

Schedule

NORTHLAB SEAMS Pte Ltd
38, Senoko Road
Singapore 758110

Certificate No. : LA-2007-0369-C

Issue No. : 10

Date : 18 October 2017

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FIELD OF TESTING : Calibration and Measurement

MEASURED QUANTITIES/ INSTRUMENTS/ RANGE TO BE CALIBRATED	METHOD	CALIBRATION & MEASUREMENT CAPABILITY (CMC *)																																																
<p>A DIMENSIONAL METROLOGY</p> <p>1. Gauge Blocks and Accessories (Tungsten & Steel only)</p> <p>1.1 Metric unit</p> <p>a. 0 mm to 10 mm</p> <p>b. Above 10 mm to 25 mm</p> <p>c. Above 25 mm to 50 mm</p> <p>d. Above 50 mm to 75 mm</p> <p>e. Above 75 mm to 100 mm</p> <p>1.2 Imperial Unit</p> <p>a. 0 inch to 0.4 inch</p> <p>b. Above 0.4 inch to 1 inch</p> <p>c. Above 1 inch to 2 inch</p> <p>d. Above 2 inch to 3 inch</p> <p>e. Above 3 inch to 4 inch</p> <p>Flatness</p> <p>Up to 2.5 mm</p> <p>Above 2.5 mm</p> <p>2. Gauge Block Comparators (Lab / On-Site)</p> <p>a. Up to 10 mm</p> <p>b. Up to 50 mm</p> <p>c. Up to 100 mm</p>	<p>BS 4311 : Part 1 : 2007</p> <p>ISO 3650 : 1998,</p> <p>JIS B 7506 : 2004</p> <p>Procedure 019, 16 May 2015</p> <p>In-house Calibration Procedure SEAMS -0008, 18 Feb 2015</p>	<p>LAB ENVIRONMENTAL CONDITIONS: TEMPERATURE : (20±1)°C HUMIDITY: (55±10) % relative humidity</p> <table> <thead> <tr> <th></th> <th>Tungsten Carbide</th> <th>Steel</th> </tr> </thead> <tbody> <tr> <td></td> <td>0.05 µm</td> <td>0.05 µm</td> </tr> <tr> <td></td> <td>0.06 µm</td> <td>0.06 µm</td> </tr> <tr> <td></td> <td>0.09 µm</td> <td>0.09 µm</td> </tr> <tr> <td></td> <td>0.10 µm</td> <td>0.11 µm</td> </tr> <tr> <td></td> <td>0.13 µm</td> <td>0.15 µm</td> </tr> <tr> <td></td> <td>1.7 µinch</td> <td>1.7 µinch</td> </tr> <tr> <td></td> <td>2.2 µinch</td> <td>2.3 µinch</td> </tr> <tr> <td></td> <td>3.4 µinch</td> <td>3.7 µinch</td> </tr> <tr> <td></td> <td>4.0 µinch</td> <td>4.5 µinch</td> </tr> <tr> <td></td> <td>5.2 µinch</td> <td>5.9 µinch</td> </tr> <tr> <td></td> <td>0.11 µm</td> <td>4.3 µinch</td> </tr> <tr> <td></td> <td>0.10 µm</td> <td>3.9 µinch</td> </tr> <tr> <td></td> <td>0.030 µm</td> <td></td> </tr> <tr> <td></td> <td>0.061 µm</td> <td></td> </tr> <tr> <td></td> <td>0.091 µm</td> <td></td> </tr> </tbody> </table>		Tungsten Carbide	Steel		0.05 µm	0.05 µm		0.06 µm	0.06 µm		0.09 µm	0.09 µm		0.10 µm	0.11 µm		0.13 µm	0.15 µm		1.7 µinch	1.7 µinch		2.2 µinch	2.3 µinch		3.4 µinch	3.7 µinch		4.0 µinch	4.5 µinch		5.2 µinch	5.9 µinch		0.11 µm	4.3 µinch		0.10 µm	3.9 µinch		0.030 µm			0.061 µm			0.091 µm	
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3. Plain Plug Gauges or Pin Gauges a. 0 mm to 10 mm b. Above 10 mm to 50 mm c. Above 50 mm to 100 mm d. Above 100 mm to 200 mm	BS 969 : 2008 Procedure 001, 15 March 2008	0.4 μ m 0.6 μ m 1.3 μ m 1.8 μ m
3.1 Plug/Pin gauges of lower accuracy (Lab/On-Site) Up to 25mm		2 μ m
3.2 Precision Balls up to 10mm		0.4 μ m
4. Thread Wires (Measuring Cylinders) 0 mm to 10 mm	BS 5590: 1978 Procedure 025, 15 March 2008	0.4 μ m
5. Plain Ring Gauges a. 1 mm to 50 mm b. Above 50 mm to 100 mm c. Above 100 mm to 150 mm d. Above 150 mm to 200 mm	BS 969 : 2008 Procedure 002, 15 March 2008	0.9 μ m 1.0 μ m 1.4 μ m 1.8 μ m
6. Parallel Screw Thread Plug Gauges a. M2 to M38 b. M38 to M100 c. Pitch d. Angle	BS 1580 : 2007 Part 1or Part 3 ANSI/ASME B1.2-1983 ASME/ANSI B1.8-1988 ASME B 1.5-1997 ISO 1502 : 1996	1.2 μ m 3 μ m 5 μ m 3 minutes
6.1 Parallel Screw Thread Ring Gauges a. M3.5 to M38 b. M38 to M100	Procedure 014, 15 March 2008	1.2 μ m 3 μ m
7. Tapered Thread Plug Gauges	ASME B1.20.5-1991 Procedure 030, 15 March 2008	5 μ m
8. Plain Gap Gauges a. 0.5 mm to 50 mm b. Above 50 mm to 150 mm c. Above 150 mm to 300 mm	ASME B 47.1 : 2007 as a guide Procedure 003, 15 March 2008	2 μ m 3 μ m 5 μ m

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MEASURED QUANTITIES/ INSTRUMENTS/ RANGE TO BE CALIBRATED	METHOD	CALIBRATION & MEASUREMENT CAPABILITY (CMC *)
9. Feeler Gauges As covered in BS 957 or JIS B 7524	BS 957: 2008 JIS B 7524 : 2008 Procedure 010,15 March 2008	0.4 μm
9.1 Feeler gauges of lower accuracy (Lab/On-Site)		2 μm
10. Surface Plate (Lab/On-site) 2000 mm X 1500 mm	BS 817 : 2008 Procedure 023, 15 March 2008	1.6 μm / 63 μinch
11. Universal Measuring Machine (Lab / On-Site)	In-house Calibration Procedure SEAMS-0012,15 Apr 2015	
a. 0 mm to 100 mm		0.3 μm
b. Above 100 mm to 500 mm		1.6 μm
c. Above 500 mm to 1000 mm		2.9 μm
Flatness		0.18 μm
12. Dial Gauge Calibration Tester	In-house Calibration Procedure SEAMS-0013, 18 Feb 2015	0.6 μm
a. Up to 25mm 0.001 mm resolution		
b. Up to 30mm 0.0001 mm resolution	SEAMS-0009, 18 Feb 2015	0.3 μm
13. Height Setting Micrometer/Riser Block	ISO 7863 : 1984	
a. up to 300 mm	Procedure 018, 23 Feb 2016	1.3 μm
b. up to 600 mm		2.5 μm
Accuracy of lead screw		0.5 μm
Flatness		0.18 μm
Parallelism		0.8 μm
14. Calliper Checker	In-house Calibration Procedure SEAMS-0001, 1 Mar 2017	
a. Up to 360 mm		1.3 μm
b. Up to 670 mm		2.5 μm
Flatness		0.18 μm
Parallelism		0.8 μm

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15. Measuring Microscopes (Toolmaker's) (Lab / On-Site) Up to 200 mm	JIS B 7153 : 1995 Procedure 022, 23 Feb 2016	3.0 μm
16. Measuring Projectors (Lab / On-Site) a. Up to 240 mm b. Up to 300 mm	JIS B 7184 : 1999 as a guide Procedure 016, 23 Feb 2016	2 minutes angular 3.0 μm linear 4.0 μm linear
17. Engineering Squares - (Including Cylindrical & Block Type)	BS 939 : 2007 Procedure 017, 15 March 2008	1.9 μm
18. External Micrometers	ISO 3611:2010 Procedure 005, 23 Feb 2016	
18.1 a. Up to 100 mm b. Above 100 mm to 300 mm c. Above 300 mm to 500 mm d. Above 500 mm to 600 mm e. Above 600 mm to 1000 mm f. Above 1000 mm to 1500 mm g. Above 1500 mm to 2000 mm Flatness Parallelism	ISO 3611:2010 as guide and with reference to manufacturers' requirements	1 μm 2 μm 3 μm 4 μm 6 μm 9 μm 13 μm 0.2 μm 1 μm
18.2 Up to 100 mm (On-Site)		2 μm
18.3 Setting Rods a. Up to 100 mm b. Above 100 mm to 300 mm c. Above 300 mm to 500 mm d. Above 500 mm to 600 mm e. Above 600 mm to 1000 mm f. Above 1000 mm to 1500 mm g. Above 1500 mm to 1950 mm		1 μm 2 μm 3 μm 4 μm 6 μm 9 μm 13 μm
Micrometer Head Accuracy		0.7 μm

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19. Thread Micrometer 0 to 100 mm	In-house Calibration Procedure SEAMS-0010, 18 Feb 2015	1 μ m
20. Internal Micrometer (incl. Stick Micrometer) Functional requirements as covered in BS 959:2008 up to 900 mm	BS 959 : 2008 Procedure 006, 15 March 2008	2 μ m
21. Internal Micrometer 5 to 300 mm	In-house Calibration Procedure SEAMS-0011, 18 Feb 2015	2 μ m
22. Depth Micrometer Functional requirements as covered in BS 6468 : 2008 Up to 300 mm	BS 6468 : 2008 Procedure 007, 15 March 2008	2 μ m
23. Holtest 23.1 Using Ring Gauge 0.001 mm resolution	In-house Calibration Procedure SEAMS-0007, 18 Feb 2015	2 μ m
23.2 Using Fixture (Bore Gauge Calibrator) 0.001 mm resolution		3 μ m
24. Dial Gauges and Precision Dial Indicators Up to 100 mm	ISO 463:2006, JIS B 7503:2011, DIN 879 : 1999, ASME B 89.1.10M-2001 Procedure 011, 15 July 2015	0.30 μ m to 1 μ m
24.1 Dial Gauges (On-Site) Up to 12.7 mm, 0.01 mm resolution		2 μ m
24.2 Electrical Comparator (Analog and Digital type)	JIS B 7536-1982 Procedure 034, 10 July 2015	0.1 μ m

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25. Dial Test Indicators Functional requirements as covered in BS 2795 : 1981	BS 2795 : 1981 ASME B 89.1.10M-2001 Procedure 012, 18 Feb 2015	0.30 μm
26. Linear Gauges (Lab/ On-Site) a. Up to 100 mm b. Up to 150 mm	In-house Calibration Procedure SEAMS-0017 18 Feb 2015	1 μm 2 μm to 10 μm
27. Digital Indicator (Lab/ On-Site) a. Up to 100 mm b. Up to 150 mm	In-house Calibration Procedure SEAMS-0017 18 Feb 2015	1 μm 2 μm to 10 μm
28. Dial Thickness Gauge a. 0.001 mm resolution b. 0.01 mm resolution	In-house Calibration Procedure SEAMS-0005, 18 Feb 2015	3 μm 5 μm
29. Electronic & Mechanical Slide Calliper a. Up to 1000 mm b. Up to 2000 mm c. Up to 300 mm (On-Site)	JIS B 7507 : 2016 BS EN ISO 13385-1:2011 Procedure 008, 8 Feb 2017	2 μm Flatness / Parallelism 10 μm 20 μm 20 μm
30. Calliper Gauge 0 to 50 mm 50 to 120 mm	In-house Calibration Procedure SEAMS-0004 18 Feb 2015	5 μm 10 μm
31. Electronic & Mechanical Height Gauges up to 1000 mm	BS EN ISO 13225 : 2012 Procedure 009, 15 May 2015	10 μm
32. Other Limit Gauges incl. Height, Depth, Length Up to 50 mm Up to 300 mm Angle Radius	ASME B 47.1 - 2007 as a guide Procedure 004, 30 Aug 2016	2 μm 5 μm 5 minutes 5 μm

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33. Precision Vernier Depth Caliper 0 to 1000 mm	BS EN ISO 13385-2:2011 Procedure 021, 15 May 2015	10 µm
34. Depth Gauge Electronic & Mechanical Up to 10 mm Up to 100 mm	In-house Calibration Procedure SEAMS-0014 16 Aug 2016	1 µm 2 µm
35. Bevel Protractor Functional requirements as covered in BS 1685 : 2008	BS 1685 : 2008 Procedure 015, 15 March 2008	3 µm linear 5 minutes angular
36. Cylinder (bore) Gauges As covered in JIS B 7515:1982	JIS B 7515 : 1982 Procedure 013, 15 March 2008	2 µm
37. Form Measurement Parallelism a. Up to 12 mm b. Up to 100 mm c. Up to 500 mm Flatness a. Up to 60 mm b. Up to 100 mm c. Up to 500 mm	In-house Calibration Procedure SEAMS-0015, 18 Feb 2015 Using optical parallel Using electronic probe	0.36 µm 0.85 µm 1.2 µm 0.18 µm 0.85 µm 1.2 µm
38. Gauge block Accessories (Dimensions)	Procedure 019, 15 March 2008 Using electronic probe Using ULM	1.1µm 0.33 µm

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39. Check- master a. Up to 30 mm b. Up to 600 mm c. Up to 1000 mm	In-house Calibration Procedure SEAMS-0016, 18 Feb 2015	1.3 µm 2.5 µm 4.1 µm
40. Coating Thickness Gauge Up to 3 mm Above 3 mm to 8 mm Foil Measurement (up to 8mm)	In-house Calibration Procedure SEAMS-0023 18 Feb 2015	2.3 µm 12 µm 1.5 µm
41. Metal Rule a. Up to 300 mm b. Above 300 mm to 500 mm c. Above 500 mm to 1000 mm d. Above 1000 mm to 2000 mm	JIS B 7516 : 2005 Procedure 027, 15 May 2015	0.02 mm 0.03 mm 0.05 mm 0.10 mm
42. Measuring Tape a. Up to 1 m b. Above 1 m up to 5 m c. Above 5 m up to 10 m d. Above 10 m up to 20 m e. Above 20 m up to 30 m f. Above 30 m up to 50 m g. Above 50 m up to 100 m	JIS B 7512 : 2005 Procedure 029, 15 May 2015	0.16 mm 0.36 mm 0.51 mm 0.72 mm 0.88 mm 1.14 mm 1.6 mm

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B MECHANICAL		
1. Weighing Scales/Balances (Lab /On-site)	In-house Calibration Procedure SEAMS-0006, 16 Jan 2017	LAB ENVIRONMENTAL CONDITIONS: TEMPERATURE: (23 ± 1) °C HUMIDITY: (55 ± 10)% relative humidity
a. Up to 62g		0.00008 g
b. Above 62 g to 400 g		0.0002 g
c. Above 400 g to 1000 g		0.003 g
d. Above 1000 g to 1500 g		0.003 g
e. Above 1500 g to 5000 g		0.03 g
f. Above 5 kg to 10 kg		0.04 g
g. Above 10 kg to 30 kg		0.10 g
h. Above 30 kg to 60 kg		0.30 g
i. Above 60 kg to 130 kg		0.002 kg
j. Above 130 kg 180 kg		0.003 kg
2. Push/Pull Gauge (Lab/On-Site)	In-house Calibration Procedure	
a. Up to 5 kgf	SEAMS-002 : 1993, 18 Feb 2015	0.002 kgf
b. Above 5 kgf to 50 kgf		0.02 kgf
c. Above 50 kgf to 110 kgf		0.3 kgf
3. Tension Gauges (Lab/On-Site)	In-house Calibration Procedure	
a. Up to 50 gf	SEAMS-0003, 18 Feb 2015	0.2 gf
b. Above 50 gf to 500 gf		0.7 gf
c. Above 500 gf to 2000 gf		7 gf
d. Above 2 kgf to 50 kgf		0.28 kgf

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4. Standard Weights	In-house Calibration Procedure SEAMS-0021, 16 Jan 2017	
a. 100 mg to 500 mg (OIML Class M2 and below)		0.0002 g
b. 1g to 20g (OIML Class M1 and below)		0.0002 g
c. 50g (OIML Class F2 and below)		0.0002 g
d. 100 g to 200 g (OIML Class F2 and below)		0.0003 g
e. 500 g (OIML Class M1 and below)		0.003 g
f. 1000 g (OIML Class F2 and below)		0.003 g
g. 2 kg to 5 kg (OIML Class M3 and below)		0.2 g
h. 10 kg (OIML Class M2 and below)		0.2 g
i. 20 kg (OIML Class M1 and below)		0.2 g
5. Force Measuring Devices (Tension and Compression- Lab) Loadcell, Crane Scale, Force Gauge, Dynamometer, Proving Rings, Load Links and Load Pins	In-house Calibration Procedure SEAMS-0024, 27 Apr 2016 (BS EN ISO 376:2011)	
a. 1 kN to 10 kN		0.20 % of full scale
b. 10 kN to 50 kN		0.10 % of full scale
c. 50 kN to 100 kN		0.11 % of full scale
d. 100 kN to 500 kN		0.06 % of full scale
e. 500 kN to 800 kN		0.16 % of full scale
f. 800 kN to 1000 kN		0.18 % of full scale

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<p>6. Force Measuring System (Tension and Compression) (On-Site) Universal Testing Machine, Compression Testing Machine, Tension Testing Machine.</p> <p>a. 1 kN to 5 kN b. 5 kN to 20 kN c. 20 kN to 100 kN d. 100 kN to 500 kN</p>	<p>In-house Calibration Procedure SEAMS-0031, 27 Apr 2016 (BS EN ISO 7500-1:2015)</p>	<p>0.10 % of full scale 0.15 % of full scale 0.16 % of full scale 0.08 % of full scale</p>
<p>7. Torque Wrenches/ Gauges</p> <p>a. Up to 3 lbf·in b. Above 3 lbf·in to 5 lbf·in c. Above 5 lbf·in to 10 lbf·in d. Above 10 lbf·in to 60 lbf·in e. Above 60 lbf·in to 100 lbf·in f. Above 8 lbf·ft to 20 lbf·ft g. Above 20 lbf·ft to 100 lbf·ft h. Above 100 lbf·ft to 250 lbf·ft i. Above 250 lbf·ft to 400 lbf·ft j. Above 400 lbf·ft to 600 lbf·ft k. Above 600 lbf·ft to 1000 lbf·ft l. Above 1000 lbf·ft to 3000 lbf·ft</p>	<p>ISO 6789:2003 Procedure 020, 3 Oct 2016</p>	<p>0.020 lbf·in 0.030 lbf·in 0.050 lbf·in 0.23 lbf·in 0.34 lbf·in 0.10 lbf·ft 0.30 lbf·ft 1.8 lbf·ft 3.6 lbf·ft 5.2 lbf·ft 8.6 lbf·ft 10.0 lbf·ft</p>
<p>8. Torque Multiplier Up to 5000 lbf·ft</p>	<p>Procedure 020, 3 Oct 2016</p>	<p>0.65 % of mean output reading</p>

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9. Torque Meter	Procedure 024, 3 Oct 2016	
9.1 Using Torque Arm and Weights		
a. Up to 2 N·m		0.30 % of reading
b. Above 2 N·m to 4 N·m		0.37 % of reading
c. Above 4 N·m to 10 N·m		0.37 % of reading
9.2 Using Transducer		
a. Up to 4 lbf·in		0.021 lbf·in
b. Above 4 lbf·in to 10 lbf·in		0.049 lbf·in
c. Above 10 lbf·in to 40 lbf·in		0.17 lbf·in
d. Above 40 lbf·in to 100 lbf·in		0.31 lbf·in

* CMC is expressed as an expanded uncertainty estimated at a level of confidence of approximately 95 %.

Approved signatories :

Mr. Sreejith Radhakrishnan - All Items
Ms. Karl Lim - All Items
Mr. Noorazmi Bin Mohamed - Items A1 to A9.1, A12 to A42 and B only.
Mr. Bhasi Arunkumar - Items A18 to A34 and B only.
Mr. Mohanakrishnan Sreesankar - Items A3 to A6.1, A18 to A33, B1 to B4, and B7

Note :

This laboratory is accredited in accordance with the recognised International Standard ISO/IEC 17025. A laboratory's fulfilment of the requirements of ISO/IEC 17025 means the laboratory meets both the technical competence requirements and **management system requirements** that are necessary for it to consistently deliver technically valid test results. The **management system requirements** in ISO/IEC 17025 are written in language relevant to laboratory operations and operate generally in accordance with the principles of ISO 9001.