

Laboratory **Hi-Tech Laboratory & Services, Shivani Complex, C-4 Vidya Vihar, Bhopal, Madhya Pradesh**

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

Certificate Number **CC-2689** (In lieu of C-0600, C-1041, C-1379) Page **1 of 14**

Validity **05.05.2018 to 04.05.2020** Last Amended on **18.05.2018**

Sl.	Quantity Measured / Instrument	Range/Frequency	*Calibration Measurement Capability (\pm)	Remarks
<u>ELECTRO-TECHNICAL CALIBRATION</u>				
I.	SOURCE			
1.	DC Voltage [#]	1mV to 10 mV 10 mV to 1 V 1 V to 1000 V	1.0 to 0.1 % 0.1 to 0.05 % 0.05 to 0.07 %	Using Multi Product Calibrator 5502E Direct Method
2.	DC Current [#]	10 μ A to 100 μ A 100 μ A to 1 A 1 A to 20 A	0.60 to 0.7 % 0.07 to 0.06 % 0.06 to 0.25 %	Using Multi Product Calibrator 5502E & Current Coil Direct Method
	DC High Current	50 A to 995 A	1.30%	
3.	DC Resistance [#]	1 m Ω to 1 Ω 1 Ω to 100 Ω	1.5 to 1.2 % 1.2 to 0.03 %	Resistance Box Direct Method
		100 Ω to 10 M Ω 10 M Ω to 1G Ω	0.03 to 0.7 % 0.7 to 1.92 %	Using Multi Product Calibrator 5502E Direct Method
	High Resistance Test Voltage up to 5 KV [#]	1 G Ω to 20 G Ω	1.92 to 2.36 %	Mega Ohm Resistance Box up to 5 KV Direct Method
4.	AC Voltage [#]	50 Hz 1 mV to 100 mV 100 mV to 1V 1V to 1000V	2.20 to 0.15 % 0.15 to 0.1 % 0.1 to 0.15 %	Using Multi Product Calibrator 5502E Direct Method

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5.	AC Current [#] AC High Current	50 Hz 100 μ A to 100 mA 100 mA to 1 A 1 A to 20 A 50 Hz 50 A to 995 A	0.4 to 0.07 % 0.07 % 0.07 to 0.39 % 0.7 to 1.1 %	Using Mult Product Calibrator 5502E & Current Coil Direct Method
6.	Frequency [#]	50 Hz to 100 KHz	0.05 to 0.04 %	Using Mult Product Calibrator 5502E Direct Method
7.	Capacitance [#]	10nF to 300nF 300nF to 10 μ F	1.0 % 1.0 %to 1.56 %	Using Capacitance Box Direct Method
8.	Inductance [#]	100 μ H to 10H	1.3 to 1.7 %	Using Inductance Box Direct Method
9.	Temperature [#] Simulation (Temperature Indicator/Controller & Recorder) RTD J Type Thermocouple K Type Thermocouple T Type Thermocouple R Type Thermocouple S Type Thermocouple	(-) 200°C to 800°C (-) 200°C to 1200°C (-)200°C to1370°C (-)200°C to 400°C 0 to 1700°C 0 to 1700°C	0.40°C 0.50°C 0.50°C 0.75°C 0.85°C 0.90°C	Using Multifunction Calibrator 5502E By Direct Method

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II.	MEASURE			
1.	DC Voltage [#]	1mV to 10mV 10 mV to 1 V 1 V to 1000 V	0.50 to 0.01 % 0.01 to 0.06 % 0.06 to 0.05 %	Using 61/2 Digital Precision Multimeter (8846A) BY Direct Method
2.	DC Current [#]	10 μ A to 1mA 1mA to 1 A 1A to 10 A	0.70 to 0.05 % 0.05 to 0.20 % 0.20 to 0.25 %	Using 61/2 Digital Precision Multimeter (8846A) & Digital Clamp Meter Direct Method
3.	Resistance [#]	1 Ω to 100 Ω 100 Ω to 10 M Ω 10 M Ω to 1G Ω	1.5 to 0.5 % 0.5 to 0.6 % 0.6 to 0.25 %	Using 61/2 Digital Precision Multimeter (8846A) By Compression Method
4.	AC Voltage [#]	50 Hz 10 mV to 100 mV 1V to 750 Vt	1.5 to 0.50 % 0.50 to 0.15 %	Using 61/2 Digital Precision Multimeter (8846A) Direct Method
5.	AC Current [#]	50 Hz 100 μ A to 100mA 50 Hz 1 A to 10 A	1.5 to 0.5 % 0.3 %	Using 61/2 Digital Precision Multimeter (8846A) Direct Method
6.	Time [#] Stop Watch Timer (Digital/Analog)	10 s to 2 Hrs	1.5 s to 2 s	Using Digital Stop Watch By Compression Method

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7.	Temperature [#] Simulation (Temperature Indicator/Controller & Recorder) RTD J Type Thermocouple K Type Thermocouple T Type Thermocouple R Type Thermocouple S Type Thermocouple	(-) 200°C to 800°C (-) 190°C to 600°C (-)190°C to 1200°C (-)190°C to 390°C 300 to 1600°C 100 to 1600°C	0.45°C 0.52°C 0.52°C 0.52°C 0.76°C 0.80°C	Using High Precision Digital Thermometer PT 100 & Thermocouple base By Direct Method
8.	AC High Voltage [#]	50 Hz 1 kV to 25 kV	3.6 %	Using HV Probe with Digital Multimeter By comparison Method
9.	DC High Voltage [#]	2.5 kV to 38 kV	3.9 to 3.2 %	Using HV Probe with Digital Multimeter By comparison Method

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<u>MECHANICAL CALIBRATION</u>				
I. DIMENSION (BASIC MEASURING INSTRUMENT, GAUGE ETC.)				
1.	External Micrometer ^s L.C. 0.001mm L.C. 0.01 mm	0 to 100 mm >100 mm to 700 mm	3.0 μ m 11.0 μ m	Using Slip Gauge Block, Length Bars, Plunger Dial & Comparator Stand by Comparison Method IS:2967
2.	Internal Micrometer ^s L.C. 0.01mm	50 mm to 2000 mm	30.50 μ m	Using Slip Gauge Block, Length Bars, Plunger Dial, Comparator Stand & Surface Plate by Comparison Method IS:2966
3.	Micrometer Setting ^s Piece/Length Bar/Height Blocks / Riser Block	0 to 100 mm >100mm to 300 mm >300mm to 700 mm	5.0 μ m 8.0 μ m 12.0 μ m	Using Slip Gauge Block, Length Bars, Plunger Dial & Comparator Stand by Comparison Method IS:7014
4.	Depth Micrometer ^s L.C. 0.01 mm	0 to 300 mm	12.20 μ m	Using Slip Gauges, Length Bar, Caliper Checker & Surface Plate by Comparison Method IS:9483

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5.	Caliper (Vernier/Dial / Digital) [§] L.C. 0.01 mm L.C. 0.02 mm	0 to 300 mm 600 mm to 1000 mm 0 to 2000 mm	10.30 μ m 20.00 μ m 40.00 μ m	Using Slip Gauges, Caliper Checker and Length Bar By Comparison Method IS:3651 Part –I,II,III
6.	Height Gauge [§] (Vernier/Dial /Digital) L.C. 0.01mm	0 to 600 mm 600mm to 1000mm	15.0 μ m 20.0 μ m	Using Slip Gauges, Caliper Checker and Length Bar & Surface Plate By Comparison Method IS:2921
7.	Depth Gauge [§] (Vernier/Dial /Digital) L.C. 0.01 mm	0 to 600 mm	22.0 μ m	Using Slip Gauges, Caliper Checker, Length Bar & Surface Plate By Comparison Method IS:4213
8.	Plunger Dial Gauge & Digital Dial Gauge [§] L.C. 0.001 mm [¶]	0 to 25 mm	3.50 μ m	By using Slip Gauges & Comparator Stand by Comparison Method By Comparison Method IS:2092

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9.	Lever Type Dial Gauge & Digital Dial Gauge ^s L.C. 0.001 mm	0 to 1 mm	3.5 μ m	Using Slip Gauges & Comparator Stand by Comparison Method IS:11498
10.	Dial Thickness Gauge ^s L.C. 0.01 mm	0 to 10 mm	7.0 μ m	Using Slip Gauges & Comparator Stand by Comparison Method
11.	Pistol Caliper ^s L.C. 0.1mm	0 to 100 mm	52.0 μ m	Using Slip Gauges & Comparator Stand by Comparison Method
12.	Snap Gauge ^s	3 mm to 100 mm	3.0 μ m	Using Slip Gauge by Comparison Method IS:3455-70
13.	Plain Plug Gauge/OD Master/Height Block/ Width Gauge/ Measuring ^s	Upto 100 mm	5.80 μ m	Using Slip Gauges, Comparator Stand & Plunger Dial Gauge by Comparison Method IS:3455 ,IS:6137 , IS:6244 , IS:6246
14.	Feeler Gauge ^s	0.01 mm to 1 mm	4.20 μ m	Using Digital Micrometer by Comparison Method IS:3179
15.	Coating Thickness Foil ^s	0.01 mm to 1 mm	3.0 μ m	Using Digital Micrometer

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Sl.	Quantity Measured / Instrument	Range/Frequency	*Calibration Measurement Capability (\pm)	Remarks
16.	Bevel Protector/Angle Protector/Combination Square Set ^s L.C. 5 min	0 to 360°	4 min of arc	Using Angle Gauge IS:42369
17.	Steel Scale ^s L.C. 1.0 mm	0 to 1000mm	52.0 μ m	Using Measuring Machine (Digital) (Tape & Scale Measuring Machine) By Comparison Method IS:1481
18.	Measuring Tape ^s Pi -Tape	0 to 50mtr. (Where L is length in mtr with step of 1 meter)	52 \sqrt{L} /1000 μ m Where L in Meter	Using Length Measuring Machine (Digital) (Tape & Scale Measuring Machine) By Comparison Method IS:1269
19.	Straight Edge ^s	Up to 1000mm	15.70 μ m	Using Plunger Dial, Surface Plate and Slip Gauge IS:2220-05
II.	ACOUSTICS			
1.	Sound Level Meter ^s	94 dB & 114 dB	1.2 dB 1.2 dB	Using Acoustic Calibrator by Comparison Method IS:15575

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Sl.	Quantity Measured / Instrument	Range/Frequency	*Calibration Measurement Capability (\pm)	Remarks
III.	ACCLERATION AND SPEED			
1.	RPM [#] Centrifuge Machine, RPM Meter, Tachometer ^{\$} (Non- contact)	100 to 20000 RPM	1.15% rdg	Using Tachometer by Comparison Method
IV.	PRESSURE INDICATING DEVICES			
1.	Pressure [#] Pneumatic Dial/ Digital Pressure Gauge / Manometer Differential Gauge, Pressure Transmitter	0 to 20 Bar 0 to 100 mbar	1% rdg 1% rdg	Using Digital Pressure & Pressure Comparator by Comparison Method As Per DKD-R-6-1
2.	Pressure [#] Hydraulic Dial/ Digital Pressure Gauge, Pressure Transmitter	0 bar to 700 bar	1% rdg	Using Digital Pressure & Pressure Comparator by Comparison Method As Per DKD-R-6-1
3.	Pneumatic Pressure Vacuum Gauge [#]	(-)0.93 to 0 bar	1%rdg	Using Digital Pressure & Pressure Comparator by Comparison Method As Per DKD-R-6-1 & ISO 3567 & ISO 27893

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V.	WEIGHTS			
1.	Mass ^s Weights Accuracy Class F2 & Coarser	1 mg 2 mg 5 mg 10 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	0.06 mg 0.06 mg 0.06 mg 0.06 mg 0.06 mg 0.25 mg 0.25 mg 0.25 mg 0.50 mg 0.50 mg 0.50 mg 0.50 mg 0.50 mg 0.5 mg 1.0 mg 3.0 mg	Using Standard Weights of F1 Class & Precision Balance, Based on OIML R-111, Substitution method of Weighing and "ABBA" Weighing Cycle.
	Accuracy Class M1 & Coarser	500 g 1000 g 2000 g 5000 g 10000 g	10 mg 20 mg 40 mg 1.15 g 1.05 g	Using Standard Weights of (F2) Class, Substitution method of Weighing and "ABBA" Weighing Cycle.

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VI.	WEIGHING SCALE and BALANCE			
1.	Weighing Scale and Balance*			
	Readability 0.01 mg	up to 200 g	1.2 mg	Using Standard Weight of F1 Class ,Procedure based on OIML R76
	Readability 0.1 mg	up to 200 g	1.2 mg	
	Readability 1 mg Readability 10 mg	up to 4000g up to 4000g	0.04 g 0.40 g	Using Standard Weights , procedure based on OIML R76 of 2006 of F2 class
	Readability 100 mg Readability 1 g Readability 10 g	up to 20 kg up to 20 kg up to 20 kg	1 g 6.42 g 30 g	Using Standard Weights of F2
	Readability 1 g Readability 10 g Readability 100 g	>1 kg to 60 kg >1 kg to 60 kg >1 kg to 60 kg	5 g 30 g 300 g	Using Standard Weights of F2

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VII.	VOLUME			
1.	Micro-Pipettes ^s	100 μ l to 10 ml	0.2 μ l	Using standard weights, Precision Weighing Balance (with readability 0.1 mg) and distilled water of known density as per ISO 8655 (Part6) & ISO 4787
2.	Glass Ware ^s Pipette, Burette, Measuring Cylinder, Flask, Volumetric Flask, Glass Tube	100 μ l to 10 ml 10 ml to 100 ml 100ml to 1000 ml	0.2 μ l 0.09 ml 5.85 ml	Using standard weights, Precision Weighing Balance (with readability 0.1 mg) and distilled water of known density as per ISO 8655 (Part6) & ISO 4787

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THERMAL CALIBRATION

I.	TEMPERATURE			
1.	Temperature RTD(Pt-100) / Thermocouple (J.K.R.S.) with or Without Temperature Indicator/Recorder/ Data logger #	(-)30°C to 100°C 100°C to 300°C 300°C to 600°C 600°C to 1200°C	0.35°C 0.55°C 1.8°C 2.24°C	Using Standard PT-100 Sensor, S Type Thermocouple Precision Thermometer, 6 ½ DMM Source: Dry Temp. Blocks by Comparison Method
2.	Temperature Indicator Of Dry Block Calibrator / Oven / Incubator / Freezer / Oil Bath / Auto Clave / Melting Point Apparatus/ Cold / Hot Chamber #	(-)30°C to 100°C 100°C to 300°C 300°C to 600°C 600°C to 1200°C	0.5°C 0.7°C 2.1°C 2.24°C	Using Standard PT-100 Sensor, S Type Thermocouple Precision Thermometer, 6 ½ DMM by Comparison Method
3.	Relative Humidity# Thermo hygrometer, RH Sensor with Data Logger, Indicator of Humidity Chamber	20°C to 40°C @50% RH 30%RH to 90%RH @25°C	0.4°C 2.2%RH	Using Thermo hygrometer Precision Digital Thermometer & RTD (PT-100) sensor Humidity & Temperature Generator Chamber

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4.	Temperature Oven / Cold & Heat Chamber/ Incubator/ Freeze/ Furnace [#]	0°C to 250°C	0.95°C	Using Standard PT-100 Sensor With Data Logger 12 Channel by Special Mapping Method at Multi Location

* 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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