

Laboratory **Global Calibration, 149 & 150, FF, Ashoka Plaza, Software Corporate Park, S. No. 32/2, Viman Nagar, Nagar Road, Pune, Maharashtra**

Accreditation Standard **ISO/IEC 17025: 2005**

Certificate Number **CC-2396** Page **1 of 13**

Validity **06.10.2017 to 05.10.2019** Last Amended on **-**

Sl.	Quantity Measured / Instrument	Range/Frequency	*Calibration Measurement Capability (\pm)	Remarks
<u>ELECTRO-TECHNICAL CALIBRATION</u>				
1.	SOURCE			
1.	DC Voltage [#]	(-) 329mV to 1mV 1mV to 329.999mV 329.999mV to 1000V	0.007% to 0.39% 0.39% to 0.006% 0.006% to 0.007%	Using Multifunction Calibrator (Fluke/5502A) by direct Method
		(-) 329 μ A to 329mA 329mA to 1A 1A to 20A	0.025% to 0.013% 0.013% to 0.13% 0.13%	Using Multifunction Calibrator (Fluke/5502A) by direct Method
		20A to 1000A	0.70 % to 0.80%	Using Multifunction Calibrator (Fluke/5502A), Coil (Fluke) by direct Method
3.	Resistance [#]	1 Ω to 329.999 Ω 329.999 Ω to 329.999k Ω 329.999k Ω to 100 M Ω 100M Ω to 1000 M Ω	0.12% to 0.015% 0.015% 0.015% to 0.58% 0.58% to 1.7%	Using Multifunction Calibrator (Fluke/5502A) by direct Method
		50Hz to 500kHz 3mV to 3V	3.5% to 0.62%	Using Multifunction Calibrator (Fluke/5502A) by direct Method
		50Hz to 100kHz 3 mV to 300V	1.68% to 0.32%	Using Multifunction Calibrator (Fluke/5502A) by direct Method
		50Hz to 10kHz 1 mV to 1000V	2.43% to 0.06%	Using Multifunction Calibrator (Fluke/5502A) by direct Method

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Sl.	Quantity Measured / Instrument	Range/Frequency	*Calibration Measurement Capability (\pm)	Remarks
5.	AC Current [#]	50Hz to 10kHz 30 μ A to 2A 2A to 20A	1.70% to 3.17% 3.17% to 3.50%	Using Multifunction Calibrator (Fluke/5502A) by direct Method
		50 Hz 20A to 1000A	3.50% to 0.81%	Using Multifunction Calibrator (Fluke/5502A), Coil (Fluke) by direct Method
6.	Capacitance [#]	1 kHz 1.0nF to 1.0mF	1.7% to 4.1%	Using Multifunction Calibrator (Fluke/5502A) by direct Method
7.	Power Factor/ Phase Angle [#]	50Hz (-) 0.1 to 1 to 0.1PF	0.004 PF	Using Multifunction Calibrator (Fluke/5502A) by direct Method
8.	DC Power [#]	1mW to 100W 100W to 12.0kW	0.4% to 0.02% 0.02% to 0.05%	Using Multifunction Calibrator (Fluke/5502A) by Direct method
9.	AC Power [#]	50Hz 30 to 480V, 1mA to 20A, \pm 0.1 to 1.0 PF (3mW-9600W)	0.60% to 0.03%	Using Multifunction Calibrator (Fluke/5502A) by Direct method
		10Hz to 1 MHz	0.04% to 0.18%	Using Multifunction Calibrator (Fluke/5502A) by Direct method
		1MHz to 990MHz	0.18% to 0.0015%	Using Signal Generator (HP /8656B) by Direct Method
11.	DC Resistance [#]	1m Ω to 10 Ω	0.64% to 0.44%	Using Milli Ohm Box (Escorp) by Direct Method

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		2M Ω to 200M Ω 200M Ω to 20G Ω	0.87% 0.87% to 2.33%	Using Mega Ohm Box (Escorp) by Direct Method
		Time Base: 2nS to 50mS	0.3% to 0.012%	
		Amp.: 10mV to 50V/Div At 100Hz	1%	
		Amp.: 10mV to 50V/Div At 1kHz	1%	
		Amp.: 10mV to 50V/Div At 10kHz	1%	
		Band Width : 20MHz to 500MHz	8.5%	
13.	1 ϕ AC Power [#]	50Hz (120W to 1.44kW)/ Phase 0 to 240V, 0.5A to 6A, PF -0.5 to 1 to 0.5	0.30%	Using 3 ϕ Energy Calibrator (Zeal) by Direct Method
14.	3 ϕ AC Power [#]	50Hz (120W to 1.44kW)/ Phase 0 to 240V, 0.5A to 6A, PF -0.5 to 1 to 0.5	0.35%	Using 3 ϕ Energy Calibrator (Zeal) by Direct Method
15.	Power Factor [#]	50 Hz (-) 0.5 to 1 to 0.5	0.34%	Using 3 ϕ Energy Calibrator (Zeal) by Direct Method
16.	1 ϕ Energy [#]	50Hz 0 to 240V, 0.5A to 6A, PF -0.5 to 1 to 0.5	1.39%	Using 3 ϕ Energy Calibrator (Zeal) by Direct Method

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17.	3 ϕ Energy [#]	50 Hz 0 to 240V, 0.5A to 6A, PF -0.5 to 1 to 0.5	1.39%	Using 3 ϕ Energy Calibrator (Zeal) by Direct Method
	Temperature Controller (Indicator/ Recorder/Data logger by Simulation) [#]			
	K Type T Type J Type E Type N Type R Type S Type RTD Type	(-) 200 °C to 1370 °C (-)200 °C to 400 °C (-)200 °C to 1200 °C (-)200 °C to 1000 °C (-)200 °C to 1300 °C 0 to 1700 °C 0 to 1700 °C (-)200 °C to 850 °C	0.41 °C to 0.48 °C 0.75 °C to 0.21 °C 0.3 °C 0.64 °C 0.34°C to 0.49 °C 0.70°C to 0.48 °C 0.60 °C 0.13°C to 0.31 °C	Using Multifunction Calibrator (Fluke/5502A) by simulation method
II.	MEASURE			
		50 Hz to 10 KHz 10mV to 100mV 100 mV to 750V	0.54% to 0.14% 0.14% to 0.11%	
		10 kHz to 50 KHz 10mV to 100V	0.88% to 0.2%	
		50 Hz 1kV to 15 kV	6.17%	Using 4½ Digit Multimeter (Fluke /87V), HV Probe (Fluke/ 80K-4) by Direct Method
		(-) 329mV to 1 mV 1 mV to 1000V	0.43% to 0.01% 0.01%	Using 6½ Digit Multimeter (HP/34401A) by Direct/Comparison Method
		1kV to 30 kV	3.60%	Using 4½ Digit Multimeter (Fluke/87V), HV Probe (Fluke/80K-40) by Direct method

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Sl.	Quantity Measured / Instrument	Range/Frequency	*Calibration Measurement Capability (\pm)	Remarks
3.	DC Resistance [#]	1 m Ω to 1 Ω	2.32% to 0.5%	Using Milli Ohm Meter (HTC/MO-5000) by Direct / Comparison Method
		1 Ω to 100 M Ω	0.50% to 0.94%	Using 6½ Digit Multimeter (HP/34401A) by Direct method
4.	Inductance [#]	1kHz 1 μ H to 10H	1.74%	Using LCR Meter (Agilent/U1731C) by Direct / Comparison Method
5.	Capacitance [#]	1 kHz 100pF to 100 μ F	1.74%	Using LCR Meter (Agilent/U1731C) by Direct / Comparison Method
		1mA to 100mA 100mA to 3A 3A to 20A	0.31% to 0.064% 0.064% to 0.13% 0.13% to 0.36%	Using 6½ Digit Multimeter (HP/34401A), Current Shunt (Agilent/34403A) by Direct Method
		20A to 800.0A	0.36% to 1.3%	Using 6½ Digit Multimeter (HP/34401A) Current Shunt (Agilent/34403A), Shunt by Direct / Comparison Method
7.	AC Current [#]	50Hz to 1 KHz 1 mA to 100mA	0.72% to 0.58%	Using 5½ Digit Multimeter (Fluke/45) by Direct /Comparison Method

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8.	AC Current [#]	50Hz to 1 KHz 100mA to 3.0A 3.0A to 20.0A	0.58% to 0.25% 0.25% to 0.63%	Using 6½ Digit Multimeter (HP/34401A) Current Shunt (Agilent/34403A), by Direct / Comparison Method
9.	AC Current [#]	50Hz 20.0A to 1000.0A	0.63% to 1.5%	Using 6½ Digit Multimeter (HP/34401A), CT by Direct / Comparison Method
		10 Hz to 100 Hz	0.07% to 0.02%	Using 6½ Digit Multimeter (HP/34401A) by Direct / Comparison Method
		100Hz to 990 MHz	0.02% to 0.13%	Using Frequency Counter (Fluke/PM6669) by Direct / Comparison Method
11.	AC Power [#] (1 ϕ)	50Hz 10W to 12KW (20V to 600V, 0.5 to 20A,UPF)	0.12% to 0.15%	Using Digital Power Meter (Yokogawa WT-210) by Direct Method
12.	Power Factor [#]	50Hz (-) 0.5 to 1 to 0.5PF	0.002PF	Using Digital Power Meter (Yokogawa WT-210) by Direct Method
13.	AC Energy [#] (1 ϕ)	50Hz (20V to 600V) , (0.5 to 20A), UPF	0.12% to 0.15%	Using Digital Power Meter (Yokogawa WT-210) by Direct Method

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14.	RF Amplitude [#]	48.25MHz to 825.25MHz 60db μ V to 120 db μ V	2.0 db μ V	Using TV Signal Level Meter (Bintian) by Direct / Comparison Method
15.	DC Power [#]	1W to 12kW (1V to 600V, 0.5 to 20A)	0.28% to 0.12%	Using Digital Power Meter (Yokogawa WT-210) by Direct Method
16.	AC Resistance [#]	1kHz 1 Ω to 100k Ω	1.74%	Using LCR Meter (Agilent U1731C) by comparison method
17.	Stop Watch/ Timer [#]	1 sec to 5 Hour	2.9 sec to 0.19 min	Using Time Interval Meter (Escorp/ ETIMS15) by comparison method
	Temperature Controller [#] (Indicator/ Recorder/Data Logger by Simulation)			
	K – Type	(-)200 °C to 1370°C	0.21°C to 0.25°C	Using 6 1/2 Digit Multimeter (HP/34401A) + ITS 90 (mV & Ω method)
	T – Type	(-)200 °C to 400°C	0.21°C to 0.25°C	
	J – Type	(-)200 °C to 1200°C	0.21°C to 0.25°C	
	E – Type	(-)200 °C to 1000°C	0.20°C to 0.25°C	
	N – Type	(-)200 °C to 1300°C	0.26°C	
	R – Type	0 to 1700°C	0.20°C to 0.50°C	
	S – Type	0 to 1700°C	0.21°C to 0.51°C	
	RTD – Type	(-)200 °C to 850°C	0.20°C to 0.26°C	

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<u>MECHANICAL CALIBRATION</u>				
I. PRESSURE INDICATING DEVICES				
1.	Pressure Pneumatic Dial and Digital Pressure Gauges, Pressure Transmitters [#]	0 to 10 bar	0.02 bar	Using Digital Pressure indicator with pneumatic pump by Comparison Method
2.	Pressure Hydraulic Dial and Digital Pressure Gauges, Pressure Transmitters [#]	10 bar to 600 bar	0.8 bar	Using Digital Pressure indicator with hydraulic pump, by Comparison Method
3.	Vacuum Dial and Digital Pressure Gauges, Pressure Transmitters [#]	(-) 0.9 bar to 0 bar	0.01 bar	Using Digital Vacuum indicator with Vacuum pump, by Comparison Method
4.	Low Pressure Pneumatic Dial and Digital Pressure Gauges, Pressure Transmitters [§]	0 to 10 mbar	0.02 mbar	Using Digital Pressure indicator with pneumatic pump, by Comparison Method
II. ACOUSTICS				
1.	Sound Level Indicators [#]	94 dB	0.71 dB	Using Sound Level generator by Comparison method

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2.	Centrifuge RPM Sources*	60 RPM to 60000 RPM	1.3% of rdg	Using Non Contact Tachometer by Direct method
III.	DIMENSION (BASIC MEASURING INSTRUMENT, GAUGE ETC.)			
1.	Calipers [§] (Vernier/Dial/ Digital) LC: 10 μ m \emptyset	Upto 600 mm	12.4 μ m	Using Gauge Blocks / Length Bars/ Caliper Checker by Comparison Method
2.	External Micrometer [§] LC: 1 μ m \emptyset	Upto 200 mm	1.2 μ m	Using Microcheck Set Gauge Blocks by Comparison Method
3.	Height Gauge [§] (Vernier /Dial/Digital) LC: 10 μ m \emptyset	Upto 600 mm	13.0 μ m	Using Gauge Blocks / Caliper Checker by Comparison Method
4.	Feeler Gauge [§]	0.03 mm to 1 mm	2.6 μ m	Using Digital Micrometer by Comparison Method
5.	Lever Type Dial Gauge [§] LC: 10 μ m \emptyset	Upto 1mm	6.5 μ m	Using Dial Calibration Tester by Comparison Method
6.	Plunger Type Dial Gauge [§] (Analog/Digital) LC: 10 μ m \emptyset	Upto 25mm	6.5 μ m	Using Dial Calibration Tester by Comparison Method
7.	Bore Gauge [§] (Stem / Split Type) (Transmission Only) LC: 10 μ m \emptyset	Dia Range: \emptyset 6-300mm Probing Range : Upto 1.0 mm	6.5 μ m	Using Dial Calibration Tester by Comparison Method

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Sl.	Quantity Measured / Instrument	Range/Frequency	*Calibration Measurement Capability (\pm)	Remarks
8.	Dial Thickness Gauge [§] LC: 10 μ m \emptyset	Upto 10mm	7.0 μ m	Using Gauge Blocks by Comparison Method
9.	Internal Micrometer [§] LC: 10 μ m \emptyset	5 mm to 30mm	7.1 μ m	Using Gauge Blocks & Gauge Block Accessories by Comparison Method
10.	Measuring Pin [§] (Grade 2 & Coarser)	\emptyset 0.2mm to 20mm	0.8 μ m	Using Gauge Block & Electronic Comparator by Comparison Method
11.	Plain Plug Gauge [§]	Upto \emptyset 100mm	1.6 μ m	Using Gauge Block & Electronic Comparator by Comparison Method
12.	Depth Gauge [§] LC: 10 μ m \emptyset	0 to 300mm	12.2 μ m	Using Gauge Blocks / Caliper Checker by Comparison Method
13.	Micrometer Setting Standard [§]	12.5 mm to 300 mm	2.8 μ m	Using Gauge Block & Electronic Comparator by Comparison Method
14.	Width Gauge [§]	12.5 mm to 300 mm	2.4 μ m	Using Gauge Block & Electronic Comparator By Comparison Method
15.	Parallel Block [§]	12.5 mm to 300mm	2.4 μ m	Using Gauge Block & Electronic Comparator by Comparison Method
16.	V-Block [§] Parallelism, Symmetry & Squareness	Upto 100 mm	8.6 μ m	Using Precision Cylinders, Mandrel & Electronic Comparator by Comparison Method

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Sl.	Quantity Measured / Instrument	Range/Frequency	*Calibration Measurement Capability (\pm)	Remarks
17.	Coating Thickness Gauge ^s LC: 1 μ m \emptyset	Upto 1mm	1.6 μ m	Using Std Foils & Gauge Blocks by Comparison Method
18.	Master Foils ^s	0.01 mm to 8 mm	2.6 μ m	Using Digital Micrometer by Comparison Method
19.	Snap Gauge ^s (Fixed/Adjustable)	2.5 mm to 100 mm	2.2 μ m	Using Gauge Blocks by Comparison Method
20.	Dial Snap Gauge ^s LC: 1 μ m \emptyset	0.5 mm to 100 mm	2.2 μ m	Using Gauge Blocks by Comparison Method
21.	Pistol Caliper ^s LC: 10 μ m \emptyset	Upto 150mm	10.7 μ m	Using Gauge Blocks by Comparison Method
22.	Depth Micrometer ^s LC: 1 μ m \emptyset	Upto 100mm	5.8 μ m	Using Gauge Blocks by Comparison Method

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<u>THERMAL CALIBRATION</u>				
I.	TEMPERATURE			
		(-) 30 °C to 100°C 100 °C to 200°C	0.15°C 0.20°C	Using RTD Sensor and 6½ DMM With Liquid Bath By Comparison Method
		200°C to 600°C	1.45°C	Using R type sensor and 6½ DMM With Dry Well Bath By Comparison Method
2.	Glass Thermometer [#]	(-) 10 °C to 50°C 50 °C to 150°C	0.17°C 0.35°C	Using RTD Sensor and 6½ DMM With Liquid Bath By Comparison Method
3.	RTD & Thermocouple Sensors- with & without Indicators, Temperature Controllers, Digital & Dial Thermometers [§]	(-) 80 °C to 50°C	0.15°C	Using RTD Sensor and 6½ DMM With Liquid Bath By Comparison Method
4.	Ovens, Chambers, Freezers, Cold Rooms [*]	(-)25 °C to 150°C	0.5°C	Using Multiple RTD/TC Sensors With Data Logger, Mapping Method-Using Multiple Sensors With Data Logger

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5.	Indicators of Ovens, Furnaces, Chambers*	200°C to 1000°C	4.3°C	Using R Type Sensor & 6½ Digit Multimeter By Comparison Method
II.	SPECIFIC HEAT & HUMIDITY			
1.	Digital Humidity Indicators/ Hygrometer [§]	20 % RH to 95 % RH At 10 °C to 50°C	3.3 % RH 0.2°C	Using Humidity Indicator With Humidity Chamber By Comparison Method
2.	Environmental Chambers*	5 % RH to 99% RH	2.4% RH	Multiple RTD/TC Sensors With Data Logger & Humidity Sensors , Mapping Method-Using Multiple Sensors With Data Logger & Humidity 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.

⊕ 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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