	0.001	0.001	1.2 µm
Z	N/A	0.001	0.002	1.2 µm

Linear Accuracy

Specification		As Found	After Correction	Uncertainty
X	N/A	0.004	0.001	(0.3 + 2.5L) µm
Y	N/A	0.016	0.001	(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	-0.0007 degrees	0.0001 degrees	(0.8 + 1.5L) µm
YZ	N/A	-0.0106 degrees	-0.0001 degrees	(0.8 + 1.5L) µm
ZX	N/A	0.0036 degrees	0.0001 degrees	(0.8 + 1.5L) µm

Volumetric Performance

Specification	As Found	After Correction	Uncertainty
N/A	0.073	0.040	(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:	mm

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.

*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.
*This certificate may only be reproduced in its entirety.

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

Certificate Number: C-0172

Company: Windsor Machine & Stamping (2009) Lt Serial Number: 600072 Date Calibrated: March 1 2012

Units: Millimeters

Repeatability 'As Found'

Meas. #	X Axis	Y Axis	Z Axis
1	-0.0006	0.0018	-0.0032
2	-0.0010	0.0020	-0.0032
3	-0.0007	0.0015	-0.0028
4	-0.0010	0.0021	-0.0034
5	-0.0012	0.0019	-0.0035
6	-0.0012	0.0017	-0.0030
7	-0.0018	0.0018	-0.0031
8	-0.0017	0.0017	-0.0033
9	-0.0011	0.0012	-0.0026
10	-0.0010	0.0013	-0.0031
Max:	-0.0006	0.0021	-0.0026
Min:	-0.0018	0.0012	-0.0035
Repeatability:	0.0012	0.0009	0.0009

Repeatability 'After Correction'

Meas. #	X Axis	Y Axis	Z Axis
1	-0.0026	0.0010	-0.0039
2	-0.0031	0.0005	-0.0022
3	-0.0036	0.0013	-0.0022
4	-0.0028	0.0003	-0.0019
5	-0.0040	0.0007	-0.0022
6	-0.0038	0.0002	-0.0020
7	-0.0039	0.0008	-0.0020
8	-0.0034	0.0008	-0.0028
9	-0.0037	0.0005	-0.0033
10	-0.0037	0.0008	-0.0024
Max:	-0.0026	0.0013	-0.0019
Min:	-0.0040	0.0002	-0.0039
Repeatability:	0.0014	0.0011	0.0020

Volumetric Performance 'As Found'

Position	Trial 1	Trial 2	Trial 3	Average
1	394.048	N/A	N/A	394.048
2	394.067	N/A	N/A	394.067
3	394.051	N/A	N/A	394.051
4	394.052	N/A	N/A	394.052
5	394.050	N/A	N/A	394.050
6	394.078	N/A	N/A	394.078
7	394.053	N/A	N/A	394.053
8	394.064	N/A	N/A	394.064
9	394.074	N/A	N/A	394.074
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:				394.099
Min:				394.026
Volumetric:				0.073

Volumetric Performance 'After Correction'

Position	Trial 1	Trial 2	Trial 3	Average
1	394.084	N/A	N/A	394.084
2	394.066	N/A	N/A	394.066
3	394.052	N/A	N/A	394.052
4	394.044	N/A	N/A	394.044
5	394.058	N/A	N/A	394.058
6	394.074	N/A	N/A	394.074
7	394.055	N/A	N/A	394.055
8	394.055	N/A	N/A	394.055
9	394.082	N/A	N/A	394.082
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:				394.084
Min:				394.044
Volumetric:				0.040

Squareness** 'As Found'

	XY		YZ		ZX	
	+X +Y	+X -Y	+Y +Z	+Y -Z	+Z +X	+Z -X
Trial 1	394.061	394.056	394.099	394.026	394.049	394.074
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:	394.061	394.056	394.099	394.026	394.049	394.074
Angle:	-0.0007 degrees		-0.0106 degrees		0.0036 degrees	
Squareness:	1.57081 arc sec.		1.57098 arc sec.		1.57073 arc sec.	
Range:	0.005		0.073		-0.025	

Squareness** 'After Correction'

	XY		YZ		ZX	
	+X +Y	+X -Y	+Y +Z	+Y -Z	+Z +X	+Z -X
Trial 1	394.063	394.063	394.067	394.066	394.062	394.063
Trial 2	394.062	394.064	394.067	394.066	394.062	394.063
Trial 3	394.063	394.064	394.067	394.067	394.062	394.063
Average:	394.063	394.064	394.067	394.066	394.062	394.063
Angle:	0.0001 degrees		-0.0001 degrees		0.0001 degrees	
Squareness:	1.57079 arc sec.		1.57080 arc sec.		1.57079 arc sec.	
Range:	-0.001		0.001		-0.001	

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Serial Number: 600072

Date Calibrated: March 1 2012

Reissue Number: _____
if applicable

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	0.002	0.004	0.004	0.003
	3	150	0.002	0.003	0.003	0.003
	4	225	0.002	0.004	0.005	0.004
	5	300	0.001	0.002	0.004	0.002
	6	375	0.002	0.005	0.003	0.003
	7	450	0.001	0.003	0.005	0.003
	8	525	0.001	0.003	0.004	0.003
	9	600	0.000	0.002	0.003	0.002
	10	675	0.001	0.003	0.003	0.002
	11	750	0.002	0.003	0.007	0.004

Range								
Axis	Trial 1		Trial 2		Trial 3		Average	
	Max	Min	Max	Min	Max	Min	Max	Min
X Axis	0.002	0.000	0.005	0.000	0.007	0.000	0.004	0.000

Linear Displacement Summary	
As Found	
Axis	Result
X Axis	0.004

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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	0.001	0.001	0.002	0.001
	3	150	0.003	0.002	0.003	0.003
	4	225	0.005	0.004	0.005	0.005
	5	300	0.007	0.006	0.007	0.007
	6	375	0.007	0.007	0.008	0.007
	7	450	0.009	0.009	0.009	0.009
	8	525	0.010	0.010	0.010	0.010
	9	600	0.012	0.013	0.013	0.013
	10	675	0.015	0.015	0.015	0.015
	11	750	0.016	0.016	0.017	0.016

Range								
Axis	Trial 1		Trial 2		Trial 3		Average	
	Max	Min	Max	Min	Max	Min	Max	Min
Y Axis	0.016	0.000	0.016	0.000	0.017	0.000	0.016	0.000

Linear Displacement Summary	
As Found	
Axis	Result
Y Axis	0.016

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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	0.000	-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	0.000	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	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	
After Correction	
Axis	Result
X Axis	0.001

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Linear Displacement - After Correction

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	
After Correction	
Axis	Result
Y Axis	0.001

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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

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