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**			
Certificate Number	**CC-2752** ***(In lieu of C-0285, C-0501, C-0826)***	**Page**	**1 of 27**	
Validity	**26.06.2018 to 25.06.2020**	**Last Amended on**	**-**	

Sl.	Quantity Measured / Instrument	Range/Frequency	*Calibration Measurement Capability (±)	Remarks
	ELECTRO TECHNICAL CALIBRATION			
I.	**SOURCE**			
1.	DC Voltage#	1mV to 10mV 10mV to 100mV 100mV to 1V 1V to 10V 10V to 100V 100V to 1000V	0.33% to 0.034% 0.034% to 0.005% 0.005% to 0.002% 0.002% to 0.0015% 0.0015% to 0.0021% 0.0021% to 0.0020%	Using Multi product calibrator (Transmille) by Direct Method
2.	AC Voltage#	**50Hz to 10kHz** 1mV to 10mV 10mV to 100mV 100mV to 1V 1V to 10V 10V to 100V 100V to 1000V	 2.54% to 0.47% 0.47% to 0.068% 0.068% to 0.056% 0.056% to 0.053% 0.053% to 0.11% 0.11% to 0.11%	Using Multi product calibrator (Fluke) by Direct Method
3.	DC Current#	10µA to 100µA 100µA to 1mA 1mA to 100mA 100mA to 1A 1A to 10A 10A to 30A 10A to 30A 30A to 1500A	0.18% to 0.029% 0.029% to 0.012% 0.012% 0.012% to 0.019% 0.019% to 0.037% 0.037% to 0.06% 1.32% to 0.56% 0.56% to 0.97%	Using Multi product calibrator (Transmille) by Direct Method Using Current coil by Direct Method

Sl.	Quantity Measured / Instrument	Range/Frequency	*Calibration Measurement Capability (±)	Remarks
4.	AC Current#	**40Hz to 1kHz**		Using Multi product calibrator (Transmille) by Direct Method
		20µA to 100µA	2.91% to 1.62%	
		100µA to 1mA	1.62% to 0.70%	
		1mA to 100mA	0.70% to 0.71%	
		100mA to 20A	0.71%	
		50 Hz		
		20A to 30A	0.71% to 0.69%	
		50 Hz		
		10A to 30A	1.33% to 0.97%	Using Current coil by Direct Method
		30A to 1500A	0.97% to 0.87%	
5.	Resistance#	100mΩ to 1Ω	0.58% to 0.50%	Using Decade Resistance Box , high stability Decade Megohm Box by Direct Method
		1Ω to 10Ω	0.50 % to 0.08%	
		10Ω to 100kΩ	0.08% to 0.06%	
		100kΩ to 1MΩ	0.06% to 2.31%	
		1MΩ to 100MΩ	2.31%	
		1MΩ to 1000MΩ	2.31% to 2.41%	
6.	Capacitance#	**1kHz**		
		1nF to 10nF	0.42% to 0.41%	
		10nF to 100nF	0.41%	Using Multi product calibrator (Transmille) by Direct Method
		100nF to 1µF	0.41% to 0.65%	
		1µF to 10µF	0.65% to 0.97%	
		10µF to 100µF	0.97%	
		100µF to 1mF	0.97% to 2.10%	
7.	Inductance#	**1kHz**		
		1mH to 10mH	0.81%	Using Multi product calibrator (Transmille) by Direct Method
		10mH to 100mH	0.81%	
		100mH to 1H	0.81% to 0.87%	
		1H to 10H	0.87%	

Sl.	Quantity Measured / Instrument	Range/Frequency	*Calibration Measurement Capability (±)	Remarks
8.	Frequency#	100 Hz to 10MHz	0.0033%	Using Multi product calibrator (Transmille) by Direct Method
9.	AC Power#	**50 Hz** @ unity 2W to 7.2 kW @ 0.8 Lead 10W to 5.7kW @ 0.5 Lag 6W to 3.6kW @ 0.2 Lag 2.4W to 1.4kW	 0.32% to 0.11% 0.70% to 0.66% 0.79% to 0.41% 1.43% to 0.41%	Using Multi product calibrator (Transmille) by Direct Method
10.	Power Factor#	**50 Hz** 0.2 to Unity (Lag & Lead)	 0.009P.F to 0.001P.F	Using Multi product calibrator (Transmille, Fluke) by Direct Method
11.	Oscilloscope# Amplitude Time Base Bandwidth	**1 kHz Sinewave** 2mV/div to 50V/div **(p-p)** 2ns/div to 5s/div Upto 600MHz	 0.22% to 0.02% 1.28% to 0.19% 14.1%	Using Multi product calibrator (Transmille) by Direct Method

Sl.	Quantity Measured / Instrument	Range/Frequency	*Calibration Measurement Capability (±)	Remarks
12.	Temperature Simulation#			Using Multi product calibrator (Transmille) by Direct Method
	K-Type	(-) 200°C to 1370°C	0.44°C	
	J-Type	(-)200°C to 1200°C	0.37°C	
	T-Type	(-)240°C to 400°C	0.98°C	
	R-Type	0°C to 1760°C	1.31°C	
	S-Type	0°C to 1760°C	1.30°C	
	E-Type	(-)250°C to 1000°C	0.86°C	
	N-Type	(-)200°C to 1300°C	0.69°C	
	B-Type	600°C to 1820°C	1.18°C	
	RTD-PT100	(-)200°C to 800°C	0.64°C	
II.	**MEASURE**			
1.	DC Voltage#	10mV to 100mV 100mV to 1V 1V to 10V 10V to 100V 100V to 1000V	0.061% to 0.011% 0.011% to 0.005% 0.005% to 0.007% 0.007% to 0.011% 0.011% to 0.012%	Using 6½ Digit Multimeter GW-Instek-8261A/ Fluke 8846A by Direct Method
2.	DC High Voltage#	1kV to 30kV	3.06% to 2.85%	Using High Voltage Probe with DMM (Fluke,80k40) by Direct Method
3.	AC Voltage#	**50Hz** 10mV to 100mV 100mV to 1V 1V to 10V 10V to 1000V	 0.62% to 0.13% 0.13% to 0.11% 0.11% 0.11% to 0.10%	Using 6½ Digit Multimeter GW-Instek-8261A/ Fluke 8846A by Direct Method
4.	AC High Voltage#	0.5kV to 28kV	6.50% to 6.44%	Using High Voltage Probe with DMM (Fluke,80k40) by Direct Method

Sl.	Quantity Measured / Instrument	Range/Frequency	*Calibration Measurement Capability (±)	Remarks
5.	DC Current#	10µA to 100µA 100µA to 1mA 1mA to 100mA 100mA to 1A 1A to 10A	0.53% to 0.10% 0.10% to 0.07% 0.07% 0.07% to 0.13% 0.13% to 0.19%	Using 6½ Digit Multimeter GW-Instek-8261A/ Fluke 8846A by Direct Method
6.	AC Current#	**50Hz** 100µA to 1mA 1mA to 100mA 100mA to 10A	 0.71% to 0.53% 0.53% to 0.18% 0.18% to 0.28%	Using 6½ Digit Multimeter GW-Instek-8261A/ Fluke 8846A by Direct Method
7.	Resistance#	10Ω to 100Ω 100Ω to 1kΩ 1kΩ to 10kΩ 10kΩ to 100kΩ 100kΩ to 1MΩ 1MΩ to 10MΩ 10MΩ to 100MΩ	0.052% to 0.017% 0.017% to 0.013% 0.013% to 0.014% 0.013% 0.013% 0.013% to 0.062% 0.062% to 1.02%	Using 6½ Digit Multimeter GW-Instek-8261A/ Fluke 8846A by Direct Method
8.	Inductance#	**1 kHz** 0.2mH to 10mH 10mH to 100mH 100mH to 1H 1H to 10H	 2.78% to 1.71% 1.71% to 1.37% 1.37% to 1.07% 1.07% to 1.20%	Using LCR Meter (DER EE , DE-5000) by Direct Method
9.	Frequency#	10Hz to 1MHz	0.061% to 0.101%	Using 6½ Digit Multimeter GW-Instek-8261A/ Fluke 8846A by Direct Method

Sl.	Quantity Measured / Instrument	Range/Frequency	*Calibration Measurement Capability (±)	Remarks
10.	Temperature Simulation[#]			Using Multi product calibrator and Multi Function Calibrator (Transmille, Beamex) by Direct Method
	K-Type			
	J-Type	(-) 200°C to 1370°C	0.52°C	
	T-Type	(-)200°C to 1200°C	0.58°C	
	R-Type	(-)240°C to 400°C	0.39°C	
	S-Type	0°C to 1760°C	1.30°C	
	E-Type	0°C to 1760°C	1.31°C	
	N-Type	(-)250°C to 1000°C	0.34°C	
	B-Type	(-)200°C to 1300°C	0.50°C	
		600°C to 1820°C	1.33°C	
	RTD PT100	(-)200°C to 800°C	0.25°C	
11.	Time[#]	1s to 24hr	0.1s to 10.78s	Using Time Totaliser Beltronics , 501 by Comparison Method

Sl.	Quantity Measured / Instrument	Range/Frequency	*Calibration Measurement Capability (±)	Remarks
	MECHANICAL CALIBRATION			
I.	**DIMENSION (BASIC MEASURING INSTRUMENT, GAUGE ETC.)**			
1.	Caliper - Vernier/ Digital/ Dial Groove[$] L.C: 0.01 mm [Φ]	0 to 300 mm >300 mm to 600 mm >600 mm to 1000 mm	6.5 µm 7.0 µm 9.0 µm	Using Slip Gauges/ Long Slip Gauges/ Slip gauge accessories by Comparison Method
2.	Caliper - Vernier/ Digital/ Dial Groove [#] L.C: 0.02 mm [Φ]	>1000 mm to 2000 mm >2000 mm to 3000 mm	15.3 µm 20.0 µm	Using Slip Gauges/ Long Slip Gauges/ Slip gauge accessories by Comparison Method
3.	Depth Gauge - Vernier/ Digital/ Dial/ Hook [$] L.C. 0.01 mm [Φ]	0 to 300 mm >300mm to 600 mm >600mm to 1000 mm	6.2 µm 6.7 µm 8.2 µm	Using Slip Gauges/ Long Slip Gauges by Comparison Method
4.	Dial Caliper Gauge/ Inter Tester/ Dial Groove Gauge [$] L.C: 0.005 mm [Φ]	2.5 mm to 12.5 mm 12.5mm to 150mm	3.1 µm 3.2 µm	Using Slip Gauges/ Long Slip Gauges/ Slip gauge accessories by Comparison Method

Sl.	Quantity Measured / Instrument	Range/Frequency	*Calibration Measurement Capability (±)	Remarks
5.	Pistol Caliper/ Od Caliper/ Od Groove Dial Gauge $ L.C : 0.01 mm Φ L.C : 0.1 mm Φ	0 to 100 mm	6.5 µm 61.2 µm	Using Slip Gauges by Comparison Method
6.	Gear Tooth Vernier $ L.C. 0.01 mm Φ	0 to 50 mm	6.5 µm	Using Slip Gauges/ Long Slip Gauges by Comparison Method
7.	Height Gauge - Vernier/ Digital/ Dial$ L.C : 0.01 mm Φ	0 to 300 mm	6.5 µm	Using Slip Gauge/ Long Slip Gauges by Comparison Method
8.	Height Gauge - Vernier/ Digital/ Dial # L.C : 0.01 mm Φ	Upto 1000 mm	11.1 µm	Using Slip Gauge/ Long Slip Gauges by Comparison Method
9.	Bore Gauges $ (Transmission Only) Span Diameter (1.5 mm to 600 mm) L.C: 1.0 µm Φ	1.5 mm	1.0 µm	Using Universal Length Measuring System by Comparison Method

Sl.	Quantity Measured / Instrument	Range/Frequency	*Calibration Measurement Capability (±)	Remarks
10.	Dial / Digital Thickness Gauge $ L.C : 0.001 mm Φ	0 to 25 mm	0.70 µm	Using Universal Length Measuring System & Slip gauges by Comparison Method
11.	Ultrasonic Thickness Gauge $ L.C. : 0.01 mm Φ L.C. : 0.1 mm Φ	0 to100 mm	7.9 µm 61.3 µm	Using Step blocks / Slip Gauges by Comparison Method
12.	Lever Type Dial Gauge$ L.C. : 0.001 mm Φ L.C. : 0.002 mm Φ L.C. : 0.01 mm Φ	0-0.14 mm 0-0.2 mm 0 -1.2 mm	0.6 µm 1.2 µm 5.8 µm	Using Universal Length Measuring System
13.	Plunger Type Dial Gauge $ (Mechanical/ Digital) L.C : 0.001 mm Φ L.C : 0.01 mm Φ	0-50 mm 0-100 mm	0.7 µm 5.8 µm	Using Universal Length Measuring System by Comparison Method
14.	Dial Gauges $ (One Revolution) L.C.: 0.001 mm Φ	Upto ± 50µm	0.6 µm	Using Universal Length Measuring System

Sl.	Quantity Measured / Instrument	Range/Frequency	*Calibration Measurement Capability (±)	Remarks
15.	Dial Gauges $ (One Revolution) L.C.: 0.0005 mm Φ	Upto ± 25µm	0.3 µm	Using Universal Length Measuring System
16.	Digital Indicator/ LVDT/ Electronic Probe / Extensometer# L.C.: 0.0001 mm Φ	0 to 25 mm	0.40 µm	Using Universal Length Measuring System
17.	Depth Micrometer$ (Analog / Digital) L.C: 0.001 mm Φ	0 to 100 mm >100mm to 300mm	1.1 µm 2.1 µm	Using Slip Gauges & Long Slip gauges by Comparison Method
18.	Micrometer $ (Analog & Digital) L.C : 0.001 mm Φ	0 to 25 mm >25 to 100mm >100mm to 300mm >300mm to 500 mm >500mm to 1000 mm	0.70 µm 1.10 µm 1.40 µm 2.50 µm 5.10 µm	Using Slip Gauges & Long Slip gauges by Comparison Method
19.	Groove / Inside Micrometer / Caliper Type $ L.C: 0.001 mm Φ	5mm to 100 mm	1.10 µm	Using Slip Gauges & Slip Gauge Accessories by Comparison Method

Sl.	Quantity Measured / Instrument	Range/Frequency	*Calibration Measurement Capability (±)	Remarks
20.	Stick Micrometer / Tubular $ L.C : 0.01 mm Φ	50mm to 500 mm 500 mm to 1000 mm	6.0 µm 7.10 µm	Using Universal Length Measuring System/ Slip Gauges/ Long Slip Gauges by Comparison Method
21.	Setting Rod For Micrometer $	25 mm to 100 mm 100 mm to 500 mm 500mm to 1000 mm	0.40 µm 2.10 µm 3.90 µm	Using Universal Length Measuring System/ Height Measuring System by Comparison Method
22.	Snap Micrometer $ L.C. 0.001 mm Φ	0 to100 mm	1.00 µm	Using Slip Gauges by Comparison Method
23.	Bore Micrometer $ (Three Point) (Analog/ Digital) LC. 0.001 mm Φ	2.5mm to 100mm 100mm to 150mm	1.3 µm 2.20 µm	Using Setting Ring Gauge which is calibrated using ULMS by Comparison Method
24.	Thread Plug Gauge $	1 mm to 100 mm 100mm to 200 mm 200 mm to 300 mm 300mm to 400 mm	1.00 µm 1.30 µm 1.70 µm 2.10 µm	Using Universal Length Measuring System/ Profile Projector & Thread Measuring Wire by Comparison Method

Sl.	Quantity Measured / Instrument	Range/Frequency	*Calibration Measurement Capability (±)	Remarks
25.	Taper Thread Plug Gauge[$]	7 mm to 100 mm 100 mm to 200 mm	1.40 µm 1.80 µm	Using Universal Length Measuring System/ Profile Projector & Thread Measuring Wire by Comparison Method
26.	Thread Ring Gauge[$]	1.4 mm to 100 mm 100 mm to 200 mm 200mm to 300 mm 300mm to 400 mm	1.4 µm 2.0 µm 3.0 µm 3.2 µm	Using Universal Length Measuring System by Comparison Method
27.	Taper Thread Ring Gauge [$]	7 mm to 100 mm 100mm to 200 mm	2.0 µm 2.8 µm	Using Universal Length Measuring System by Comparison Method
28.	Plain Plug Gauge[$]	1 mm to 100 mm >100mm to 200 mm >200 mm to 300 mm >300mm to 400 mm >400mm to 500 mm	0.6 µm 1.1 µm 1.5 µm 2.0 µm 2.4 µm	Using Universal Length Measuring System by Comparison Method
29.	Plain Ring Gauge/ Setting Ring Gauge[$]	1 mm to 50 mm >50mm to 140 mm >140mm to 230 mm >230mm to 320 mm >320mm to 400 mm	1.4 µm 1.5 µm 2.1 µm 3.0 µm 3.1 µm	Using Universal Length Measuring System by Comparison Method
30.	Cylindrical Measuring Pin[$]	2 mm to 20 mm	0.4 µm	Using Universal Length Measuring System by Comparison Method
31.	Cylindrical Setting Master [$]	1 mm to 100 mm	0.9 µm	Using Universal Length Measuring System by Comparison Method

Sl.	Quantity Measured / Instrument	Range/Frequency	*Calibration Measurement Capability (±)	Remarks
32.	Thread Measuring Cylinders $	0.17 mm to 10 mm	0.4 µm	Using Universal Length Measuring System by Comparison Method
33.	Bevel Protractor $ L.C : 1' Φ	Upto 360°	3 min	Using Profile Projector / Video Measuring System by Comparison Method
34.	Combination Set$ LC : 1° Φ	0°-180°	35 min	Using Profile Projector / Video Measuring System by Comparison Method
35.	Degree Protractor / Digital / Inclinometer / Angle Level $ LC : 1° Φ	Upto 180°	35 min	Using Profile Projector / Video Measuring System / Angle Gauge Blocks by Comparison Method
36.	Radius Gauge $	Upto 50 mm	4.2 µm	Using Profile Projector / Video Measuring System by Comparison Method
37.	Scale$ LC : 0.5 mm Φ	Upto 2000 mm	290 √ L (where L in “m”)	Using Profile Projector/ Scale Calibrator by Comparison Method

Sl.	Quantity Measured / Instrument	Range/Frequency	*Calibration Measurement Capability (±)	Remarks
38.	Tape[$] LC : 1mm [Φ]	Upto 30 m	588 √ L (where L in "m")	Using Profile Projector/ Scale Calibrator by Comparison Method
39.	Pi Tape [$] L.C : 0.1 mm [Φ]	Upto 3 m	840 √ L (where L in "m")	Using Profile Projector/Scale calibrator by Comparison Method
40.	Test Sieves [$] (Perforated Plate / Wire Cloth)	Upto 4 mm 4mm to 10 mm 10mm to 125 mm	8.5 µm 7.9 µm 20.4 µm	Using Profile Projector
41.	Taper Scale[$]	Upto 200 mm	8.3 µm	Using Profile Projector
42.	Thread Pitch Gauge[$]	0.2 mm to 7.0 mm	5.0 µm	Using Profile Projector
43.	Coating Thickness Foil[$]	0.01mm to 2 mm	0.37 µm	Using Universal Length Measuring System/ Electronic Probe with Indicator by Comparison Method
44.	Coating Thickness Gauge[$] L.C : 0.1 µm	0.01mm to 2 mm	6.37 µm	Using Standard Coating thickness foils by Comparison Method
45.	Feeler Gauge / Thickness Standards[$]	0.01 mm to 1 mm	1.43 µm	Using Digital Micrometer by Comparison Method

Sl.	Quantity Measured / Instrument	Range/Frequency	*Calibration Measurement Capability (±)	Remarks
46.	Spirit Level[$] -Sensitivity : 0.02 mm/m [Φ] Base length : 50 mm (Type 1 & 2 & 3)	Upto 300 mm	0.017 mm/m	Using Electronic Level / Height Measuring System by Comparison Method
47.	Sine Bar[$]	Upto 200 mm	20 Arc sec	Using Angle Gauge Block/ Co-ordinate Measuring machine/ by Comparison Method
48.	Snap Gauge - Fixed/ Adjustable/ Gap Gauge[$]	3 mm to 50 mm 50 mm to 100 mm 100 mm to 200 mm 200 mm to 300 mm 300 mm to 400 mm	0.68 µm 0.83 µm 1.01 µm 1.43 µm 1.87 µm	Using Universal Length Measuring System/Slip Gauge/ Long Slip Gauges/ by Comparison Method
49.	Slip Gauge[$]	0.5 mm to 25 mm 25 mm to 50 mm 50mm to 75 mm 75mm to 100 mm Upto 125 mm	0.22 µm 0.31 µm 0.49 µm 0.68 µm 0.86 µm	Using Gauge Block Comparator with reference grade slip gauges by Comparison Method
50.	Length Bar/ Length Rod/ Long Slip Gauges[$]	125 mm 150 mm 175 mm 200 mm 250 mm 300 mm 400 mm 500 mm 1000 mm	0.56 µm 0.74 µm 0.82 µm 0.91 µm 1.09 µm 1.28 µm 1.66 µm 2.04 µm 4.00 µm	Using Universal Length Measuring System & "K" Grade Long slip gauges by Comparison Method

Sl.	Quantity Measured / Instrument	Range/Frequency	*Calibration Measurement Capability (±)	Remarks
51.	Slip Gauge Accessories[$] (Flatness Only)	300 mm	1.0 µm	Using Optical parallels by Comparison Method
52.	Comparator Stand[$] (Flatness Only)	Upto 300 mm	4.58 µm	Using Co-ordinate measuring machine by Comparison Method
53.	Engineer's Parallels[$] Parallelism Flatness	Up to 500 mm	 4.95 µm 5.50 µm	Using Co-ordinate Measuring Machine by Comparison Method
54.	Fillet Gauge[$] Linear Angular	Upto 200 mm	 0.15 mm 0.72°	Using Profile Projector / Video Measuring System by Comparison Method
55.	Limit Gauges - Height / Depth / Length / Width / Radius[$]	Upto 300 mm	4.72 µm	Using Height Measuring System / Co-ordinate measuring machine / Universal Length Measuring System/ Profile Projector / Video Measuring System / Digital Micrometer by Comparison Method
56.	Limit Gauges-Angle[$]	Upto 300 mm	17 Arc sec	Using Co-ordinate measuring machine / Profile Projector / Viedo Measuring System by Comparison Method

Sl.	Quantity Measured / Instrument	Range/Frequency	*Calibration Measurement Capability (±)	Remarks
57.	Riser Block $	Upto 300 mm	4.91 µm	Using Height Measuring System by Comparison Method
58.	Flush Pin Gauge $	Upto 50 mm	4.30 µm	Using Height Measuring System and Co-ordinate Measuring Machine by Comparison Method
59.	V-Block$ -Flatness -Parallelism -Symmetry	Upto 300mm	4.20 µm	Using Co-ordinate Measuring Machine by Comparison Method
60.	Straight Edge$ -Straightness -Parallelism	Upto 600mm	5.60 µm 8.42 µm	Using Co-ordinate Measuring Machine
61.	Engineer's Square / Granite Square$ -Straightness -Squareness	Upto 600mm	5.59 µm 5.88 µm	Using Co-ordinate Measuring Machine
62.	Angle Plate$ -Flatness -Parallelism -Squareness	Upto 600mm	5.71 µm 5.86 µm 5.50 µm	Using Co-ordinate Measuring Machine Height Measuring System with dial gauge
63.	Height Master$ L.C: 0.001 mm	5 to 310 mm	5.80 µm	Using Height Measuring System / Co-ordinate Measuring Machine by Comparison Method

Sl.	Quantity Measured / Instrument	Range/Frequency	*Calibration Measurement Capability (±)	Remarks
64.	Micrometer Head[$] L.C : 0.0001mm [Φ]	Upto 100 mm	0.80 µm	Using Universal Length Measuring System/ Electronic Probe with Indicator by Comparison Method
65.	Air Gauge Unit[$]	± 0.05 mm (Linearity)	1.80 µm	Using Setting Plug/ Ring by Comparison Method
66.	Surface Plate [#]	3500 mm x 2600 mm	± 0.54 x √(L+W)/100 mm where L is length in mm and W is width in mm	Using Electronic Level by Comparison Method
67.	Floating Carriage Diameter Measuring Machine[$]	Upto 25 mm	4.62 µm	Using Slip Gauges/ Co-ordinate measuring machine by Comparison Method
68.	Caliper Checker[$]	Upto 600 mm	5.29 µm	Using Co-ordinate Measuring Machine/ Height Measuring System by Comparison Method
69.	Surface Roughness Specimen[#]	Upto 10µm	± 6.8% of rdg	Using Surface Roughness Tester & Master Specimen by Comparison method
70.	Surface Roughness Tester[#]	Upto 25µm	± 7.8% of rdg	Using Surface Roughness Specimen & Depth Master by Comparison method
71.	Bench Centre[♣]	Upto 500mm	3.10 µm	Using Master Mandrel/ Digital Dial Gauge by Comparison Method

Sl.	Quantity Measured / Instrument	Range/Frequency	*Calibration Measurement Capability (±)	Remarks
72.	Dial Snap Gauge $ (Flatness , Parallelism)	>2 to 200 mm	± 1.29 µm	Using Slip Gauges/ Long Slip gauges / Optical parallels by Comparison Method
II.	**DIMENSION (PRECISION INSTRUMENTS)**			
1.	Profile Projector/ Tool Maker Microscope/ Vision Measuring Machine # - Linear L.C : 0.1µm - Angular L.C : 1Arc sec - Magnification	 250mm x 150 mm 360° 100 X	 2.70 µm 7 Arc sec 0.5 %	Using Glass Calibration Grid / Angle Gauge Block Set / Digital Vernier Caliper by Comparison Method
2.	Profile Projector/ Tool Maker Microscope/ Vision Measuring Machine # - Linear L.C : 0.1µm - Angular L.C : 1Arc sec - Magnification	 250mm x 150 mm 360° upto 100 X	 0.80 µm 7 Arc sec 0.5 %	Using Laser Measuring System / Angle Gauge Block Set / Digital Vernier Caliper by Comparison Method
3.	Height Measuring System #	Upto 1000 mm	5.82 µm	Using "K" Grade Slip Gauges by Comparison Method

Sl.	Quantity Measured / Instrument	Range/Frequency	*Calibration Measurement Capability (±)	Remarks
4.	Universal Length Measuring System / Metroscope [#] L.C : 0.01µm	Upto 100mm (Absolute)	0.19 µm	Using Laser measuring System
5.	Length Measuring System [#] L.C : 1µm	Upto 100mm 100mm to 500 mm 500mm to 1000 mm 1000 mm to 2500 mm	2.96 µm	Using Laser measuring System
6.	CNC Machine Tools [♣] (Positioning Accuracy Only)	Upto 1000mm Upto 9000mm	± 1.36 (L/570) µm, Where “L” is in mm	Using Laser measuring System
7.	Dial Calibration Tester [$] L.C: 0.0001 mm [Φ]	0 to 25 mm	0.63 µm	Using Universal Length Measuring System/ Electronic Probe with Indicator
8.	Co-Ordinate Measuring Machine [#]	Upto 1000mm	2.64 + L / 420 µm Where "L" in mm	Using "K" Grade Slip Gauges by Comparison Method

Sl.	Quantity Measured / Instrument	Range/Frequency	*Calibration Measurement Capability (±)	Remarks
9.	Universal Length Measuring System / Metroscope[#] L.C : 0.1µm	Upto 100mm (Absolute) 100mm to 500 mm 500mm to 1000 mm	0.13 + (L/185) µm Where “L” in mm 0.32 + (L/300) µm Where “L” in mm 2.00 + (L/430) µm Where “L” in mm	Using "K" Grade Slip Gauges & "K" Grade Long Slip Gauges by Comparison Method
10.	Scale & Tape Measuring Machine / Calibrator [#] L.C : 0.001 mm	Upto 1000mm	7.20 µm	Using "K" Grade Slip Gauges & "K" Grade Long Slip Gauges by Comparison Method
11.	Scale & Tape Measuring Machine / Calibrator [#] L.C : 0.001 mm	Upto 1000mm	3.41 µm	Using Laser Measuring System
12.	Slip Gauge Calibrator[$]	Upto 100 mm	0.065 µm	Using Bridge blocks (11 set)
III.	**ACCOUSTICS**			
1.	Sound Level Meter [$]	114 dB @ 1 kHz	0.23 dB	Using Sound Accoustic Calibrator by Comparison Method

Sl.	Quantity Measured / Instrument	Range/Frequency	*Calibration Measurement Capability (±)	Remarks
IV.	**ACCELERATION & SPEED**			
1.	Digital / Analog Tachometer $ Contact Type Noncontact Type	 100 RPM to 4500 RPM 100 RPM to 90000 RPM	 1.52 % to 0.12 % 1.52 % to 0.34%	Using Digital Tachometer using rotating disc by electric motor as source
2.	RPM Measurement# (Centrifuge / Stirrer etc. With RPM Indicator etc.)	100 RPM to 90000 RPM	1.52 % to 0.34%	Using Digital Tachometer by Comparison Method
V.	**WEIGHTS**			
1.	Weights$ E2 class & Coarser	1 mg 2 mg 5 mg 10 mg 20 mg 50 mg 100 mg 200 mg 500 mg 1 g 2 g 5 g 10 g 20 g 50 g 100 g 200 g	0.002 mg 0.002 mg 0.002 mg 0.002 mg 0.002 mg 0.002 mg 0.002 mg 0.002 mg 0.003 mg 0.004 mg 0.004 mg 0.005 mg 0.007 mg 0.008 mg 0.02 mg 0.08 mg 0.1 mg	Using E1 class weights (1mg – 200g) & Microbalance(21 g / 1µg) & Weighing balance (220g/ 0.01mg) as per OIML R 111 by Substitution Method through ABA Cycles

Sl.	Quantity Measured / Instrument	Range/Frequency	*Calibration Measurement Capability (±)	Remarks
	F2 class & Coarser[$]	500 g 1 kg 2 kg 5 kg	1 mg 2 mg 10 mg 20 mg	Using F1 class weights (500g – 5kg) & Weighing balance (1 kg / 1 mg & 6 kg / 10 mg) by Substitution Method through ABBA Cycles
VI.	**WEIGHING BALANCE AND SCALE**			
1.	Weighing Balance [#] Class I & coarser d=≥ 0.001 mg d=≥ 0.01 mg d=≥ 0.1 mg	 1 mg to 20 g 1 mg to 60 g 10 mg to 220 g	 0.007 mg 0.02 mg 0.07 mg	Using E1 class weights (1 mg – 200g)
	d=≥ 1 mg d=≥ 10 mg d=≥ 0.2 g	100 mg to 1 kg 500 mg to 6 kg 50 g to 12 kg	0.64 mg 5.94 mg 0.34 g	Using E2 class weights upto 200g & F1 class weights upto 20 kg
	d=≥ 10 g d=≥ 20 g	200 g to 150 kg 400 g to 300 kg	1.38 g 11.8 g	Using M1 class standard weights upto 300 kg
2.	Spring Balance (mechanical)[$] d : 1g d : 10g d : 20g d : 50g d : 100g	 0 to 100 g 100g to 1kg 1kg to 10kg 10kg to 25kg 25kg to 50kg	 1 g 10.93 g 52.28 g 104.56 g 206.11 g	Using F1 class weights & M1 class weights

Sl.	Quantity Measured / Instrument	Range/Frequency	*Calibration Measurement Capability (±)	Remarks
IX.	**VOLUME**			
1.	Glass Ware[$] (Pipette,Burette, Measuring Cylinder, Volumetric Flask & Bottle Top Dispenser)	0.1 ml ≤ V < 10 ml 10 ml ≤ V < 100 ml 100 ml ≤ V < 1000 ml 1000 ml ≤ V < 5000 ml	0.005 ml 0.01 ml 0.05 ml 0.30 ml	Using Weighing balance with (d : 0.001 mg, d : 0.01 mg, d : 0.1 mg) & Distilled water
2.	Micro Pipettes [$]	1 µl ≤ V< 10 µl 10 µl ≤ V< 100 µl 100 µl ≤ V < 1 ml 1 ml ≤ V< 5 ml	0.09 µl 0.10 µl 1.6 µl 3.95 µl	Using Weighing balance with (d : 0.001 mg, d : 0.01 mg, d: 0.1mg) & Distilled water
X.	**TORQUE GENERATING DEVICES**			
1.	Torque Generating Devices [$] Type I-Classes Type II-Classes	0.5 Nm to 20 Nm 20 Nm to 500 Nm 500 Nm to 2000 Nm	1.26 % rdg. 1.23 % rdg. 0.78 % rdg.	Torque Transducer with indicator and Torque Wrench Calibration Rig
XI.	**PRESSURE INDICATING DEVICES**			
1.	Pressure -Pneumatic Digital And Dial Pressure Gauges/ Pressure Transmitters/ Pressure Indicator of Switches/ Transducers/ [#]	0 to 20 bar	0.15 %of rdg	Using Twin mode calibrator Druck DPI-610 based on DKD R-6-1 by Comparison Method

Sl.	Quantity Measured / Instrument	Range/Frequency	*Calibration Measurement Capability (±)	Remarks
2.	Pressure -Hydraulic Digital And Dial Pressure Gauges/ Pressure Transmitters/ Transducers/ Indicator of Switches #	20bar to 700bar	0.05 %of rdg	Using Pressure calibrator Druck DPI610 & Hydraulic pump based on DKD R-6-1 by Comparison Method
3.	Vacuum Digital And Dial Vacuum Gauges, Indicator of Switches/ Transmitters/ #	-0.9 to 0 bar	1.0 %of rdg	Using Vacuum calibrator Druck DPI610 & Vacuum pump ISO 3567 – 2011(E) & DKD R-6-2
4.	Pressure -Hydraulic Digital And Dial Pressure Gauges/ Pressure Transmitters/Transducers#	0 to 400 bar Above 400 to 1200 bar	0.055 %of rdg 0.07 %of rdg	Using Budenberg UK Digital calibrator H542 & Hydraulic pump based on DKD R-6-1
5.	Pressure -Hydraulic Digital And Dial Pressure Gauges/ Pressure Transmitters/ Transducers/ Indicators #	0 to 2800 bar	0.1% of rdg	Using Additel USA Digital Pressure gauge ADT680 & Hydraulic pump ADT959 based on DKD R-6-1

Sl.	Quantity Measured / Instrument	Range/Frequency	*Calibration Measurement Capability (±)	Remarks
		THERMAL CALIBRATION		
I.	**TEMPERATURE**			
1.	RTD's, Thermocouples, Temperature Gauges, Pyrometer With Sensors, Temperature Sensors With Or Without Indicators/ Controllers, Temperature Transmitters #	(-)25°C to 140°C 140°C to 500°C 500°C to 1200°C 1200°C to 1500°C	0.24°C 0.70°C 1.76°C 3.31°C	Using Standard PRT, RTD S-Type Thermocouple with Multi Function calibrator/Data Logger
2.	Deep Freezer, Incubator, Oven, Furnace, Auto Clave, Temperature Bath Temperature Calibrator Etc (Single Point) #	(-)80°C to 200°C 200°C to 500°C 500°C to 1200°C 1200°C to 1500°C	0.21°C 0.61°C 1.73°C 3.10°C	Using Standard PRT RTD , S-Type Thermocouple with Multi Function calibrator/Data Logger
3.	Deep Freezer ,Oven, Furnace, Temperature Bath Etc (Mapping) ♣	(-)80°C to 200°C 200°C to 1200°C	1.85°C 3.62°C	Using RTD sensors , N-Type Thermocouples with Multi Function calibrator/Data Logger

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**		
Certificate Number	**CC-2752** ***(In lieu of C-0285, C-0501, C-0826)***	**Page**	**27 of 27**
Validity	**26.06.2018 to 25.06.2020**	**Last Amended on**	**-**

Sl.	Quantity Measured / Instrument	Range/Frequency	*Calibration Measurement Capability (±)	Remarks
4.	Humidity Indicator Of Humidity Chamber / Environmental / Humidity Chamber (Mapping) ♣	20% to 95% RH @20°C to 50°C	1.56% to 1.63 % RH @20°C to 50°C	Using Humidity Indicator with sensor & Humidity Transmitter with Data logger

*** Measurement Capability is expressed as an uncertainty (±) 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.
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.

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