

Laboratory Sacardande Engineers Pvt. Ltd., PAP R-158, 159, First Floor, TTC Industrial Area, MIDC Rabale, Pipeline Road, Rabale, Navi Mumbai, Maharashtra

Accreditation Standard ISO/IEC 17025: 2005

Certificate Number CC-2558

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Validity 06.08.2018 to 02.02.2020

Last Amended on -

Sl.	Quantity Measured / Instrument	Range/Frequency	*Calibration Measurement Capability (\pm)	Remarks
<u>ELECTRO-TECHNICAL CALIBRATION</u>				
I.	SOURCE			
1.	Resistance [#]	1 m Ω 10 m Ω 100 m Ω 1 Ω to 100 k Ω 100 k Ω to 10 M Ω 10 M Ω to 100 G Ω 100 G Ω to 1 T Ω	3.031 % 0.563 % 0.183 % 0.410 % to 0.007 % 0.007 % to 0.038 % 0.038 % to 0.905 % 0.905 % to 0.510 %	Using m Ω Box by Direct Method Using Decade Resistance Box by Direct Method
2.	Temperature Simulation [#] K Type J Type E Type T Type N Type R Type S Type B Type RTD PT 100	(-)200 $^{\circ}$ C to 1370 $^{\circ}$ C (-)200 $^{\circ}$ C to 1370 $^{\circ}$ C (-)200 $^{\circ}$ C to 1370 $^{\circ}$ C (-)200 $^{\circ}$ C to 1370 $^{\circ}$ C (-)200 $^{\circ}$ C to 1370 $^{\circ}$ C (-)200 $^{\circ}$ C to 1370 $^{\circ}$ C (-)200 $^{\circ}$ C to 1370 $^{\circ}$ C (-)200 $^{\circ}$ C to 1370 $^{\circ}$ C (-)200 $^{\circ}$ C to 600 $^{\circ}$ C	0.668 $^{\circ}$ C to 1.233 $^{\circ}$ C 0.645 $^{\circ}$ C to 0.640 $^{\circ}$ C	Using Signal Calibrator by Direct method
3.	Capacitance [#]	1 nf to 1 mf	1.449 % to 1.400 %	Using Master Capacitance Box by Direct Method
4.	Inductance [#]	102.1 μ H to 10.07 H	0.594 % to 0.598 %	Using Master Inductance Box by Direct Method

Vishal Shukla
Convenor

Avijit Das
Program Manager

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II.	MEASURE			
1.	DC Voltage [#]	1 mV to 10 mV 10 mV to 100 mV 100 mV to 1 V 1 V to 10 V 10 V to 1000 V 1 kV to 2 kV 2 kV to 5 kV	0.451 % to 0.235 % 0.235 % to 0.013 % 0.013 % to 0.022 % 0.022 % to 0.012 % 0.012 % to 0.014 % 0.020 kV to 0.234 kV 0.234 kV to 0.626 kV	Using 6½ DMM by Direct method Using 5½ DMM & HV Probe by Direct method
2.	DC Current [§]	10 µA to 100 mA 100 mA to 10 A 10 A to 50 A	0.359 % to 0.072 % 0.072 % to 0.250 % 0.358 % to 1.002 %	Using 6½ DMM by Direct method Using 6½ DMM & Master Shunt by Direct method
	DC Current [*]	1mA to 10 mA 10 mA to 100 mA 100 mA to 1 A 1 A to 10 A 10 A to 50 A 50 A to 100 A 100 A to 400 A 400 A to 1000 A	0.165 % to 0.101 % 0.101 % to 0.156 % 0.156 % to 0.741 % 0.741 % to 0.434 % 0.434 % to 1.530 % 1.530 % to 0.562 % 0.562 % to 0.747 % 0.747 % to 0.310 %	Using 5½ DMM by Direct method
3.	AC Voltage [§]	50 Hz 1 mV to 10 mV 10 mV to 1000 V 1 kV to 2 kV 2 kV to 6 kV 6 kV to 10 kV	1.720 % to 0.544 % 0.544 % to 0.260 % 0.250 kV to 0.181 kV 0.181 kV to 0.394 kV 0.394 kV to 0.624 kV	Using 6½ DMM by Direct method Using 5½ DMM & HV Probe by Direct method

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	AC Voltage ^a	50 Hz 1 mV to 100 mV 100 mV to 1 V 1 V to 1000 V 1 kV to 2 kV 2 kV to 6 kV 6 kV to 10 kV	4.087 % to 0.973 % 0.973 % to 0.587 % 0.587 % to 0.581 % 0.260 kV to 0.181 kV 0.181 kV to 0.385 kV 0.385 kV to 0.624 kV	Using 5½ DMM by Direct method Using 5½ DMM & HV Probe by Direct method
4.	Resistance ^b	1 mΩ to 10 mΩ 10 mΩ to 100 mΩ 100 mΩ to 1000 mΩ 1 Ω to 10 Ω 10 Ω to 100 Ω 100 Ω to 100 kΩ 100 kΩ to 1 MΩ 1 MΩ to 10 MΩ 10 MΩ to 100 MΩ 100 MΩ to 1 GΩ	3.031 % to 0.130 % 0.130 % to 0.146 % 0.146 % to 0.026 % 2.414 % to 0.093 % 0.093 % to 0.016 % 0.016 % to 0.025 % 0.025 % to 0.142 % 0.142 % to 0.081 % 0.081 % to 0.956 % 0.956 % to 2.564 %	Using 6½ & 5½ DMM 4 Wire Method Using 6½ DMM by Direct method
	Resistance ^a	1 Ω to 10 Ω 10 Ω to 100 Ω 100 Ω to 1 kΩ 1 kΩ to 100 kΩ 100 kΩ to 1 MΩ 1 MΩ to 10 MΩ 10 MΩ to 30 MΩ	4.100 % to 0.502 % 0.502 % to 0.222 % 0.222 % to 0.098 % 0.098 % to 0.133 % 0.133 % to 0.191 % 0.191 % to 1.845 % 1.845 % to 1.439 %	Using 5½ DMM by Direct Method
5.	Capacitance ^b	1 nf to 10 nf 10 nf to 1 mf	1.419 % to 1.418 % 1.418 % to 1.427 %	Using LCR Meter by Direct method
	Capacitance ^a	1 nf to 1 mf	1.420 % to 1.427 %	Using LCR Meter by Direct method

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6.	Frequency [#]	10 Hz to 50 Hz 50 Hz to 100 Hz 100 Hz to 1 kHz 1 kHz to 25 kHz 25 kHz to 80 kHz	0.136 % to 0.034 % 0.034 % to 0.023 % 0.023 % to 0.028 % 0.028 % to 0.037 % 0.037 % to 0.012 %	Using 6½ DMM by Direct method
7.	Inductance ^{\$}	100 μ H to 100 mH 100 mH to 10 H	0.113 % to 0.103 % 0.103 % to 0.108 %	Using LCR Meter by Direct method
	Inductance [*]	102.1 μ H to 10.07 H	0.594 % to 0.598 %	Using LCR Meter by Direct method
8.	Time [#]	1 Sec to 1000 Sec 1000 Sec to 50000 Sec 50000 Sec to 86400 Sec	0.232 Sec to 0.828 Sec 0.828 Sec to 1.278 Sec 1.278 Sec to 21.008 Sec	Using Master Timer by Direct method
9.	AC Current [*]	50 Hz 1 mA to 10 A 10 A to 875 A	0.935 % to 0.994 % 1.160 % to 0.842 %	Using 5½ DMM with Shunt by Direct method

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<u>MECHANICAL CALIBRATION</u>				
1. DIMENSION (BASIC MEASURING INSTRUMENT, GAUGE ETC.)				
1.	Vernier Calipers ^s (Dial, Digital & Analog) L.C.: 10 μ m	0 to 300 mm 0 to 1000 mm	12.46 μ m 15.6 μ m	Using Gauge Block Grade 0 & Caliper Checker By Comparison Method
2.	Depth Gauge ^s L.C.: 10 μ m	0 to 300 mm	9.5 μ m	Using Gauge Block Grade 0 Surface Plate By Comparison Method
3.	Height Gauge ^s (Dial, Digital & Analog) L.C.: 10 μ m	0 to 300 mm 0 to 1000 mm	9.12 μ m 21 μ m	Using Gauge Block Grade 0 & Caliper Checker Surface Plate By Comparison Method
4.	Internal Micrometer ^s (Caliper Type) L.C.: 1.0 μ m (Stick Type) L.C.: 10 μ m	3 mm to 100 mm 25 mm to 500 mm 500 mm to 1000 mm	1.90 μ m 12.50 μ m 21.10 μ m	Using Slip Gauge Set , Micrometer Setting Standard & Plunger Dial By Comparison Method
5.	External Micrometer ^s L.C.: 1.0 μ m L.C.: 10 μ m	0 to 25 mm 25 mm to 150 mm 150 mm to 300 mm 300 mm to 400 mm 400 mm to 500 mm	1.0 μ m 2.87 μ m 5.30 μ m 10.75 μ m 11.95 μ m	Using Gauge Block Set & Micrometer Setting Standard & Long Slip Gauge By Comparison Method

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		500 mm to 600 mm 600 mm to 800 mm 800 mm to 1000 mm	12.90 μ m 17.10 μ m 19.20 μ m	
6.	Depth Micrometer [§] L.C.: 1.0 μ m L.C.: 10 μ m	0 to 150 mm 0 to 300 mm	3.10 μ m 8.50 μ m	Using Gauge Block Grade 0 Surface Plate By Comparison Method
7.	Micrometer Setting Standard [§]	0 to 150 mm 150 mm to 300 mm 300 mm to 400 mm 400 mm to 500 mm 500 mm to 600 mm 600 mm to 800 mm 800 mm to 1000 mm	3.35 μ m 7.00 μ m 7.51 μ m 9.14 μ m 10.50 μ m 14.50 μ m 18.70 μ m	Using Gauge Block Grade 0 & Long Slip Gauge, Probe DRO, Surface Plate By Comparison Method
8.	Plunger Type Dial Gauges [§] L.C.: 0.5 μ m L.C.: 1.0 μ m L.C.: 10 μ m	0.025 mm 0.1 mm 0 to 1 mm 0 to 50 mm 0 to 25 mm	0.80 μ m 0.80 μ m 0.90 μ m 1.1 μ m 3.9 μ m	LMM 100 Dial Gauge Tester By Comparison Method
9.	Lever Type Dial Gauges [§] L.C.: 10 μ m	0 to 2 mm	3.9 μ m	Using Dial Gauge Tester By Comparison Method
10.	Bore Dial Gauge [§] (Transmission Error)	0 to 1 mm	4.6 μ m	Using Dial Gauge Tester By Comparison Method
11.	Plain Ring Gauge [§]	3 mm to 100 mm	2.1 μ m	Using LMM 100 Master Ring Gauge By Comparison Method

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12.	Plain Plug Gauge ^s	Up to 100 mm 100 mm to 200 mm	4.34 μ m 5.3 μ m	Using Gauge Block Grade 0 & Comparator With Dial By Comparison Method
13.	Measuring pins ^s	Up to 20 mm	1.67 μ m	Using Gauge Block Grade 0 & Electronic Comparator By Comparison Method
14.	Snap Gauge ^s	2 mm to 100 mm	1.9 μ m	Using Gauge Block Set By Comparison Method
15.	Thread Plug Gauge ^s	1.6 mm to 100 mm	4.49 μ m	Using FCDM, Thread Measuring Wire By Comparison Method
16.	Thread Ring Gauge ^s	3 mm to 100 mm	2.1 μ m	Using LMM 100 Master Ring Gauge By Comparison Method
17.	Dial Thickness Gauge ^s L.C.: 1.0 μ m L.C.: 10 μ m	0 to 25 mm 0 to 50 mm	0.80 μ m 5.10 μ m	Using Gauge Block Set By Comparison Method
18.	Feeler Gauge ^s	0.01 mm to 3 mm	1.8 μ m	Using Digital Micrometer By Comparison Method
19.	Digital /Bevel Protractor ^s L.C.: 5'	0 to 90°	6.6 min	Using Angle Gauges By Comparison Method
20.	Combination Sets/ Degree Protractor ^s L.C.: 1°	0 to 90°	39.00 min	Using Angle Gauges By Comparison Method

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21.	Pistol Caliper ^s L.C.: 100 μ m	0 to 50 mm	35.13 μ m	Using Gauge Block Set By Comparison Method
22.	Inside Dial Caliper ^s L.C.: 10 μ m	10 mm to 65 mm	16.0 μ m	Using Gauge Block Set By Comparison Method
23.	Out Side Dial Caliper ^s L.C.: 10 μ m	0 to 10 mm	4.95 μ m	Using Gauge Block Set By Comparison Method
24.	Scale & Tape Calibrator ^s L.C.: 0.02 mm	0 to 1000 mm	26.10 μ m	Using Gauge Block Set Micrometer Setting Standard By Comparison Method
25.	Thickness Foils ^s	0 to 25 mm	1.8 μ m	Using Digital Micrometer By Comparison Method
26.	Step Block ^s (Thickness)	0 to 100 mm	6.2 μ m	Using Gauge Block Set, Plunger Dial By Comparison Method
27.	Dial Depth Gauge ^s L.C.: 0.01 mm	Up to 300 mm	8.8 μ m	Using Gauge Block Grade 0 Surface Plate By Comparison Method
28.	Dial Gauge Tester ^s L.C.: 0.001 mm	Up to 25 mm	1.12 μ m	Using Electronic Probe, Slip Gauge By Comparison Method
29.	Ultrasonic Thickness Gauge ^s L.C.: 0.01 mm	Up to 100 mm	32.2 μ m	Using Thickness Step Block By Comparison Method
30.	Measuring Scale ^s L.C.: 1.0 mm	Up to 1000 mm	315 μ m	Using Scale & Tape Calibrator By Comparison Method

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31.	Measuring Tape ^s L.C.: 1.0 mm	Up to 50000 mm	$315\sqrt{L}$ μ m (L in Meter)	Using Scale & Tape Calibrator By Comparison Method
32.	Engineers Parallels ^s (Parallelism)	Up to 100 mm	5.30 μ m	Using Lever Dial Indicator By Comparison Method
33.	V Block ^s (Symmetricity, Parallelism of Faces & V Axis to Base)	Up to 100 mm	6.40 μ m	Using Cylindrical Mandrels Lever Dial Indicator By Comparison Method
34.	Straight Edge ^s	Up to 500 mm	15.0 μ m	Using Lever Dial Indicator By Comparison Method
35.	Taper Thread Plug Gauge ^s	Up to 100 mm	12.3 μ m	Using FCDM, Thread Measuring Wire By Comparison Method
36.	Micrometer Head ^s L.C.: 0.001 mm	Up to 25 mm	2.8 μ m	Using Gauge Block Grade 0 By Comparison Method
37.	Height Gauge ^s (Dial/Digital/Analog) L.C.: 0.01 mm	0 to 600 mm	13.9 μ m	Using Slip Gauge Block Set Long Slip Gauge By Comparison Method
II.	PRESSURE INDICATING DEVICES			
1.	Pressure Gauge ^s (Dial/Digital)	0 to 6 bar 0 to 20 bar 0 to 160 bar 0 to 350 bar 0 to 700 bar	0.08 % Rdg 0.23 % Rdg 0.15 % Rdg 0.10 % Rdg 0.12 % Rdg	Using Digital Pressure Gauge By Comparison Method

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2.	Pressure Gauge* (Dial/Digital)	0 to 6 bar 0 to 20 bar 0 to 160 bar 0 to 350 bar 0 to 700 bar	0.08 % Rdg 0.23 % Rdg 0.15 % Rdg 0.10 % Rdg 0.12 % Rdg	Using Digital Pressure Gauge By Comparison Method
III.	ACCELERATION & SPEED			
1.	Tachometer # (Contact Type)	100 RPM to 3000 RPM	2.53 % Rdg to 0.3 % Rdg	Using Master Tachometer By Comparison Method
2.	Tachometer # (Non Contact Type)	100 RPM to 999 RPM 999 RPM to 24000 RPM	2.94 % Rdg to 0.4 % Rdg 0.4 % Rdg to 0.3 % Rdg	Using Master Tachometer By Comparison Method

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<u>THERMAL CALIBRATION</u>				
1.	TEMPERATURE			
1.	Oven [#]	(-) 30 °C to 400 °C 400 °C to 500 °C 500 °C to 1200 °C	0.64 °C 1.88 °C 3.60 °C	Using PT 100 Sensor & S type TC with 6½ DMM Comparison method Single Point Calibration
2.	Glass Thermometer [#]	(-) 25 °C to 250°C	0.50 °C	Using Oil Bath, PT 100 Sensor & 6½ DMM Comparison method
3.	Temperature Sensor with or without Indicator [#]	(-) 30 °C to 400°C 400 °C to 500°C 500 °C to 1200°C	0.46 °C 2.11 °C 3.70 °C	Using Dry Block Furnace & 6½ DMM with PT 100 Sensor & S type TC Comparison method
4.	Oven [*]	(-) 25 °C to 400°C	0.76 °C	Multi Point Calibration by Using Data Logger with 9 PT 100 Sensors

* 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.

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