

Laboratory Vaidyanatheshwara Instruments, No. 301/A, 9th Main Road, 3rd Cross, Rajiv Gandhi Nagar, J.B Kaval, Nandini Layout Post, Bangalore, Karnataka

Accreditation Standard ISO/IEC 17025: 2005

Certificate Number CC-2473 (in lieu of C-0579, C-0766 & C-0767)

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| Sl. | Quantity Measured / Instrument | Range/Frequency | *Calibration Measurement Capability (\pm) | Remarks |
|---|--------------------------------|--|---|--|
| <u>ELECTRO-TECHNICAL CALIBRATION</u> | | | | |
| I. | SOURCE | | | |
| 1. | DC Voltage [#] | 1 mV to 10 mV 10 V to 100 mV 100 V to 1 V 1 V to 10 V 10 V to 1000 V | 0.240 % to 0.025 % 0.025 % to 0.0041 % 0.0041 % to 0.0016 % 0.0016 % to 0.0017 % 0.0017 % to 0.0024 % | Using Standard Calibrator Fluke 5522A by Direct method |
| 2. | AC Voltage [#] | 45 Hz to 1 kHz 30 V to 3 V 3m V to 30m V 10 Hz to 10 kHz 30 mV to 100 mV 100 mV to 1 V 1 V to 30 V 45 Hz to 1 kHz 30 V to 300 V 300 V to 1000 V 100 kHz 30 mV to 30V 30 V to 100 V 450 kHz 30 mV to 3 V | 45 Hz to 10 kHz 0.712 % to 0.25 % 0.25 % to 0.044 % 10 Hz to 10 kHz 0.12 % to 0.087 % 0.087 % to 0.081 % 0.081 % 0.044 % 45 Hz to 1 kHz 0.20 % to 0.024 % 0.024 % to 0.036 % 100 kHz 0.452 % to 0.055 % 0.055 % to 0.026 % 450 kHz 1.122% to 0.304 % | Using Standard Calibrator Fluke 5522A by Direct method |
| 3. | DC Current [#] | 10 μ A to 100 μ A 100 μ A to 1 mA 1 mA to 100 mA 100 mA to 1 A 1 A to 10 A | 0.25 % to 0.025 % 0.035 % to 0.017 % 0.017 % to 0.012 % 0.012 % to 0.028 % 0.028 % to 0.064 % | Using Standard Calibrator Fluke 5522A by Direct method |

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| | | 10 A to 20 A 20 A to 200 A 200 A to 1000 A | 0.064 % to 0.12 % 0.12 % to 0.98 % 0.98 % to 0.34 % | With Current Coil Fluke 5500A |
| 4. | AC Current [#] | 1 kHz 30 μ A to 330 μ A 330 μ A to 3.3 mA 3.3 mA to 1A 1 A to 10 A 10 Hz to 1 kHz 330 μ A to 3.3mA 3.3 mA to 3 A 45 Hz to 5 kHz 3 A to 20 A 50 Hz 20A to 1000A | 1 kHz 0.55 % to 0.18 % 0.18 % to 0.16 % 0.16 % to 0.074 % 0.074 % to 0.14 % 10 Hz to 1 kHz 0.27 % to 0.28 % 0.28 % to 0.47 % 45 Hz to 5 kHz 0.24 % to 0.14 % 50 Hz 0.69 % to 0.38 % | Using Standard Calibrator Fluke 5522A by Direct method With Current Coil Fluke 5500A |
| 5. | Resistance [#] | 1m Ω 10m Ω 50m Ω 150m Ω 150m Ω to 1 Ω 1 Ω to 10 Ω 10 Ω to 100 Ω 100 Ω to 1 k Ω 1k Ω to 10 k Ω 10 Ω to 100 k Ω 100 k Ω to 1 M Ω 1M Ω to 10 M Ω 10 M Ω to 300 M Ω 300 M Ω to 1 G Ω | 0.611% 0.611% 0.611% 0.611% 0.611% 0.611 % to 0.12 % 0.120 % to 0.016 % 0.016 % to 0.005 % 0.005 % to 0.0037 % 0.0037 % to 0.0036 % 0.0036 % to 0.0036 % 0.0036 % to 0.0042 % 0.0042 % to 0.016 % 0.016 % to 0.39 % 0.39 % to 1.79 % | Using Standard Resistance by Direct method Using Standard Calibrator Fluke 5522A by Direct method |

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|-----|---------------------------------------|--|--|--|
| | | 0.1 M Ω to 1 G Ω 1G Ω to 100G Ω 100 G Ω to 1 T Ω | 5.89 % to 4.92 % 4.92 % to 8.68 % 8.68 % to 5.89 % | Using High Stability Megohm Box By Direct Method |
| 6. | Capacitance [#] | 1 kHz 220 pF to 300 nF 300 nF to 100 μ F 100 Hz 1 μ F to 30 μ F | 5.79 % to 0.29 % 0.29 % to 1.15 % 1.55 % to 0.58 % | Using Standard Calibrator Fluke 5522A by Direct method DCB by Direct Method |
| 7. | AC Power - 1 \emptyset [#] | 50 Hz @ UPF 120V to 240V 0.01A to 20A 1.2 W to 4.8 kW 50Hz @ 0.8 Lead 120V to 240V 0.1A to 20A 9.6 W to 3.8 kW 50Hz @ 0.5 Lag 120V to 240V 0.1A to 20A 6 W to 2.4 kW 50Hz @ 0.2 Lag 120V to 240V 0.1A to 20A 2.4 W to 960 W | 0.17 % 0.28 % to 0.21% 0.47 % 0.58 % | Using Standard Calibrator Fluke 5522A by Direct method |
| 8. | Power Factor [#] | 0.2 Lead to UPF 0.2 Lag to UPF | 0.004 PF (0.4 $^\circ$) | Using Standard Calibrator Fluke 5522A by Direct method |

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| 9. | Inductance [#] | 1 kHz 10 μ H to 10 H | 2.35 % to 1.14 % | Using Decade Inductance box By Direct Method |
| 10. | Oscilloscope [#] | a) DC Signal 2 mV to 130 V b) Amplitude – Sq. wave 2 mV to 55 Vp-p (@ 1 kHz) Time Marker 1 ns to 5 s Band Width 50 kHz to 1 GHz with Reference to 50 kHz | 0.29 % to 0.096 % 0.6 % to 0.3 % 0.0003 % 0.23% to 0.87% | Using Scope Calibrator Fluke 5522A By Direct Method |
| 11. | Frequency [#] | 1 Hz to 1 GHz | 0.004 % to 0.006 % | Using Standard Calibrator By Direct Method |
| 12. | Temperature Simulation [#] (Temperature Indicator/Recorder/Controller) | | | |
| | K Type | (-) 200 °C to 1350 °C | 0.50°C | Using Standard Calibrator Fluke 5522A By Direct Method |
| | J Type | (-) 200 °C to 1200 °C | 0.27°C | |
| | B Type | 600 °C to 1750 °C | 0.51°C | |
| | E Type | (-) 200 °C to 900 °C | 0.47°C | |
| | N Type | (-) 200 °C to 1300 °C | 0.47°C | |
| | R Type | 10 °C to 1750 °C | 0.65°C | |
| | S Type | 10 °C to 1750 °C | 0.63°C | |
| | T Type | (-) 200 °C to 400 °C | 0.59°C | |
| | RTD Type | (-) 200 °C to 800 °C | 0.207°C | |

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| II. | MEASURE | | | |
| 1. | DC Voltage [#] | 1mV to 100 mV 100m V to 1 V 1V to 100 V 100 V to 1000 V | 0.467 % to 0.0004 % 0.0004 % to 0.0007 % 0.0007 % to 0.0007 % 0.0007 % to 0.0005 % | Using 8½ DMM Fluke 8508A by Direct Method |
| 2. | AC Voltage [#] | 20 Hz to 50 kHz 1 mV to 100 mV 100 mV to 1 V 1 V to 100 V 45 Hz to 1 kHz 100V to 1000 V 50 kHz to 500 kHz 1 V to 20 V | 0.822 % to 0.104 % 0.104 % to 0.081 % 0.081 % 0.01 % to 0.019 % 0.348 % to 0.232 % | Using 8½ DMM Fluke 8508A by Direct Method |
| 3. | DC Current [#] | 10 µA to 100 µA 100 µA to 1 mA 1 mA to 100 mA 100 mA to 1 A 1 A to 20 A 20 A to 1000 A | 0.0021 % 0.0056 % to 0.003 % 0.003 % to 0.009 % 0.064 % to 0.022 % 0.022 % to 1.51 % 1.52 % | Using 8 ½ DMM Fluke 8508A by Direct Method Using Shunt |
| 4. | AC Current [#] | 300 Hz to 10 kHz 100 µA to 100 mA 100 mA to 1 A 1 A to 20 A 50 Hz 20 A to 700 A | 0.052 % 0.053 % to 0.094 % 0.094 % to 0.108 % 2.52 % to 2.55 % | Using 8½ DMM Fluke 8508A by Direct Method Using Shunt |
| 5. | Resistance [#] | 1mΩ to 100 mΩ 100 mΩ to 150 mΩ 150 mΩ to 1 Ω | 0.571 % to 0.592 % 0.592 % to 0.391 % 0.391 % to 0.0092 % | Using LCR Meter By Direct Method Using 8½ DMM Fluke 8508A by Direct Method |

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|-----|--|--|---|--|
| | | 1 Ω to 100 Ω 100 Ω to 10 K Ω 10k Ω to 100 K Ω 100K Ω to 1M Ω 1M Ω to 10 M Ω 10 M Ω to 100M Ω 100 M Ω to 1 G Ω 1 G Ω to 10 G Ω | 0.0092 % to 0.0009 % 0.0009 % to 0.001 % 0.001 % to 0.001 % 0.001 % to 0.0014 % 0.0014 % to 0.002 % 0.002 % to 0.017 % 0.017 % to 0.001 % 0.001 % to 0.135 % | |
| 6. | Capacitance # | @1 kHz 1nF to 100 nF 100 nF to 1 μ F 1 μ F to 100 μ F | 0.061 % to 0.060 % 0.06 % to 0.061 % 0.061 % to 0.058 % | Using LCR Meter By Direct Method |
| 7. | Inductance# | @1 kHz 100 μ H to 100 mH 100 mH to 10 H | 0.237 % to 0.066 % 0.066 % to 0.074 % | Using LCR Meter By Direct Method |
| 8. | Temperature Simulation# (Temperature Indicator/Recorder/Controller) | | | |
| | K Type J Type B Type E Type N Type R Type S Type T Type RTD Type | (-) 200 $^{\circ}$ C to 1350 $^{\circ}$ C (-) 200 $^{\circ}$ C to 1200 $^{\circ}$ C 600 $^{\circ}$ C to 1750 $^{\circ}$ C (-) 200 $^{\circ}$ C to 900 $^{\circ}$ C (-) 200 $^{\circ}$ C to 1300 $^{\circ}$ C 10 $^{\circ}$ C to 1750 $^{\circ}$ C 10 $^{\circ}$ C to 1450 $^{\circ}$ C (-) 200 $^{\circ}$ C to 400 $^{\circ}$ C (-) 200 $^{\circ}$ C to 800 $^{\circ}$ C | 0.49 $^{\circ}$ C 0.32 $^{\circ}$ C 0.54 $^{\circ}$ C 0.49 $^{\circ}$ C 0.49 $^{\circ}$ C 0.68 $^{\circ}$ C 0.57 $^{\circ}$ C 0.61 $^{\circ}$ C 0.27 $^{\circ}$ C | Using Standard Calibrator Fluke 5522A & 6 1/2 DMM by Direct method |
| 9. | Frequency# | 10 Hz to 1 GHz | 0.0012 % to 0.0025 % | Using Frequency counter / Philips - PM 6669 by Direct method |

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| 10. | Timer [#] | 1 sec to 9000 sec | 0.07 % to 0.06 % | Using Digital Timer Beltronics 501 By Comparison Method |
| 11. | DC Voltage [*] | 1kV to 20kV 20 kV to 40kV | 1.71 % to 1.68 % 1.68 % to 1.66 % | Using H.V. Probe Fluke 80K with DMM Fluke 17B by Direct method |
| 12. | AC Voltage [*] | 50 Hz 1 kV to 25 kV | 7.94 % to 7.58 % | Using H.V. Probe Fluke 80K with DMM Fluke 17B by Direct method |

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| <u>MECHANICAL CALIBRATION</u> | | | | |
| I. | DIMENSION (BASIC MEASURING INSTRUMENT, GAUGE ETC.) | | | |
| 1. | Callipers [§] (Analog/Dial /Digital) Res: 0.01mm ϕ | 0 to 300 mm 0 to 600 mm 0 to 1000 mm | 11.0 μ m 13.0 μ m 21.0 μ m | Using Caliper checker and Gauge Block By Comparison Method As per IS 3651 |
| 2. | Depth Micrometer [§] Res: 0.001mm ϕ | 0 to 300 mm | 7.0 μ m | Using Gauge Block Set By Comparison Method As per IS Based 2967 |
| 3. | External Micrometer [§] (Analog / Digital / Flange / Point / V Anvil / Pitch) Res: 0.001 mm* (0 to 450 mm) 0.01 mm ϕ (0 to 1000 mm) | 0 to 450 mm 0 to 1000 mm | 4.0 μ m 9.0 μ m | Using Gauge Block Set By Comparison Method As per IS 2967 |
| 4. | Setting Rods & Extensions Rods [§] | 25 mm to 975 mm | 10.0 μ m | Using Gauge Block Set By Comparison Method |
| 5. | Depth Vernier [§] (Analog/Dial/Digital) Res: 0.01 mm ϕ | 0 to 600 mm | 20.0 μ m | Using gauge block set By Comparison Method As per IS 4213 |
| 6. | Height Gauge [§] (Dial, Digital & Analog) Res: 0.01 mm ϕ | 0 to 600 mm 0 to 1000 mm | 13.0 μ m 22.0 μ m | Using Caliper checker By Comparison Method As per standard based on IS 2921 |

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|-----|--|--|---|---|
| 7. | 3 Point Micrometer [§] Res: 0.001 mm Φ | 0 to 100 mm | 4.0 μ m | Using Master Ring Gauges By Comparison Method |
| 8. | Dial Gauge-Plunger Type [§] (Analog/Digital) Res: 0.001 mm Φ | 0 to 1 mm 0 to 10 mm 0 to 50 mm | 2.9 μ m 3.1 μ m 6.5 μ m | Using Electronic Dial Calibration Tester As per standard based on IS 2092 |
| 9. | Lever Dial Gauge [§] mm* (0 to 1 mm), 0.01mm Φ (0 to 0.2 mm) 0.002 mm (0 to 0.14 mm) 0.001mm | 0 to 1 mm 0 to 0.2 mm 0 to 0.14 mm | 6.3 μ m 3.0 μ m 2.9 μ m | Using Electronic Dial Calibration Tester As per standard based on IS 11498 |
| 10. | Bore Gauge [§] 0.001mm Φ | 1 mm Transmission only | 3.7 μ m | Using Electronic Dial gauge Calibration Tester As per standard based on IS 2092 |
| 11. | Plain Plug Gauges [§] | 1 mm to 300 mm | 1.5 μ m | Using Universal Length Measuring Machine As per standard based on IS 3455 |
| 12. | Plain Ring Gauges [§] | 4 mm to 300mm | 3.3 μ m | Using Universal Length Measuring Machine As per standard based on IS 3455 |

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|-----|--|-----------------|---|---|
| 13. | Snap Gauges / Dial Snap Gauges / Width Gauges [§] | 3 mm to 300 mm | 3.5 μ m | Using Universal Length Measuring Machine As per standard based on IS 3477 & 8023 |
| 14. | Measuring Pins [§] (Grade 1 & 2) | Up to 25 mm | 0.6 μ m | Using Universal Length Measuring Machine As per standard based on IS 11103 |
| 15. | Thread Plug Gauge [§] (Effective Dia) | Up to 300 mm | 2.6 μ m | Using Universal Length Measuring Machine As per standard based on IS 2344 & AMSI/ASME B1.20.5 |
| 16. | Thread Ring Gauge [§] (Effective Dia) | 3 mm to 300 mm | 3.0 μ m | Using Universal Length Measuring Machine As per standard based on IS 2344 |
| 17. | Taper Thread Plug Gauge [§] (Effective Dia) | 0 to 100 mm | 4.0 μ m | Using Universal Length Measuring Machine As per standard based on IS 2344 |
| 18. | Taper Thread Ring Gauge [§] (Effective Dia.) | 0 to 110 mm | 6.8 μ m | Using Universal Length Measuring Machine As per standard based on IS 2344 |
| 19. | Bevel Protractor [§] Res: 1 min ϕ | 0 to 360° | 3.4 arc of min | Using Profile Projector As per standard based on IS 4239 |

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|-----|--|---------------------------------|---|--|
| 20. | Combination Set [§] Res:1 ° | 0 to 180 ° | 16.6 arc of sec | Using Profile Projector As per standard based on IS 4239 |
| 21. | Feeler Gauge [§] | 0.1 mm to 1 mm | 2.5 μ m | Using Universal Length Measuring Machine As per standard based on IS 3179 |
| 22. | Comparator Dial Stand [§] (Flatness) | Up to 300 mm | 7.0 μ m | Using Lever Dial & Linear Height Master By Comparison Method |
| 23. | Steel Scale / Taper Scale [§] Res: 0.1 mm ϕ | 0 to 1000 mm | 17.0 μ m | Using Tape & Scale Measuring Machine As per standard based on IS 1481 |
| 24. | Measuring Tape / PI Tape [§] Res: 0.5 mm ϕ | 0 to 50,000 mm | 17 + 5.9 L μ m (L in meters) | Using Tape & Scale Measuring Machine As per Standard Based on IS 1269 |
| 25. | Glass Scale [§] Res: 0.5 Mm ϕ | 0 to 300 mm | 8.0 μ m | Using Profile Projector By comparison Method |
| 26. | Radius Gauges [§] | 0.5 mm to 25.0 mm | 8.0 μ m | Using Profile Projector As per IS 5273 |
| 27. | Thread Pitch Gauge , Set Pitch Flank Angle [§] | 0.3 mm to 6.0 mm 55 ° to 60° | 4.0 μ m 6.9 min of arc | Using Profile Projector As per standard based on IS 4211 |

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| 28. | 'V' – Block [§] (Squareness) (Parallelism) (Symmetricity) | Up to 200 mm | 7.0 μ m 7.0 μ m 8.0 μ m | Using Mandrel + Linear Height Master + Lever Dial Gauge As per Standard Based on IS 2949 |
| 29. | Spirit Level / Frame Level [§] Res: 10 μ m / m Φ | 0.12 mm/m | 15.0 μ m/m | Using Electronic Level As per standard based on IS 5706 |
| 30. | Test Sieves [§] | 0.16 mm to 1 mm 1 mm to 100 mm | 5.0 μ m 20.0 μ m | Using Profile Projector As per standard based on IS 460 |
| 31. | Pistol Caliper [§] Res: 0.01 mm * | 0 to 100 mm | 10 μ m | Using Gauge Block Set By Comparison Method |
| 32. | Engineering Square / Angle Plates [§] (Squareness) | Up to 350 mm | 9.0 μ m | Using Digital Dial Gauge + Linear Height Master As per standard based on IS 2103 |
| 33. | Surface Plate [§] (Granite / Cast Iron Surface Table) | (6000 mm x 2000 mm) "L" in mm | 1.0 $\sqrt{L+W}$ /150 μ m | Using Electronic Level As per standard based on IS 7327 for granite 2281 for cast Iron |
| 34. | Coating Thickness Gauge [§] Res: 0.1 μ m Φ | 0 to 1250 μ m | 3.0 μ m | Using Standard Thickness Foils By Comparison Method |
| 35. | Calibration Foils [§] | 10 μ m to 2000 μ m | 1.0 μ m | Using Universal Length Measuring Machine By Comparison Method |

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| 36. | Groove Dial / Leg Caliper [§] (OD & ID) Gauge Res: 0.025mm ^Φ | Up to 150 mm | 8.0 μ m | Using Gauge Block Set By Comparison Method |
| 37. | Internal Micrometer/ Stick Micrometer (Including Extension rod) [§] Res: 0.01mm | Up to 300 mm | 8.0 μ m | Using Gauge Block set and Gauge Block Accessories By Comparison Method IS 2966 |
| 38. | Dial Thickness Gauge [§] Res: 0.001 mm/ 0.01mm ^Φ | 0 to 10 mm | 8.0 μ m | Using Gauge Block Set By Comparison Method |
| 39. | Height Measuring System [§] Res: 0.001 μ m ^Φ | 0 to 1000 mm | 5.6 μ m | Using Gauge Block Set By Using Gauge Block Set |
| 40. | Dial Calibration Tester / LVDT Probe With Indicator [§] Res: 0.01 μ m ^Φ | 0 to 25 mm | 2.0 μ m | Using ULM By Comparison Method |
| 41. | Caliper Checker [§] | 0 to 950 mm | 10.0 μ m | Using Gauge Block Set and Linear Height Master As per standard based on IS 13709 |
| 42. | Pitch Micrometer [§] Res: 0.01mm | Up to 200 mm | 7.0 μ m | Using Gauge Block Set By Comparison Method |
| 43. | Micrometer Head [§] Res: 0.001mm ^Φ | 0 to 25 mm | 2.0 μ m | Using ULM By Comparison Method |

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| 44. | Parallel Block [§] | Up to 1000 mm | 10.0 μ m | Using Lever Dial Gauge By Comparison Method |
| 45. | Ultra Sonic Thickness Gauge [§] | Up to 200 mm | 8.3 μ m | Using Slip Gauge Set BY Comparison Method |
| 46. | Gauge Block Set [§] | 0.5 mm to 25 mm 25 mm to 50 mm 50 mm to 75 mm 75 mm to 100 mm | 0.10 μ m 0.14 μ m 0.13 μ m 0.20 μ m | Using Slip Gauge Calibrator By Comparison Method |
| 47. | Universal Length Measuring Machine [§] | Up to 100 mm | 0.8 μ m | Using Grade 'K' Slip Gauge Set By Comparison Method |
| II. | ACCELERATION & SPEED | | | |
| 1. | Tachometer [§] (Contact Type) | 100 rpm to 5000 rpm | 1.7 % to 2.3 % | Using Tachometer Calibrator By Comparison Method |
| 2. | Stroboscope, Tachometer [§] (Non-contact Type) | 60 rpm to 25000 rpm 25000 rpm to 45000 rpm | 1.02 % to 0.01 % 0.01 % to 0.005 % | Using Master Tachometer By Comparison Method |
| III. | TORQUE GENERATING DEVICES | | | |
| 1. | Torque Wrench [§] (Type-I Class B,C,D,E & Type-II Class A,B,C,D) | 0 to 20 Nm 20 Nm to 200 Nm 200 Nm to 1000 Nm | 0.36 % 1.5 % 1.2 % | Using Torque Transducer with Indicators IS/ISO 6789 : 2003 Using Torque Wrench calibration System |

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| Sl. | Quantity Measured / Instrument | Range/Frequency | *Calibration Measurement Capability (\pm) | Remarks |
|------------|---|---------------------------------|---|--|
| IV. | PRESSURE INDICATING DEVICES | | | |
| 1. | Hydraulic Pressure Digital/Analog Pressure Gauges, Compound Gauge, Pressure Indicator With Transducer/ Transmitter , Pressure Switch [#] | 0 to 700 Bar 0 to 1000 bar | 0.20 bar 0.32 bar | Using Digital Pressure Gauge Dial Test Gauge Based on DKD-R6-1 |
| 2. | Pneumatic Pressure Magnehelic Gauges, Differential Pressure transmitters, Low Pressure Indicators/ Transducers, Barometer [#] | 0 to 500 mbar 0 to 2000 mbar | 0.16 mbar 4.8 mbar | Using Digital Manometer Based on DKD-R6-1 |
| 3. | Pneumatic Pressure Digital / Dial Gauges/ Pressure Indicator with Transmitter/ Transducer, Compound Gauge [#] | 0 to 35 bar 0 to 70 bar | 0.01 bar 0.15 bar | Using Digital Pressure Gauge Based on DKD-R6-1 |
| 4. | Digital / Dial Vacuum Gauges/Transmitters/ Transducers, Compound Gauge [#] | 0 to (-) 0.75 bar | 0.0062 bar | Using Digital Vacuum Gauge Based on DKD-R6-2 |
| V. | DIMENSION (PRECISION INSTRUMENTS) | | | |
| 1. | Height Measuring System* Res: 0.1 μ m* | 0 to 1000 mm | 5.6 μ m | Using Gauge Block Set By Comparison Method |

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|------------|---|---|--|---|
| 2. | Surface Plate* (Granite / Cast Iron Surface Plate) | Up to (6000 mm x 2000 mm) "L" in mm | 1.0 $\sqrt{L+W}/150$ μ m | Using Electronic Level As per standard based on IS 7327 & 2283 |
| 3. | Bench Centre* | Up to 500 mm | Parallelity: 9.0 μ m Co-axiality: 8.0 μ m | By Comparison Method |
| 4. | Centrifuge / Centrifugal Motor/ Speed (Non-Contact) * | 10 RPM to 15000 RPM | 0.79 % to 1.1 % | By Comparison Method |
| 5. | Profile Projector/ Video Measuring System / Micro Scope \$ | Linear : 0 to 200 mm L.C.: 0.001 mm Angular : 0° to 360° L.C.: 12 arc sec Magnification: 10x to 100x | 2.6 μ m 50 min of arc 0.6 % | Using Slip Gauge set + Glass Angle Gauge + Glass Scale By Comparison Method |
| 6. | Profile Projector/ Video Measuring System / Micro Scope* | Linear: 0 to 200 mm L.C.- 0.001 mm Angular: 0° to 360° L.C.- 12 arc sec Mag.: 10x to 100x | 2.4 μ m 50 min of arc 0.6 % | Using Slip Gauge set + Glass Angle Gauge + Glass Scale By Comparison Method |
| VI. | MASS | | | |
| 1. | Weights\$ (F2 Class & Coarser) | 20 kg | 0.084 g | Using Weights of Accuracy ClassF1 And Precision Balances as per OIML R 111- 1:2004 By Substitution Method ABBA Weighing Cycle |

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|-----|---|--------------------|---|---|
| | Weights (M1 Class & Coarser) | 10 kg | 0.083 g | Using Weights of Accuracy Class F1 And Precision Balances as per OIML R 111-1:2004 By Substitution Method ABBA Weighing Cycle |
| | Weights ^s (F2 Class & Coarser) | 5 kg 2 kg | 0.010 g 0.009 g | Using Weights of Accuracy Class F1 And Precision Balances as per OIML R 111-1:2004 By Substitution Method ABBA Weighing Cycle |
| | Weights ^s (F1 Class & Coarser) | 1 kg 500 kg | 0.001g 0.001 g | Using Weights of Accuracy Class E2 And Precision Balances as per OIML R 111-1:2004 By Substitution Method ABBA Weighing Cycle |
| | Weights ^s (E2 Class & Coarser) | 200 g 100 g | 0.099 mg 0.089 mg | Using Weights of Accuracy Class E1 And Precision Balances as per OIML R 111-1: 2004 By Substitution Method. ABBA Weighing Cycle |
| | Weights ^s (E2 Class & Coarser) | 50 g 20 g 10 | 0.014 mg 0.012 mg 0.012 mg | Using Weights of Accuracy Class E1 And Precision Balances as per OIML R 111-1:2004 By Substitution Method. ABBA Weighing Cycle |

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| Sl. | Quantity Measured / Instrument | Range/Frequency | *Calibration Measurement Capability (\pm) | Remarks |
|-----|---|--|---|--|
| | | 5 g 2 g 1 g 500 mg 200 mg 100 mg 50 mg 20 mg 10 mg 5 mg 2 mg 1 mg | 0.006 mg 0.004 mg 0.004 mg 0.003 mg 0.003 mg 0.003 mg 0.002 mg 0.002 mg 0.002 mg 0.002 mg 0.002 mg 0.002 mg | Using Weights of Accuracy Class E1 And Precision Balances as per OIML R 111-1:2004 By Sub-division Method ABBA Weighing Cycle |
| 2. | Weighing Balance ^s Readability: 0.0001 mg Readability: 0.001 mg Readability: 0.1 mg Readability: 0.01 mg Readability: 1 mg Readability: 10 mg Readability: 100 mg Readability: 100 mg Readability: 100 mg Readability: 1 g Readability: 10 g Readability: 50 g Readability: 100 g | (1 mg to 2.1 g) (1 mg to 5.1 g) (1 mg to 200 g) (1 mg to 50 g) (1mg to 1kg) (0.1 mg to 5 kg) (0.1 mg to 2 kg) (0.1g to 35kg) (0.1g to 20kg) (0.1mg to 10kg) (1g to 100 kg) (10g to 100 kg) (2kg to 500 kg) (2kg to 1000 kg) | 0.003 mg 0.005 mg 0.060 mg 0.011m g 0.002g 0.014 g 0.011g 0.186 g 0.109 g 0.037 g 1g 10g 20g 50g | Using Weights of Accuracy Class E1 As per OIML R-76:2006 Using Weights of Accuracy Class E1 As per OIML R-76:2006 Using Weights of Accuracy Class E2 As per OIML R76-:2006 Using Weights of Accuracy Class E2 As per OIML R76-:2006 Using Weights of Accuracy Class M1 As per OIML R76-:2006 |

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|-------------|--|--|--|--|
| VII. | VOLUME | | | |
| 1. | Micropipette [§] | 1 μ l 2 μ l 5 μ l 10 μ l 20 μ l 50 μ l 100 μ l 200 μ l 500 μ l 1000 μ l 2000 μ l 5000 μ l | 0.01 μ l 0.01 μ l 0.02 μ l 0.03 μ l 0.05 μ l 0.20 μ l 0.62 μ l 1.30 μ l 3.10 μ l 6.20 μ l 12.5 μ l 32.0 μ l | Using Weights of Accuracy Class E1 & Distilled water by Gravimetric method on ISO 8655 (Part 6) :2002 Using Weights of Accuracy Class E2 & Distilled water by Gravimetric method on ISO 8655 (Part 6) :2002 |
| 2. | Graduated One Mark [§] (Pipette & Burette) | 5 ml 10 ml 25 ml 50 ml 100 ml | 0.02 ml 0.03 ml 0.06 ml 0.11 ml 0.21 ml | Using Weights of Accuracy Class E2 & Distilled water by Gravimetric method on ISO 4787:2010 & ISO 20461 |
| 3. | Volumetric [§] (Flask/Beaker) | 5 ml 10 ml 20 ml 50 ml 100 ml 200 ml 500 ml 1000 ml 2000 ml | 0.02 ml 0.03 ml 0.06 ml 0.11 ml 0.21 ml 0.41 ml 1.03 ml 2.2 0ml 4.60 ml | Using Weights of Accuracy Class E2 & Distilled water by Gravimetric method on ISO 4787:2010 & ISO 20461 |
| 4. | Measuring Cylinder [§] | 5 ml 10 ml 20 ml | 0.1 ml 0.8 ml 1.5 ml | Using Weights of Accuracy Class E2 & Distilled water by |

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|--------------|---|--|---|--|
| | | 50 ml 100 ml 200 ml 500 ml 1000 ml 2000 ml 5000 ml 10000 ml | 1.5 ml 1.9 ml 2.3 ml 10.5 ml 11.5 ml 12.0 ml 25.0 ml 75.0 ml | Gravimetric method on ISO 4787:2010 & ISO 20461 |
| VIII. | DENSITY AND VISCOSITY | | | |
| 1. | Density [§] (Hydrometer) L.C.: 0.0005 g/ml | 0.600 g/ml to 1.8 g/ml | 0.0009 g/ml | Using Standard Hydrometer By Comparison Method |
| IX. | UTM, TENSION CREEP AND TORSION TESTING MACHINE | | | |
| 1. | Force Measuring System of UTM Compression Mode* | 0 to 500 kN | 0.72 % | For UTM of accuracy class 0.5 and coarser as per IS:1828 (Part 1) 2015 |
| X. | HARDNESS TESTING MACHINES | | | |
| 1. | Rockwell Hardness Testing Machine* | HRA HRB HRC | 1.0 HRA 1.76 HRB 0.85 HRC | Using Standard Blocks by indirect Method as per IS:1586 (Part 2) 2012 |
| 2. | Vickers Hardness Testing Machine* | HV1 HV5 HV10 HV30 | 5.12 % 3.0 % 2.50 % 2.0 % | Using Standard Blocks by indirect Method as per IS:1501 (Part 2) 2013 |

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|-----|------------------------------------|--------------------------------------|---|---|
| 3. | Brinell Hardness Testing Machine* | HBW 5/750 HBW 10/3000 | 7.10% 3.65% | Using Standard Blocks by indirect Method as per IS:1500 (Part 2) 2013 |
| 4. | Shore Hardness Tester [§] | 0 to 100 Shore A 0 to 100 Shore D | 2.2 Shore A 2.2 Shore D | Using Rubber Hardness Tester Calibrator By Comparison Method As per ASTM D 2240 |

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|-----------------------------------|---|---|---|---|
| <u>THERMAL CALIBRATION</u> | | | | |
| I. | TEMPERATURE | | | |
| 1. | Thermocouples & RTD Sensors/ Temperature Sensors with indicators / Temperature gauges/ Transmitters/ Temperature Switches & Transmitters With Indicators [#] | @(-) 95°C @140 °C 140 °C to 600 °C 600 °C to 1200 °C | 0.083 °C 0.18 °C 0.32 °C 1.8 °C | Using RTD Sensor with Indicator Oil Bath, Dry Block Furnace By Comparison Method Using Fluke S- Type Thermocouple with Fluke Reference Thermometer, Dry Block Furnace By Comparison Method |
| 2. | Oil Baths/Low & high Temp bath/Dry bath ^{\$} | @ (-) 95 °C @140 °C 140 °C to 600 °C 600 °C to 1200 °C | 0.083 °C 0.18 °C 0.32 °C 1.9 °C | Using RTD Thermometer, Multichannel Temperature Recorder & Fluke S type Thermocouple with cold Bath & Dry Block Furnaces By Comparison Method |
| 3. | Non-Contact Thermometer Pyrometer ^{\$} | 50 °C to 650 °C 650 °C to 1200 °C | 6.67 °C 8.32 °C | Using Black Body, Pyrometer by Comparison Method |
| 4. | Glass Thermometer ^{\$} | (-) 20 °C to 150 °C | 0.34 °C | Using RTD sensor with Oil Bath by Comparison Method |

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|------------|---|--|---|--|
| 5. | Temperature (Digital & Analog Thermo hygrometer) Temperature & Humidity Meter, Humidity Indicator, Humidity & Temperature Transmitter With Indicator) § | 10° C to 50° C | 0.21°C | Using Standard RTD & Temperature Generator By Comparison Method |
| 6. | Thermal Freezers Chambers/Ovens/ Incubators & Furnace (Multipoint) * | (-) 80 °C to 200 °C 200 °C to 1200 °C | 0.95 °C 1.88 °C | Using Standard Humidity Meter With Humidity Generator By Comparison Method |
| II. | SPECIFIC HEAT AND HUMIDITY | | | |
| 1. | Humidity Chambers/ Climatic Chamber/ Environmental Chamber* | 15%RH to 95%RH @ 10 °C to 60 °C | 1.36 % RH | Using Temperature and Humidity meter By Single Point Method |

* 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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