

Laboratory Roots Metrology & Testing Laboratory (A Unit of Roots Industries India Limited) RKG Industrial Estate, Ganapathy, Coimbatore, Tamil Nadu

Accreditation Standard ISO/IEC 17025:2005

Discipline Mechanical Calibration **Issue Date** 26.06.2014

Certificate Number C-0285 **Valid Until** 25.06.2016

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Quantity Measured/ Instrument	Range / Frequency	*Calibration Measurement Capability (\pm)	Remarks
I. DIMENSION			
1. Caliper - Vernier/ Digital/ Dial^{\$} L.C: 0.01 mm ϕ	Upto 300 mm >300 mm to 600 mm >600 mm to 1000 mm >1000 mm to 2000 mm	7.3 μ m 8.0 μ m 9.2 μ m 11.2 μ m	Using Slip Gauges/ Long Slip Gauges/ Slip gauge accessories by Comparison Method
2. Depth Gauge - Vernier/ Digital/ Dial/ Hook^{\$} L.C. 0.01 mm ϕ	Upto 300 mm >300 mm to 600 mm >600 mm to 1000 mm	6.9 μ m 7.7 μ m 8.8 μ m	Using Slip Gauges/ Long Slip Gauges by Comparison Method
3. Dial Caliper Gauge/ Inter Tester/ Dial Groove Gauge^{\$} L.C: 0.005 mm ϕ	2.5 mm to 150 mm	3.3 μ m	Using Slip Gauges/ Long Slip Gauges/ Slip gauge accessories by Comparison Method
4. Pistol Caliper/ OD Caliper/ OD Groove Dial Gauge^{\$} L.C : 0.01 mm ϕ	0 to 100 mm	6.4 μ m	Using Slip Gauges by Comparison Method

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Quantity Measured/ Instrument	Range / Frequency	*Calibration Measurement Capability (\pm)	Remarks
5. Gear Tooth Vernier ^{\$} L.C. 0.01 mm ϕ	Upto 300 mm Upto 600 mm	6.8 μ m 8.4 μ m	Using Slip Gauges/ Long Slip Gauges by Comparison Method
6. Height Gauge - Vernier/ Digital/ Dial ^{\$} L.C : 0.01 mm ϕ	Upto 300 mm Upto 1000 mm	8.3 μ m 11.4 μ m	Using Height Measuring System/ Slip Gauge/ Long Slip Gauges by Comparison Method
7. Bore Gauges ^{\$} (Transmission Only)	1.5 mm	0.8 μ m	Using Universal Length Measuring System by Comparison Method
8. Dial / Digital thickness Gauge ^{\$} L.C : 0.001 mm ϕ	0 to 150 mm	1.6 μ m	Using Universal Length Measuring System & Slip gauges by Comparison Method
9. Ultrasonic Thickness Gauge ^{\$} L.C. : 0.01 mm	0 to 100 mm	8.2 μ m	Using Slip Gauge by Comparison Method
10. Lever Type Dial Gauge ^{\$} L.C. : 0.001 mm L.C. : 0.002 mm L.C. : 0.01 mm	0 to 0.14 mm 0 to 0.8 mm 0 to 1.2 mm	0.5 μ m 0.7 μ m 2.4 μ m	Using Universal Length Measuring System by Comparison Method

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11. Plunger Type Dial Gauge ^s (Mechanical/ Digital) L.C : 0.001 mm ^φ L.C : 0.01 mm	0 to 25 mm 0 to 100 mm	0.7 μ m 2.8 μ m	Using Universal Length Measuring System by Comparison Method
12. Dial Gauges ^s L.C.: 0.001 mm	Upto \pm 50 μ m	0.5 μ m	Using Universal Length Measuring System by Comparison Method
13. Dial Gauges ^s L.C.: 0.0005 mm	Upto \pm 25 μ m	0.5 μ m	Using Universal Length Measuring System by Comparison Method
14. Digital Indicator/ LVDT/ Electronic Probe ^s L.C.: 0.0001 mm ^φ	Upto 10 mm	0.5 μ m	Using Universal Length Measuring System by Comparison Method
15. Depth Micrometer ^s (Analogue & Digital) L.C: 0.001 mm ^φ	Upto 100 mm >100 mm to 300 mm >300 mm to 500 mm	1.1 μ m 1.7 μ m 3.5 μ m	Using Slip Gauges & Long Slip gauges by Comparison Method
16. Micrometer ^s (Analogue & Digital) L.C : 0.001 mm ^φ	0 to 25 mm >25 mm to 100 mm >100 mm to 300 mm >300 mm to 500 mm >500 mm to 1000 mm	1.1 μ m 1.3 μ m 2.2 μ m 3.4 μ m 5.7 μ m	Using Slip Gauges & Long Slip gauges by Comparison Method

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Quantity Measured/ Instrument	Range / Frequency	*Calibration Measurement Capability (±)	Remarks
17. Groove / Inside Micrometer / Caliper Type^s L.C: 0.01 mm	5 mm to 100 mm	6.4 µm	Using Slip Gauges & Slip Gauge Accessories by Comparison Method
18. Internal / Stick Micrometer^s L.C : 0.01 mm	50 mm to 500 mm 500 mm to 1000 mm 1000 mm to 2100 mm	6.1 µm 6.9 µm 9.6 µm	Using Universal Length Measuring System/ Slip Gauges/ Long Slip Gauges by Comparison Method
19. Setting Rod For Micrometer^s	25 mm to 100 mm 100 mm to 500 mm 500 mm to 1000 mm	2.3 µm 4.5 µm 7.1 µm	Using Universal Length Measuring System/ Slip Gauges/ Long Slip Gauges/ Height Measuring System by Comparison Method
20. Snap Micrometer^s L.C. 0.001 mm ^φ	0 to 100 mm	1.3 µm	Using Slip Gauges by Comparison Method
21. Bore Micrometer^s (Three Point) (Analog/ Digital) LC. 0.001 mm ^φ	2.5 mm to 320 mm	2.0 µm	Using Setting Ring Gauge which is calibrated using ULMS by Comparison Method

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Quantity Measured/ Instrument	Range / Frequency	*Calibration Measurement Capability (\pm)	Remarks
22. Thread Plug Gauge ^{\$}	Upto 200 mm 200 mm to 400 mm	1.3 μ m 2.1 μ m	Using Universal Length Measuring System/ Profile Projector by Comparison Method
23. Taper Thread Plug Gauge ^{\$}	Upto 100 mm Upto 300 mm	1.0 μ m 1.7 μ m	Using Universal Length Measuring System by Comparison Method
24. Thread Ring Gauge ^{\$}	Upto 150 mm 150 mm to 200 mm 200 mm to 300 mm	1.1 μ m 1.3 μ m 1.7 μ m	Using Universal Length Measuring System by Comparison Method
25. Taper Thread Ring Gauge ^{\$}	Upto 150 mm	1.6 μ m	Using Universal Length Measuring System by Comparison Method
26. Plain Plug Gauge ^{\$}	Upto 100 mm >100 mm to 200 mm >200 mm to 400 mm >400 mm to 500 mm	1.9 μ m 2.1 μ m 2.7 μ m 3.4 μ m	Using Universal Length Measuring System/ Slip Gauges/ Long Slip Gauges by Comparison Method
27. Plain Ring Gauge/ Setting Ring Gauge ^{\$}	Upto 50 mm >50 mm to 100 mm >100 mm to 200 mm >200 mm to 400 mm	1.8 μ m 1.9 μ m 2.1 μ m 2.7 μ m	Using Universal Length Measuring System by Comparison Method
28. Cylindrical Measuring Pin ^{\$}	Upto 50 mm	1.3 μ m	Using Universal Length Measuring System by Comparison Method

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	Quantity Measured/ Instrument	Range / Frequency	*Calibration Measurement Capability (\pm)	Remarks
29.	Cylindrical Setting Master^{\$} (Diameter only)	Upto 100 mm	1.4 μ m	Using Universal Length Measuring System by Comparison Method
30.	Thread Measuring Cylinders^{\$}	Upto 10 mm	0.5 μ m	Using Universal Length Measuring System by Comparison Method
31.	Bevel Protractor-Mechanical/ Digital^{\$} L.C : 1' ϕ	Upto 360 $^{\circ}$	42"	Using Profile Projector by Comparison Method
32.	Combination Set^{\$} LC : 1$^{\circ}$	0 to 180 $^{\circ}$	35'	Using Profile Projector by Comparison Method
33.	Degree Protractor^{\$}	Upto 180 $^{\circ}$	34'	Using Profile Projector by Comparison Method
34.	Radius Gauge^{\$}	Upto 50 mm	4.0 μ m	Using Profile Projector by Comparison Method
35.	Scale^{\$} L.C.: 0.5 mm	0 to 1000 mm	0.3 mm	Using Profile Projector/ Scale Calibrator by Comparison Method

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Quantity Measured/ Instrument	Range / Frequency	*Calibration Measurement Capability (\pm)	Remarks
36. Tape ^s L.C.: 1 mm	Upto 30 m	0.6 mm/ mtr	Using Profile Projector/ Scale Calibrator by Comparison Method
37. PI Tape ^s L.C : 1 mm	Upto 3 m	0.6 mm/ mtr	Using Profile Projector/ Scale Calibrator by Comparison Method
38. Test Sieves ^s	Upto 3.5 mm	4.1 μ m	Using Profile Projector by Comparison Method
39. Taper Scale ^s	Upto 200 mm	7.5 μ m	Using Profile Projector by Comparison Method
40. Thread Pitch Gauge ^s	0.2 mm to 7.0 mm	3.6 μ m	Using Profile Projector by Comparison Method
41. Coating Thickness Foil ^s	Upto 2 mm	0.4 μ m	Using Universal Length Measuring System by Comparison Method
42. Feeler Gauge ^s	Upto 1 mm	2.5 μ m	Using Digital Micrometer by Comparison Method
43. Spirit Level ^s Sensitivity : 0.02 mm/ mtr (Type 1 & 2 & 3)	Upto 300 mm	0.017 mm/ mtr	Using Electronic Level/ Height Measuring System by Comparison Method

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Quantity Measured/ Instrument	Range / Frequency	*Calibration Measurement Capability (\pm)	Remarks
44. Sine Bar ^s	Upto 200 mm	19 Arc sec	Using Slip Gauges / Angle Gauge Block/ Co-ordinate Measuring machine by Comparison Method
45. Snap Gauge - Fixed/ Adjustable/ Gap Gauge ^s	3 mm to 50 mm 50 mm to 100 mm 100 mm to 200 mm 200 mm to 300 mm 300 mm to 400 mm	2.6 μ m 2.8 μ m 3.7 μ m 4.8 μ m 6.0 μ m	Using Universal Length Measuring System/Slip Gauge/ Long Slip Gauges by Comparison Method
46. Slip Gauge ^s	0.5 mm to 25 mm 25 mm to 50 mm 50 mm to 75 mm 75 mm to 100 mm Upto 125 mm	0.29 μ m 0.35 μ m 0.37 μ m 0.45 μ m 1.48 μ m	Using Gauge Block Comparator with reference grade slip gauges by Comparison Method
47. Length Bar/ Long Slip Gauges ^s	125 mm to 200 mm > 200 mm to 300 mm >300 mm to 500 mm	1.86 μ m 2.31 μ m 3.75 μ m	Using Universal Length Measuring System & Long slip gauges by Comparison Method
48. Slip Gauge Accessories ^s (Flatness only)	300 mm	0.33 μ m	Using Optical parallels by Comparison Method
49. Comparator Stand ^s (Flatness only)	Upto 300 mm	4.2 μ m	Using Co-ordinate measuring machine by Comparison Method

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Quantity Measured/ Instrument	Range / Frequency	*Calibration Measurement Capability (\pm)	Remarks
50. Engineer's Parallels ^{\$}	Up to 500 mm	4.2 μ m	Using Co-ordinate Measuring Machine by Comparison Method
51. Fillet Gauge ^{\$}	Upto 200 mm	7.5 μ m	Using Co-ordinate Measuring Machine by Comparison Method
52. Flow Cup/ Ford Cup ^{\$} (Orifice dia only)	Dia 4 mm	4.2 μ m	Using Co-ordinate Measuring Machine by Comparison Method
53. Limit Gauges ^{\$} -Height -Depth -Length/ Width	Upto 300 mm	7.1 μ m	Using Height Measuring System/Co-ordinate measuring machine /Universal Length Measuring System/ Digital Micrometer by Comparison Method
54. Limit Gauges ^{\$} -Radius -Angle	Upto 300 mm Upto 300 mm	4.9 μ m 18 sec	Using Co-ordinate Measuring Machine by Comparison Method
55. Riser Block ^{\$}	Upto 300 mm	4.4 μ m	Using Height Measuring System by Comparison Method
56. Flush Pin Gauge ^{\$}	Upto 50 mm	4.2 μ m	Using Height Measuring System and Co-ordinate Measuring Machine by Comparison Method

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57. V-Block ^{\$} -Flatness -Parallelism -Symmetry	Upto 300 mm	4.2 μ m	Using Co-ordinate Measuring Machine by Comparison Method
58. Straight Edge ^{\$}	Upto 700 mm	4.2 μ m	Using Co-ordinate Measuring Machine by Comparison Method
59. Engineer's Square ^{\$}	Upto 700 mm	4.3 μ m	Using Co-ordinate Measuring Machine by Comparison Method
60. Angle Plate ^{\$}	Upto 600 mm	4.3 μ m	Using Co-ordinate Measuring Machine by Comparison Method
61. Dial Calibration Tester ^{\$} L.C: 0.001 mm ϕ	0 to 100 mm	1 μ m	Using Universal Length Measuring System/ Height Measuring System by Comparison Method
62. Height Master ^{\$} L.C: 0.001 mm ϕ	5 mm to 310 mm	6.2um	Using Height Measuring System by Comparison Method
63. Micrometer Head ^{\$} L.C : 0.001mm ϕ	Upto 100 mm	1.1 μ m	Using Universal Length Measuring System by Comparison Method

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Quantity Measured/ Instrument	Range / Frequency	*Calibration Measurement Capability (±)	Remarks
64. Air Gauge Unit ^{\$}	± 0.05 mm	0.9 µm	Using Setting plug/ ring by Comparison Method
65. Profile Projector/ Tool Maker Microscope/ Vision Measuring Machine [#]			
Linear	200 mm x 150 mm	4.0 µm	Using Glass Calibration Grid, Angle Gauge Block Set by Comparison Method
Angular	360°C	12 Arc sec	
66. Surface Plate [#]	3500 mm x 2600 mm	$1.7x \sqrt{\frac{L+W}{100}}$ mm	Using Electronic Level by Comparison Method
		Where L is Length & W is Width in mm	
67. Co-Ordinate Measuring Machine [#] (Linear)	Upto 1000 mm	4.0 µm	Using Slip Gauges by Comparison Method
68. Height Measuring System [#]	Upto 1000 mm	5.5 µm	Using Slip Gauges by Comparison Method
69. Floating Carriage Diameter Measuring Machine ^{\$}	25 mm	4.62 µm	Using Slip Gauges/ Co-ordinate measuring machine by Comparison Method

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70. Universal Length Measuring System [#]	Upto 100 mm (Absolute) 100 mm to 1000 mm	$0.4 + \left[\sqrt{\left(\frac{L}{300\mu\text{m}} \right)^2} \right]$ Where L is Length in mm	Using Slip Gauges & Long Slip Gauges by Comparison Method
71. Caliper Checker ^{\$}	Upto 600 mm	5.07 μm	Using Co-ordinate Measuring Machine/ Height Measuring System by Comparison Method
72. Scale Calibrator ^{\$}	Upto 1000 mm	6.7 μm	Using Slip Gauges & Long Slip Gauges by Comparison Method
73. Slip Gauge Calibrator ^{\$}	Upto 170 mm	$0.04 + \frac{L}{1000} \mu\text{m}$ Where L is Length in mm	Using Slip Gauges EAL - G -21 by Comparison Method
74. Bench Centre [*]	Upto 500 mm	4.3 μm	Using Master Mandrel by Comparison Method
II. ACCOUSTICS			
1. Sound Level Meter ^{\$}	114 dB	1.4 dB	Using Sound Accoustic Calibrator by Comparison Method

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III. ACCELERATION & SPEED

- | | | | |
|---|----------------------|--------------------------|--|
| 1. RPM Tachometer ^{\$}
(Contact Type) | 100 rpm to 4500 rpm | 1% rdg | Using Digital Tachometer
by Comparison Method |
| 2. RPM Tachometer ^{\$}
(Non Contact Type) | 100 rpm to 90000 rpm | 1.56 % rdg to 0.11 % rdg | Using Digital Tachometer
by Comparison Method |

IV. PRESSURE & VACUUM

- | | | | |
|--|---|-------------------------------------|---|
| 1. Pressure- Pneumatic [#]
Digital and Dial
Pressure gauges/
Pressure transmitters /
Transducers | 1 kg/cm ² to 20 kg/cm ² | 0.16% rdg | Using Twin mode calibrator
Druck DPI 610& Pneumatic
pump procedures based on
DKD guidelines R-6-1 |
| 2. Pressure- Hydraulic ^{\$}
Digital and Dial
Pressure gauges and
Pressure transmitters/
Transducers | 1 kg/cm ² to 400 kg/cm ²
400 kg/cm ² to 700 kg/cm ²
700 kg/cm ² to 1200 kg/cm ² | 0.67% rdg
0.24% rdg
1.20% rdg | Using Budenberg UK
Digital Calibrator H542
&Hydraulic Pump
procedures based on DKD
guidelines R-6-1 |
| Pressure- Hydraulic
Digital and Dial
Pressure gauges and
Pressure transmitters/
Transducers* | 20 kg/cm ² to 700 kg/cm ² | 1.63% rdg | Using Pressure calibrator
Druck DPI 610& Hydraulic
pump procedures based on
DKD guidelines R-6-1 |
| 3. Vacuum
Digital and Dial
vacuum gauges and
transmitters [#] | -0.8 bar to 0 bar | 4.11% rdg | Using Vacuum calibrator
Druck DPI 610& Vacuum
pump |

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V. TORQUE			
1. Type 1 Dial /Digital Torque Wrenches/ Torque Screw Drivers Class A,B,C,D,E ^s	1 Nm to 20Nm	0.5 % rdg	Using Torque Calibration System with Torque Sensors 5,20,100, 500, 2000 Nm procedures based on ISO 6789
	20 Nm to 500 Nm	0.6 % rdg	
	500 Nm to 2000 Nm	1.3 % rdg	
2. Type 2 Click type Torque Wrenches/ Torque Screw Drivers ^s Class A,B,C,D,E F,G	1 Nm to 20Nm	0.4 % rdg	Using Torque Calibration System with Torque Sensors 5,20,100, 500,2000 Nm procedures based on ISO 6789
	20 Nm to 500 Nm	1.2 % rdg	
	500 Nm to 2000 Nm	1.3 % rdg	
VI. MASS			
1. Weights ^s	1 mg	0.010 mg	Using E2 class weights, (ABBA method) as per OIML R 111
	2 mg	0.010 mg	
	5 mg	0.010 mg	
	10 mg	0.010 mg	
	20 mg	0.010 mg	
	50 mg	0.010 mg	
	100 mg	0.010 mg	
	200 mg	0.012 mg	
	500 mg	0.018 mg	
	1 g	0.012 mg	

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	2 g	0.016 mg	Using E2 class weights, (ABBA method) as per OIML R 111
	5 g	0.019 mg	
	10 g	0.022 mg	
	20 g	0.028 mg	
	50 g	0.034 mg	
	100 g	0.098 mg	
	200 g	0.132 mg	
2. Weighing Balance [#]	0 to 60g >60 g to 220 g	0.063 mg 0.138 mg	Using E2 & F1 Class Standard weights based on OIML R-76(2006)
Weighing Balance [#]	>220g to 600 g >600 kg to 3 kg >3kg to 6 kg >6kg to 30 kg >30kg to 88 kg	8.5 mg 75 mg 379 mg 3 g 5.9g	Using M1 Class Standard weights based on OIML R- 76(2006)
3. Gram gauge ^{\$}	0 to 6 g >6g to 30g >30g to 100 g >100 g to 1000 g	0.165 g 0.824 g 2.8 g 28 g	Using F1 & M1 class standard weights Based on OIML R-76(2006)

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4. Spring Balance [§]	0 to 100g	1g	Using F1 & M1 class standard weights based on OIML R-76(2006)
	>100 g to 500 g	5g	
	>500 g to 1 kg	10 g	
	>1 kg to 5kg	20 g	
	>5kg to 10 kg	50g	
	>10kg to 25 kg	165 g	
	>25kg to 50 kg	165 g	

* Measurement Capability is expressed as an uncertainty (\pm) at a confidence probability of 95%

^φ Laboratory can also calibrate instruments/devices of coarser resolution / least count within the accredited range using same reference standard/ master equipment under the scope of accreditation.

[§]Only in Permanent Laboratory

^{*}Only for Site Calibration

[#] The laboratory is also capable for site calibration however, the uncertainty at site depends on the prevailing actual environmental conditions and master equipment used.