

Laboratory Measure Techno Lab, 2 B. T. Road, (Jayanti Cinema Complex),
Barrackpore, Kolkata, West Bengal

Accreditation Standard ISO/IEC 17025: 2005

Certificate Number CC-2545 (In lieu of C-0462, C-0463, C-0895) **Page** 1 of 15

Validity 11.02.2018 to 10.02.2020 **Last Amended on** --

| Sl. | Quantity Measured / Instrument | Range/Frequency | *Calibration Measurement Capability (\pm) | Remarks |
|---|--------------------------------|---|--|--|
| <u>ELECTRO TECHNICAL CALIBRATION</u> | | | | |
| I. | SOURCE | | | |
| 1. | DC Voltage [#] | 1 mV to 200 mV 200 mV to 2 V 2 V to 20 V 20 V to 1000 V | 1.09 % to 0.027 % 0.027 % to 0.18 % 0.18 % to 0.12 % 0.12 % to 0.13 % | Using Multifunction Calibrator By Direct Method |
| 2. | DC Current [#] | 0.2 mA to 200 mA 200 mA to 10 A 10 A to 1000 A | 0.2 % to 0.14 % 0.14 % to 0.33 % 0.33 % to 0.94 % | Using Multifunction Calibrator & Current Coil By Direct Method |
| 3. | Resistance [#] | 1 m Ω to 1 Ω 1 Ω to 100 Ω 100 Ω to 200 k Ω 200 k Ω to 90 M Ω 90 M Ω to 1 G Ω 1 G Ω to 90 G Ω | 5.85 % to 0.68 % 0.68 % to 0.12 % 0.12 % 0.12 % to 1.15 % 1.15 % to 1.37 % 1.37 % to 4.57 % | Using Precision Decade Resistance Box & Insulation Tester Calibration System By Direct Method |
| 4. | AC Voltage [#] | 50 Hz to 1 kHz 10 mV to 200 mV 200 mV to 2 V 2 V to 200 V 50 Hz 200 V to 1000 V | 1.01 % to 0.3 % 0.3 % 0.3 % 0.3 % to 0.23 % | Using Multifunction Calibrator By Direct Method |
| 5. | AC Current [#] | 50 Hz & 1 kHz 0.2 mA to 200 mA 0.2 A to 10 A 50 Hz 10 A to 1000 A | 0.33 % to 0.25 % 0.25 % to 0.34 % 0.34 % to 1.23 % | Using Multifunction Calibrator With Current Coil By Direct Method |

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|-----|--|--|---|--|
| 6. | Frequency [#] | 10 Hz to 50 kHz | 0.058 % to 0.016 % | Using Multifunction Calibrator By Direct Method |
| 7. | Temperature Simulation [#] (Indicator/Recorder/Controller) RTD Type R Type S Type K Type J Type T Type E Type N Type B Type | (-) 200 to 800°C 0 to 1700°C 0 to 1700°C (-) 200 to 1370°C (-) 200 to 750°C (-) 200 to 400°C (-) 200 to 1000°C (-) 200 to 1200°C 600 to 1800°C | 0.36°C 1.13°C 1.27°C 0.49°C 0.3°C 0.36°C 0.34°C 0.48°C 1.24°C | Using Multifunction Calibrator By Direct Method |
| 8. | Time [#] | 10 sec to 5400 sec | 2.40 % to 0.058 % | Using Time Totaliser By Direct Method |
| II. | MEASURE | | | |
| 1. | DC Voltage [#] | 1 mV to 200 mV 200 mV to 300 V 300 V to 1000 V | 0.72 % to 0.009 % 0.009 % to 0.012 % 0.012 % to 0.006 % | Using 6 ½ Digit Multimeter By Direct Method |
| 2. | DC Current [#] | 1 mA to 1 A 1 A to 3 A | 0.07 % to 0.13 % 0.13 % to 0.2 % | Using 6 ½ Digit Multimeter By Direct Method |
| 3. | Resistance [#] | 1 Ω to 100 Ω 100 Ω to 2 k Ω 2 k Ω to 200 k Ω 200 k Ω to 100 M Ω | 0.48 % to 0.016 % 0.016 % to 0.034 % 0.034 % to 0.02 % 0.02 % to 0.92 % | Using 6 ½ Digit Multimeter By Direct Method |

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| 4. | AC Voltage [#] | 50 Hz & 1 kHz 10 mV to 300 mV 300 mV to 1 V 1 V to 300 V 50 Hz 300 V to 750 V | 0.46 % to 0.19 % 0.19 % to 0.13 % 0.13 % to 0.2 % 0.2 % to 0.15 % | Using 6 ½ Digit Multimeter By Direct Method |
| 5. | AC Current [#] | 50 Hz & 1 kHz 1 mA to 1 A 1 A to 3 A | 0.17 % 0.20 % | Using 6 ½ Digit Multimeter By Direct Method |
| 6. | Frequency [#] | 50 Hz to 50 kHz | 0.013 % | Using 6 ½ Digit Multimeter By Direct Method |
| 7. | Temperature Simulation [#] (Indicator/Recorder/Controller) RTD Type R Type S Type K Type J Type T Type E Type N Type B Type | (-) 200°C to 800°C 0°C to 1700°C 0°C to 1700°C (-) 200°C to 1370°C (-) 200°C to 750°C (-) 200°C to 400°C (-) 200°C to 1000°C (-) 200°C to 1200°C 600°C to 1800°C | 0.31°C 0.72°C 0.83°C 0.47°C 0.28°C 0.35°C 0.32°C 0.48°C 1.09°C | Using Multifunction Calibrator By Direct Method |
| 8. | Time [#] | 10 sec to 5400 sec | 2.49 % to 0.058 % | Using Time Totaliser By Direct Method |
| 9. | AC High Voltage [#] | 1 kV to 15 kV | 5.4 % | Using H V Probe By Direct Method |

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| 10. | DC High Voltage [#] | 1 kV to 15 kV | 3.6 % | Using H V Probe By Direct Method |
| 11. | Energy [#] 1 Phase (Active Energy) | 240 V Current 1 A / 5 A 50 Hz,0.5pf to Upf | 0.26 % to 0.54 % | Using Accuchek LT+ By Direct Method |
| | Energy 3 Phase (Active Energy) | 415 V Current 1 A / 5 A 50 Hz,0.5pf to Upf | 0.24 % to 0.32 % | Using Accuchek LT+ By Direct Method |
| | | 110 V Current 1 A / 5 A 50 Hz,0.5pf to Upf | 0.24 % to 0.37 % | Using Accuchek HT+ By Direct Method |

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| <u>MECHANICAL CALIBRATION</u> | | | | |
| 1. | DIMENSION (BASIC MEASURING INSTRUMENT, GAUGE ETC.) | | | |
| 1. | Outside / External Micrometer ^s L.C.0.001 mm L.C.0.01 mm | 0 to 100 mm 0 to 100 mm 100 mm to 300 mm 300 mm to 600 mm 600 mm to 1000 mm | 1.8 μ m 6.0 μ m 7.0 μ m 10.6 μ m 10.92 μ m | Using Slip Gauge Set, Long Gauge Blocks by comparison method |
| 2. | Vernier / Dial / Digital Caliper ^s L.C.0.01mm L.C.0.005mm | 0 to 300 mm 0 to 600 mm 0 to 1000 mm 0 to 300 mm | 8.5 μ m 13.0 μ m 12.9 μ m 4.38 μ m | Using Slip Gauge Set, Long Gauge Blocks by comparison method |
| 3. | Height Gauge ^s L.C.0.01mm | 0 to 300 mm 0 to 600 mm 0 to 1000 mm | 9.0 μ m 12.9 μ m 11.0 μ m | Using Slip Gauge Set, Long Gauge Blocks by comparison method |
| 4. | Vernier / Dial / Digital Depth Gauge ^s L.C.0.01mm | 0 to 300 mm | 8.5 μ m | Using Slip Gauge Set, Long Gauge Blocks by comparison method |
| 5. | Depth Micrometer ^s L.C. 0.01mm | 0 to 300 mm | 4.7 μ m | Using Slip Gauge Set, Long Gauge Blocks by comparison method |

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|-----|---|----------------------------|---|--|
| 6. | Internal Micrometer ^s L.C.0.01mm | 50 mm to 1000 mm | 11.0 μ m | Using Digital Dial Gauge, Slip Gauge Set, Long Gauge Blocks by comparison method |
| 7. | Plunger Type Dial Gauge ^s L.C.0.001mm L.C.0.01mm | 0 to 25 mm 0 to 50 mm | 0.8 μ m 6.2 μ m | Using Micrometer Head, Slip Gauge by comparison method |
| 8. | Lever Type Dial Gauge ^s L.C.0.002mm L.C.0.01mm | 0 to 0.2 mm 0 to 0.8 mm | 1.2 μ m 6.2 μ m | Using Micrometer Head by comparison method |
| 9. | Dial Thickness Gauge ^s L.C.0.001mm | 0 to 25 mm | 0.8 μ m | Using Slip Gauge Set by comparison method |
| 10. | Feeler Gauge ^s | 0.03 to 1.0 mm | 4.0 μ m | Using Digital Outside Micrometer by comparison method |
| 11. | Coating Thickness Gauge ^s | Up to 966 μ m | 13.3 μ m | Using Foils by comparison method |
| 12. | Foils ^s | Up to 2 mm | 5.2 μ m | Using Digital Outside Micrometer by comparison method |

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|-----|--|--|--|--|
| 13. | Setting Rod ^s | Up to 100 mm >100 mm to 200 mm >200 mm to 400 mm >400 mm to 600 mm >600 mm to 800 mm >800 mm to 1000 mm | 2.3 μ m 3.2 μ m 6.0 μ m 8.0 μ m 7.4 μ m 10.18 μ m | Using Slip Gauge Set, Long Gauge Blocks by comparison method |
| 14. | Measuring Scale ^s L.C.0.5/1 mm | 0 to 1000 mm | $3.94\sqrt{L}$ μ m (‘L’ in mm) | Using Scale and Tape Calibrator by comparison method |
| 15. | Measuring Tape ^s | 30 m | $1.92\sqrt{L}$ μ m (‘L’ in mm) | Using Scale and Tape Calibrator by comparison method |
| 16. | Test Sieve ^s | 38 μ m to 1000 μ m >1 mm to 25 mm >25 mm to 125 mm | 3.99 μ m 47.74 μ m 150 μ m | Using Profile Projector & Digital Vernier Caliper by comparison method |
| 17. | Bevel Protractor ^s L.C.-5 min | 0 to 360° | 2.25 min of arc | Using Profile Projector by comparison method |
| 18. | Angle protractor / Combination Square Set ^s | 0 to 180° | 20 min of arc | Using Profile Projector by comparison method |
| 19. | Radius Gauge ^s | 0 to 40 mm | 12.55 μ m | Using Profile Projector by comparison method |
| 20. | Pitch Gauge ^s | 0.4 to 6 mm 55° to 60° | 5.7 μ m 4 min of arc | Using Profile Projector by comparison method |

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| 21. | Profile / Form Gauge ^s Linear Angle | Up to 60 mm Up to 60° | 0.98 \sqrt{L} μ m ('L' in mm) 3.8 min of arc | Using Profile Projector by comparison method |
| 22. | Plain Plug Gauge ^s | Up to 225 mm | 2.7 μ m | Using Slip Gauge Set, Long Gauge Blocks by comparison method |
| 23. | Snap Gauge ^s | Up to 225 mm | 2.6 μ m | Using Slip Gauge Set, Long Gauge Blocks by comparison method |
| 24. | Bore Dial Gauge ^s L.C 0.001mm (Transmission Movement) | Up to 2 mm | 1.3 μ m | Using Slip Gauge Set, micrometer head by comparison method |
| II. | TORQUE GENERATING DEVICES | | | |
| 1. | Torque Wrench / Screw Driver ^s | 1 Nm to 100 Nm 100 Nm to 500 Nm 500 Nm to 2000 Nm | 1.26 % of reading 1.33 % of reading 0.56 % of reading | Using Torque Calibrator |
| III. | ACCELERATION & SPEED | | | |
| 1. | Speed-RPM [#] (Dig. Tachometer / Centrifuge / Shaker / RPM meter) | 10 RPM to 100 RPM >100 RPM to 10000 RPM >10000 RPM to 30000 RPM | 11.89 % of reading 1.24 % of reading 0.10 % of reading | Using Laser type Digital Tachometer |
| IV. | ACOUSTICS | | | |
| 1. | Sound Level Meter ^s | 1kHz 94 dB & 114 dB | 0.52 dB | Using Sound Level Calibrator |

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| V. | PRESSURE & VACUUM INDICATING DEVICES | | | |
| 1. | Hydraulic Pressure# (Dial / Digital Pressure Gauges / Calibrators / Indicators / Transmitters) | 0 to 1000 bar | 0.07 % of reading | Using Multifunction Calibrator with external Pressure Module and Hydraulic Comparator Pump by comparison Method |
| 2. | Pneumatic Pressure# (Dial / Digital Pressure Gauges / Calibrators / Indicators / Transmitters) | 0 to 10 bar | 0.14 % of reading | Using Digital Pressure Gauge and Pneumatic Comparator Pump by comparison method |
| 3. | Pneumatic Low Pressure\$ (Dial / Digital Pressure Gauges / Magnehelic gauge/ water based manometer/Calibrators / Indicators / Transmitters) | 0 to 1000 mm H ₂ O | 1.29 % of reading | Using Multifunction Calibrator with built in port and Pneumatic Pump by comparison method |
| 4. | Pneumatic Low Pressure\$ (Dial / Digital Pressure Gauges) | 0 to 300 mmHg | 2.05 % of reading | Using Multifunction Calibrator with built in port and Pneumatic Pump by comparison method |

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| 5. | Pneumatic Pressure ^{\$} (Absolute Pressure) | 710 to 780 mmHg | 0.23 % of reading | Using Digital Barometer and Vacuum Desiccators, Rotary Vacuum Pump by comparison method |
| 6. | Vacuum Gauge [#] (Dial / Digital Vacuum Gauges / Calibrator / Transmitters / Indicators) | 0 to 635 mmHg | 0.08 % of reading | Using Multifunction Calibrator with built in port and Vacuum Pump by comparison method |
| VI. | WEIGHTS | | | |
| 1. | Mass / Weights ^{\$} Accuracy Class F1 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 | 0.0088 mg 0.0088 mg 0.0088 mg 0.0088 mg 0.0088 mg 0.0088 mg 0.0088 mg 0.0088 mg 0.0088 mg 0.012 mg 0.015 mg 0.016 mg 0.018 mg 0.022 mg 0.046 mg 0.103 mg 0.135 mg | Using E1 Class Standard Weight & Digital weighing Balance up to 11 g of d=0.001 mg, up to 80 g of d=0.01 mg, up to 200 g d=0.1 mg Using ABBA Method (For calibration of F1 Class weights & Coarser) |

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| | Accuracy Class M1 Class & Coarser | 500 g 1 kg 2 kg 5 kg | 9.69 mg 10.77 mg 15.0 mg 52.92 mg | Using F1 Class Standard Weight & Digital weighing Balance up to 5 kg of d=10 mg Using ABBA Method (For calibration of M1 Class weights & Coarser) |
| | Accuracy Class M2 Class & Coarser | 10 kg 20 kg | 444.38 mg 572.19 mg | Using F1 Class Standard Weight & Digital weighing Balance up to 50 kg of d=5 g Using ABBA Method (For calibration of M2 Class weights & Coarser) |
| VII. | WEIGHING SCALE AND BALANCE | | | |
| 1. | Electronic Weighing Balance* | | | |
| | d \geq 0.001 mg | Up to 11 g | 0.03 mg | Using E1 Class Standard Weights 1mg. to 200g. (For calibration of Class I & Coarser) |
| | d \geq 0.01 mg | >11 g to 80 g | 0.06 mg | |
| | d \geq 0.1 mg | >80 g to 200 g | 0.25 mg | |
| | d \geq 10 mg | >200 g to 5 kg >5 kg to 10 kg | 56mg 56 mg | Using F1 Class Standard Weights >200g. to 50kg. (For calibration of Class II & Coarser) |

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| | d \geq 5 g | >10 kg to 50 kg >50 kg to 100 kg | 5.4 g 5.4 g | Using F1 & M1 Class Standard Weights >50kg. to 100kg. as per OIML R-76(For calibration of Class III & Coarser) | |
| VIII. | VOLUME | | | | |
| 1. | Graduated Pipette ^s | 0.1 to 1 ml | 0.23 μ l | Using E1 & F1 Class Weights, Distilled water & Weighing Balance of 0.001 mg / 0.01 mg / 0.1 mg / 10 mg readability. Gravimetric Method based on ISO:4787 | |
| 2. | Burette ^s | 100 ml | 0.35 μ l | | |
| 3. | Density Bottle ^s | 50 ml | 0.27 μ l | | |
| 4. | Centrifuge Tube ^s | 100 ml | 0.49 μ l | | |
| 5. | Volumetric Flask ^s | 250 ml | 17.96 μ l | | |
| 6. | Measuring Cylinder ^s | 2000 ml | 45.40 μ l | | |
| 7. | Graduated Pipette, Single Mark Pipette, Burette, Volumetric Flask, Conical Flask, Transfer Pipette, Density bottle, Measuring Cylinder, Beaker ^s | 1 ml to 100 ml 100 ml to 1000 ml 1000 ml to 2000 ml | 26.52 μ l 70.64 μ l 115.58 μ l | | By Gravimetric Method |
| 8. | Micro Pipette / Auto Pipette / Micro Syringe / Dispenser ^s | 1 μ l to 10 μ l 10 μ l to 1000 μ l | 0.03 μ l 0.35 μ l | | |

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| IX. | DENSITY & VISCOSITY | | | |
| 1. | Density of Unknown Liquid ^s | 0.600 g/ml to 1.8 g/ml | 0.00045 g/ml | Using Density Bottle, Standard Weights & Distilled Water |
| 2. | Hydrometer ^s | 0.650 g/ml to 1.000 g/ml 1.000 g/ml to 2.000 g/ml | 0.00087 g/ml 0.0015 g/ml | Using Reference Standard Hydrometer |

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| <u>THERMAL CALIBRATION</u> | | | | |
| I. | TEMPERATURE | | | |
| 1. | RTD / Digital Thermometer / Temp Indicator with sensor / Transmitter / Recorder / Dial Thermometer ^s | (-) 80°C to (-) 30°C (-) 30°C to 50°C 50°C to 250°C 250°C to 1200°C | 0.43°C 0.14°C 0.28°C 2.32°C | Using Liquid Bath, Dry Block Bath, RTD (4, wire), R Type Thermocouple Data Acquisition Thermolab Switch Unit By Comparison Method |
| 2. | Glass Thermometer ^b | (-) 80°C to (-) 30°C (-) 30°C to 50°C 50°C to 250°C | 0.67°C 0.59°C 0.64°C | Using Liquid Bath, RTD (4 Wire), Data Acquisition Switch Unit By Comparison Method |
| 3. | Thermocouple / Dry Block Calibrator ^s | amb to 1200°C 1200°C to 1600°C | 2.32°C 5.80°C | Using Dry Block Bath, Tube Furnace, R Type Thermocouple, Data Acquisition Switch Unit By Comparison Method |
| 4. | Non Contact Temperature Sensor ^s | 50°C to 500°C 500°C to 1000°C | 3.65°C 6.27°C | Using Black Body Source, Std Pyrometer By Comparison Method |
| 5. | Thermo – hygrometer / Humidity sensor with or without Indicator ^s | 20 % RH to 95 % RH at 25°C 5°C to 50°C at 45% RH | 1.76 % RH 0.85°C | Using Temp & Humidity Data Logger, Humidity Chamber By Comparison Method |

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| 6. | Glass Thermometer /RTD / Digital Thermometer / Temp Indicator with sensor / Transmitter / Recorder / Dial Thermometer / Thermocouple* | (-) 30°C to 50°C 50°C to 250°C 250°C to 1200°C | 0.30°C 0.56°C 2.60°C | Using Liquid Bath, Dry Block Calibrator, RTD (4 Wire), R Type Thermocouple, Data Acquisition Switch Unit By Comparison Method |
| 7. | Temp Calibration of Thermal Chamber (Cold Chamber, Refrigerator, Deep Freezer, Bath, Hot Air Oven, Autoclave, Incubator, etc)* | (-) 80°C to 0°C 0°C to 50°C Up to 300°C | 0.79°C 1.02°C 1.08°C | Using RTD (4 Wire), Data Acquisition Switch Unit By Comparison Method(single point) |
| 8. | Furnace / Room / Tube Furnace / Carbon Strohlein Apparatus* | Amb to 600°C 600°C to 1200°C 1200°C to 1500°C | 2.77°C 3.98°C 4.66°C | Using R Type Thermocouple, Data Acquisition Switch Unit By Comparison Method (single point) |
| 9. | Humidity Chamber* | 20 % RH to 95 % RH at 25°C 5°C to 50°C at 45% RH | 1.76 % RH 0.85°C | Using Temp & Humidity Data Logger By Comparison Method (single point) |

* 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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