

Laboratory Metrology Laboratory, CMTI, Central Manufacturing Technology Institute, Tumkur Road, Bangalore, Karnataka

Accreditation Standard ISO/IEC 17025: 2005

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Sl.	Quantity Measured / Instrument	Range/Frequency	*Calibration Measurement Capability (\pm)	Remarks
<u>MECHANICAL CALIBRATION</u>				
1.	DIMENSION (BASIC MEASURING INSTRUMENT, GAUGE ETC.)			
1.	Angle Gauge Blocks [§]	0° to 90°	2.8 arc sec	Using Autocollimator & Index Table by Comparison Method
		4" to 90°	3.4 arc sec	Using Rotary Table & Electronic Lever Probe by Comparison Method
2.	Ball Bar System [§]	Up to 300 mm	$(1.5 + \frac{L}{1000}) \mu\text{m}$ L is in mm	Using Coordinate Measuring Machine
	Ball Bar Calibrator			
	Ball Bar Transducer			Range: ± 1 mm @ 100 mm nominal
3.	Bench Centre [§]	50 mm to 600 mm	3.0 μm	Using Coordinate Measuring Machine
	Parallelism of the Axis of Centres			
	Co-axiality of Centres			
4.	Bevel Protractor / Combination Set [§]	0° to 180°	2.5 arc min	Using Profile Projector
	Angle Resolution: 1 arc min			
	Geometrical Parameters (Parallelism,		2 μm	Using Digital Height Gauge & Electronic Lever Probe & Surface Plate

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	Straightness, Squareness & Flatness)			
5.	Bore Gauge ^{\$} Resolution: 1 μ m	Up to 300 mm Transmission Range: 2 mm	2.0 μ m	Using Universal Length Measuring Machine
6.	Clinometer ^{\$} Resolution: 60 arc sec	0 to 180°	20 arc sec	Using Electronic Level & Rotary Table by Comparison Method
7.	Dial Gauge Plunger Type ^{\$} (Mechanical / Digital) Resolution: 0.1 μ m Resolution: 0.2 μ m Resolution: 0.5 μ m Resolution: 1 μ m Resolution: 2 μ m Resolution: 10 μ m	0 to 25 mm 0 to 0.8 mm 0 to 2 mm 0 to 50 mm 0 to 50 mm 0 to 100 mm	0.3 μ m 0.4 μ m 0.5 μ m 0.8 μ m 1.7 μ m 7.0 μ m	Using Universal Length Measuring Machine / Gr '0' Slip Gauges by Comparison Method
8.	Dial Gauge Lever Type ^{\$} (Mechanical / Digital) Resolution: 0.2 μ m Resolution: 0.5 μ m	0 to 0.8 mm 0 to 2 mm	0.4 μ m 0.5 μ m	Using Universal Length Measuring Machine / Gr '0' Slip Gauges by Comparison Method
9.	Electronic Probe - Plunger Type ^{\$} Resolution: 0.1 μ m	Up to 25 mm	0.3 μ m 0.4 μ m	Using Universal Length Measuring Machine by Comparison Method Gr '0' Slip Gauges by Comparison Method

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	Resolution 1 μ m	Up to 50 mm	0.7 μ m	Universal Length Measuring Machine / Gr '0' Slip Gauges by Comparison Method
10.	Electronic Probe – Lever Type [§] Resolution 0.1 μ m	Up to 2 mm	0.3 μ m	Using Universal Length Measuring Machine by Comparison Method
11.	Feeler Gauges & Thickness Standards [§]	Up to 1 mm	2 μ m	Using Digital Micrometer
12.	Granite Square / Try Square [§]	Up to 630 mm X 800 mm	3.2 μ m	Using Coordinate Measuring Machine
13.	Height Gauge [§] (Digital/ Vernier) Resolution: 10 μ m Linear Accuracy Geometrical Parameter (Flatness, Parallelism, Squareness)	Up to 1000 mm	$(6.0 + \frac{L}{1000}) \mu\text{m}$ L is in mm 2.0 μ m	Using Step Gauge/ Grade "0" Slip Gauges, Electronic Lever Probe by Comparison Method Using Electronic Lever Probe, Master Cylinder/ Granite Square by Comparison Method
14.	2D Height Gauge / Height Measuring Instrument [§] Resolution: 0.1 μ m Linear Squareness	Up to 1000 mm	$(1.0 + \frac{L}{400}) \mu\text{m}$ L is in mm 1.6 μ m	Using Step Gauge/ Grade "0" Slip Gauges, Electronic Lever Probe by Comparison Method Using Master Cylinder/ Granite Square by Comparison Method
15.	Height Master [§] Resolution: 0.1 μ m	Up to 1000 mm	$(0.8 + \frac{L}{225}) \mu\text{m}$ L is in mm	Using Step Gauge & Coordinate Measuring Machine/ Grade "0" Slip Gauges, Electronic

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				Comparator by Comparison Method
16.	Inclinometer [§] Resolution:1°	0 to 90°	18 arc min	Using Rotary Table by Comparison Method
17.	Involute & Lead Master /Master Gears [§] (Spur/Helical) Profile Helix Angle Error Pitch & Run Out	Up to ϕ 300 mm	2.8 μ m 2.8 μ m 2.8 μ m	Using Gear Testing Machine
18.	Lever Arm [§]	Up to 1200 mm	$(2.0 + \frac{L}{450}) \mu$ m L is in mm	Using Coordinate Measuring Machine
19.	Micrometers / Depth Micro-meters / Micrometer Head [§] Resolution 1 μ m Thimble Accuracy Parallelity & Flatness of Anvils	Up to 100 mm 101 mm to 300 mm Above 300 mm to 1000 mm	1.5 μ m 2.0 μ m 5.0 μ m 1.0 μ m	Using Universal Length Measuring Machine / Gr "0" Slip Gauges & Electronic Lever Probe Using Optical Flat & Parallel
20.	Stick Micrometer [§] Resolution 1 μ m	50 mm to 1000 mm	5.0 μ m	Using Universal Length Measuring Machine / Gr "0" Slip Gauges & Electronic Lever Probe
21.	Radius Gauges [§]	Up to 25 mm	20.0 μ m	Using Profile Projector

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22.	Index Table ^{\$}	0 to 360°	1.5 arc sec	Using Autocollimator & Polygon Mirror by Comparison Method
23.	Rotary Table / Optical Dividing Head ^{\$} Resolution 1 arc sec	0 to 360°	1.8 arc sec	Using Autocollimator & Polygon Mirror by Comparison Method
24.	Thread Pitch Gauges ^{\$} Pitch Flank Angle	Up to 6 mm	3.0 μ m 2.5 arc min	Using Profile Projector
25.	Setting Gauge Rods / Extension Rods ^{\$}	Up to 100 mm Above 100 mm to 300 mm Above 300 mm to 1000 mm Upto 1000 mm	1.0 μ m $(1.0 + \frac{L}{800}) \mu$ m L is in mm $(5.5 + \frac{L}{800}) \mu$ m L is in mm $(3.0 + \frac{L}{2000}) \mu$ m L is in mm	Using Gr "0" Slip Gauges & Electronic Lever Probe by Comparison Method Using Length Measuring Machine Using Laser Measurement System
26.	Setting Master for Electronic Height Gauge ^{\$}	Up to 50 mm	1.0 μ m	Using Gr "0" Slip Gauges & Electronic Lever Probe by Comparison Method
27.	Setting Plug Gauges/ Master Disc ^{\$} Diameter	Up to 100 mm	$(0.6 + \frac{L}{550}) \mu$ m	Using Universal Length Measuring Machine / Gr "0" Slip gauges & Electronic Lever Probe

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	Circularity	Up to 300 mm	L is in mm $(0.5 + \frac{L}{800}) \mu\text{m}$	by Comparison Method Using CMM
	Roughness	Up to 300 mm	L is in mm $(0.8 + \frac{L}{500}) \mu\text{m}$	Using Form Tester
		Up to 300 mm	0.1 μm	Using Roughness Tester
		Up to 300 mm	5.5%	
28.	Setting Ring Gauges ^s	3 mm to 100 mm	$(0.65 + \frac{L}{1000}) \mu\text{m}$	Using Universal Length Measuring Machine by Comparison Method
	Diameter	Above 100 mm to 275 mm	L is in mm $(0.1 + \frac{L}{125}) \mu\text{m}$	Using CMM
		Up to 275 mm	$(0.8 + \frac{L}{500}) \mu\text{m}$	
	Circularity	Up to 275 mm	L is in mm 0.1 μm	Using Form Tester
	Roughness	Up to 275 mm	5.5%	Using Roughness Tester
29.	Sine Bar/Sine Centre/Sine Table ^s	Up to 500 mm	3.8 arc sec 2.8 μm	Using Gr "0" Slip Gauges, Angle Gauges, Electronic Lever Probe & CMM by Comparison Method
	Angle			
	Centre Distance Between Rollers			

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	Geometrical Parameter		2.8 μ m	
30.	Spirit Level / Frame Level/ Coincidence Level [§] Sensitivity Geometrical Parameter (Flatness, Parallelism & Squareness)	0.03 mm/m 0.02 mm/m 0.01 mm/m	0.020 mm/m 0.015 mm/m 0.010 mm/m 2.8 μ m	Using Electronic Level & Rotary Table by Comparison Method Using Surface Plate, Electronic Lever Probe & Cylindrical Test Mandrel
31.	Steel Scales [§]	Up to 300 mm Above 300 mm to 2000 mm	10 μ m $(13 + \frac{L}{125}) \mu$ m L is in mm	Using Profile Projector & Length Measuring Machine
32.	Steel Tapes & Pi Tapes [§]	Up to 15 m length	$(25 + \frac{L}{250}) \mu$ m L is in mm	Using Profile Projector & Length Measuring Machine
33.	Straight Edge & Parallels [§]	Up to 2000 mm	2.0 μ m	Using Electronic Lever Probe/ Electronic Level
34.	Surface Plate [#]	Up to 5000 mm Longer Side	$0.7 \sqrt{\frac{L+W}{B}} \mu$ m Where, L= Length in mm, W= Width of surface Plate in mm, B (Base Length of Level) =100 mm	Using Electronic Level

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35.	Surface Plate ^s	630 mm x 630 mm	2.5 μ m	Using CMM
36.	Taper Plug Gauges ^s Half Taper Angle Dia @ end Circularity Straightness Roughness	10 °	6 arc sec 3.4 μ m 0.1 μ m 1 μ m 2 μ m 5.5 %	Using CMM Using Form Tester Using Form Tester Using CMM Using Roughness Tester
37.	Taper Ring Gauges ^s Half Taper Angle Dia @ end Circularity Straightness Roughness	10 °	6 arc sec 3.4 μ m 0.1 μ m 1 μ m 2 μ m 5.5 %	Using CMM Using Form Tester Using Form Tester Using CMM Using Roughness Tester
38.	Test Mandrels ^s Taper Angle Dimension Geometrical Parameters Roughness	0 to 1000 mm long 0 to 1000 mm long 0 to 450 mm long 0 to 1000 mm long	5.5 arc sec 2 μ m 1.2 μ m 2 μ m 5.5 %	Using CMM Using Marameter Using Form Tester, Bench Centre, Electronic Lever Probe Using CMM, Bench Centre, Electronic Lever Probe Using Roughness Tester
39.	Test Sieves ^s Perforated Plate Wire Cloth	32 μ m to 4 mm > 4 mm to 10 mm > 10 mm to 125 mm	3 μ m 10 μ m 25 μ m	Using Profile Projector Using Vernier Caliper

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40.	Thread Plug Gauges [§] Diameter	Up to 125 mm	2 μ m	Using Universal Length Measuring Machine / Vertical Metroscope by Comparison Method
	Pitch		2 μ m	Using Profile Projector
	Flank Angle		2.5 arc min	Using Profile Projector
41.	Thread Measuring Wire [§]	Up to 6.35 mm	0.5 μ m	Using Universal Length Measuring Machine by Comparison Method
42.	Cylindrical Rollers / Pins [§]	Up to 20 mm	0.5 μ m	Using Universal Length Measuring Machine by Comparison Method
43.	Thread Ring Gauges [§] Diameter	3 mm to 125 mm	2.0 μ m	Using Universal Length Measuring Machine & Bore Gauge
	Pitch	10 mm to 125 mm	2.0 μ m	Using Profile Projector
	Flank Angle	10 mm to 125 mm	2.5 arc min	Using Profile Projector
44.	V – Block [§] (Single Non-Paired)	Length Up to 200 mm	3 μ m	Using Electronic Lever Probe, Electronic Height Gauge & Mandrel by Comparison Method
45.	Vernier Calipers / Vernier Depth Gauge / Gear Tooth Vernier [§] Resolution: 10 μ m Length	Up to 300 mm 301 mm to 1000 mm	10 μ m 20 μ m 2.5 μ m	Using Gr "0" Slip Gauges, Master Ring Gauges
	Parallelism			Using Profile Projector

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46.	Rotary / Indexing Table *	0 to 360°	2.7 arc sec	Using Laser Measuring System with Rotary Indexer/ Autocollimator
II. DIMENSION (PRECISION INSTRUMENTS)				
1.	Angular Graticule ^{\$}	0° to 360°	60 arc sec	Using Profile Projector
2.	Autocollimator ^{\$} Resolution: 0.05 arc sec	Up to 2000 arc sec	1.0 arc sec	Using Auto-collimator & Double sided Plane Parallel Reflector by Comparison Method
3.	Caliper Checker / Check Master / Inside Micro Checker ^{\$}	Up to 1000 mm	$(0.80 + \frac{L}{350}) \mu\text{m}$ L is in mm	Using Step Gauge & Coordinate Measuring Machine by Comparison Method
4.	Depth Microchecker ^{\$} Pitch Block Accuracy Parallelity	Up to 300 mm	$(0.65 + \frac{L}{500}) \mu\text{m}$ L is in mm 2 μm	Using Gr "0" Slip Gauges & Electronic Lever Probe by Comparison Method
5.	Dial Gauge Calibrator/ Tester ^{\$} Resolution: 0.1 μm Resolution: 0.1 μm	25 mm 25 mm	0.3 μm 0.5 μm	Using Universal Length Measuring Machine by Comparison Method Using Gr '0' Slip Gauges & Electronic Probe by Comparison Method
6.	Electronic Level ^{\$} Angle	Up to 1000 arc sec	1.0 arc sec	Using Autocollimator, Plane Mirror, on a common Tilt Table by Comparison Method

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	Geometrical Parameter (Flatness, Parallelism & Squareness)	Above 1000 arc sec	1.5 arc sec	Using Electronic Level by Comparison Method
			3.0 arc sec	Using Rotary Table by Comparison Method
			2 μ m	Electronic Lever Probe, Electronic Height Gauge
7.	Glass Scales/ Glass Grid ^{\$}	Up to 400 mm	$(0.3 + \frac{L}{500}) \mu$ m L is in mm	Using Laser Measurement System
		Up to 100 mm	0.9 μ m	Using F25 CMM
		Up to 200 mm	2.5 μ m	Using Profile Projector
8.	Long Slip Gauges/ Length Bars ^{\$}	Up to 300 mm	$(0.05 + \frac{L}{3000}) \mu$ m L is in mm	Using Gauge Block Interferometer
		Up to 300 mm	$(0.45 + \frac{L}{1000}) \mu$ m L is in mm	Using Grade "K" Slip Gauges & Electronic Lever Probe by Comparison Method
		Above 300mm to 1000mm	$(1.0 + \frac{L}{500}) \mu$ m L is in mm	Using CMM & Long Slip Gauges by Comparison Method
9.	Magnification Master ^{\$} (Flick Standard)	Up to 20 μ m	0.41 μ m	Using Form Tester
		Above 20 μ m to 300 μ m	$(0.40 + \frac{L}{400}) \mu$ m L is in μ m	

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10.	Master Cylinder [§] Circularity Cylindricity & Straightness Squareness & Flatness Surface Roughness Circularity Cylindricity & Straightness Squareness & Flatness Surface Roughness	Up to 300 mm Above 300 to 450 mm	0.14 μ m 0.6 μ m 0.11 μ m 6.8 % 0.14 μ m 1.0 μ m 1.2 μ m 6.8 %	Using Form Tester
11.	Optical Flat [§]	Up to Dia.100 mm	0.041 μ m	Using Flatness Interferometer & Reference (Transmission) Flat
12.	Optical Parallel [§] Flatness Parallelism Thickness	Up to Dia.100 mm Up to Dia.100 mm Up to Dia.100 mm	0.041 μ m 0.067 μ m 0.2 μ m 0.4 μ m	Using Flatness Interferometer & Reference (Transmission) Flat Using Universal Length Measuring Machine & Gr "0" Slip Gauges by Comparison Method Using Electronic Lever Probe & Gr "0" Slip Gauges by Comparison Method
13.	Polygons Mirror / Prisms [§]	360°	2.6 arc sec	Using Autocollimator & Index Table by Comparison Method

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14.	Radius Standard / Contour Master ^{\$} Size Circularity Roughness Contour Master Step Height	Up to 100 mm	0.5 μ m 1.5 μ m 0.06 μ m 5.5% 1.5 μ m	Using Universal Length Measuring Machine by Comparison Method Using CMM Using Form Tester Using Roughness Tester Using CMM
15.	Roundness Master ^{\$}	Up to 300 mm	0.06 μ m	Using Form Tester
16.	Slip Gauges / Gauge Blocks ^{\$}	Up to 100 mm	$(0.03 + \frac{L}{3000}) \mu$ m L is in mm $(0.054 + \frac{L}{2500}) \mu$ m L is in mm	Using Gauge Block Interferometer Using Slip Gauges & Slip Gauge Comparator by Comparison Method
17.	Spherical Master , Thread Measuring Balls & Master Steel Balls ^{\$} Dimension Full Sphere Hemisphere Circularity Surface Roughness	0.8 to 50 mm	0.5 μ m 2 μ m 0.06 μ m 5.5%	Using Universal Length Measuring Machine by Comparison Method Using CMM Using Form Tester Using Roughness Tester

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18.	Step Gauges [§]	Up to 1020 mm	$(0.85 + \frac{L}{450}) \mu\text{m}$ L is in mm	Using Step Gauges & CMM by Comparison Method
19.	Surface Roughness Master [§]	R _a 7 μm R _z 25 μm	5.5 % 5.5 %	Using Roughness Tester
20.	Surface Roughness Master-Depth [§]	Up to 10 μm	5.5%	Using Roughness Tester
21.	Profile Projector [§] Length Resolution: 0.1 μm Angle Resolution: 1arc sec Magnification	Up to 200 mm 360° 100 X	$(0.85 + \frac{L}{325}) \mu\text{m}$ L is in mm $(0.7 + \frac{L}{650}) \mu\text{m}$ L is in mm 17 arc sec 0.4 %	Using Glass Scale Using Laser Measuring System Using Angle Gauge Blocks Using Glass Scale & Vernier Caliper
22.	Gear Testing Machine [#]	Up to 300 mm	2.6 μm	Using Lead & Profile Master, Master Gear
23.	Slip Gauge / Gauge Block Calibrator [#]	100 mm / $\pm 10 \mu\text{m}$	$(0.03 + \frac{L}{3555}) \mu\text{m}$ L is in mm	Using Grade "K" Slip Gauges by Comparison Method
24.	Universal Length Measuring Machine / Metroscope [§] Resolution: 0.01 μm	Up to 100 mm	$(0.16 + \frac{L}{500}) \mu\text{m}$ L is in mm	Using Grade "K" Slip Gauges

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			$(0.1 + \frac{L}{345}) \mu\text{m}$ L is in mm	Using Laser Measuring System
25.	Co-ordinate Measuring Machine [§]	1200 X 850 X 600 mm	$(0.8 + \frac{L}{1000}) \mu\text{m}$ L is in mm	Using Step Gauges/ Slip Gauges
26.	Length Measuring Machine [§] L.C.: 1 μm	2.5 m	$(3 + \frac{L}{110}) \mu\text{m}$ L is in mm	Using Laser Measuring System/ Slip Gauges
27.	Roughness Tester [#] Stand alone Portable	25 μm	4.1 % 5.5%	Using Depth Master & Surface Roughness Masters
28.	Roundness /Form Tester [#] Roundness Magnification Other Parameters	ϕ 350 mm x 500 mm	0.04 μm 0.4 μm 1 μm	Using Glass Hemisphere Using Magnification (Flick) Standard Using Master Cylinder / Optical Flat
29.	Ultra Precision Co-Ordinate Measuring Machine, F25 [§] Resolution: 0.001 μm	130 x130 x100 mm	0.50 μm	Using Grade "K" Slip Gauges & Glass Scale
30.	Vertical Metroscope [§] Resolution: 1 μm	Up to 100 mm	$(0.99 + \frac{L}{1200}) \mu\text{m}$ L is in mm	Using Grade "0" Slip Gauges

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31.	Laser Measuring System [§] Resolution: 0.01 μ m	1 m	$(0.058+0.9L) \mu$ m L in Meter	Using Master Laser
32.	Rotary Indexer with Laser Measuring System [§]	Up to 360°	2.7 arc sec	Using Indexing Table
33.	Flatness Interferometer [§]	Up to Dia.100 mm	40 nm	Using Reference (Transmission) Flat
34.	Universal Length Measuring Machine / Metroscope *	Up to 100 mm 101 to 300 mm Up to 1000 mm	$(0.2 + \frac{L}{500}) \mu$ m L is in mm $(0.55 + \frac{L}{1000}) \mu$ m L is in mm $(0.1 + \frac{L}{345}) \mu$ m L is in mm	Using Grade "0" Slip Gauges Using Laser Measuring System
35.	Co-Ordinate Measuring Machine* Resolution: 0.1 μ m	2000 X 1500 X 800 mm	$(1.2 + \frac{L}{600}) \mu$ m L is in mm	Using Step Gauges/ Slip Gauges
36.	Length Measuring Machine* Resolution: 1 μ m	5 m	$(1.3 + \frac{L}{300}) \mu$ m L is in mm	Using Laser Measuring System/ Slip Gauges
37.	Profile Projector * Length Resolution: 0.1 μ m	Up to 200 mm	$(0.85 + \frac{L}{325}) \mu$ m L is in mm $(0.7 + \frac{L}{650}) \mu$ m	Using Glass Scale Using Laser Measuring System

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	Angle Resolution: 1arc sec Magnification	201 mm to 500 mm 360° 100 X	L is in mm $(0.7 + \frac{L}{400}) \mu\text{m}$ L is in mm 17 arc sec 0.4 %	Using Laser Measuring System Using Angle Gauge Blocks Using Glass Scale & Vernier Caliper
38.	Universal Measuring Microscope * Resolution: 1 μm	Up to 200 mm Up to 500 mm	$(0.6 + \frac{L}{500}) \mu\text{m}$ L is in mm $(0.7 + \frac{L}{400}) \mu\text{m}$ L is in mm	Using Gr "0" Slip gauges & Electronic Lever Probe Using Laser Measuring System
	CNC Machine Tools * Positioning Accuracy	Up to 10 m	$(0.2 + \frac{L}{600}) \mu\text{m}$ L is in mm	Using Laser Measuring System
	Pitch/ Yaw	Up to 10 m	2.4 arc sec	Using Laser Measuring System
		Up to 4 m Above 4m to 10m	$(1 + \frac{L}{500}) \mu\text{m}$ L is in mm $(6 + \frac{L}{1500}) \mu\text{m}$ L is in mm	

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Accreditation Standard ISO/IEC 17025: 2005

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Validity 31.08.2018 to 30.08.2020 **Last Amended on** -

Sl.	Quantity Measured / Instrument	Range/Frequency	*Calibration Measurement Capability (\pm)	Remarks
	Squareness	Up to 4 m	1.5 arc sec	Using Laser Measuring System
		Above 4 m to 10 m	2.0 arc sec	
		Up to 700 mm	5.35 μ m	Using Granite Square/ Master Cylinder
	Roll	Up to 10 m	2.0 arc sec	Using Electronic Level
	Positioning/ Indexing Accuracy	0 to 360°	2.5 arc sec	Using Laser Measuring System with Rotary Indexer/ Autocollimator
40.	Extensometer [§] Resolution : 1 μ m	Up to 5 mm	1.7 μ m	Using Electronic Height Gauge (Resolution: 0.1 μ m) & Profile Projector

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

[§]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.