**Calibration Laboratory.**

Scope of Applied Physics, Computer & Instrumentation Centre (APC&IC), Pakistan Council of Scientific & Industrial Research Laboratories Complex, Lahore, Pakistan

**Field of Measurement:**

| Measured Quantity | Range | Best Measurement Capability Expressed as Uncertainty | Brief Description of measurement and equipment used |
|---|---|---|---|
| **Length** | | | |
| Line Length Standard | 0cm - 100 cm | 0.1 cm | U.ID#(LLC/APCIC/CP/001)<br>Technique: Direct Comparison<br>Line Length Standard<br># 251100 PTB, Germany |
| Measuring Tape | 0 cm - 500 cm | 0.1 cm | U.ID#(LLC/APCIC/CP/002)<br>Technique:Direct Comparison<br>Measuring tape<br># 34-336, Stanley USA |
| Vernier Caliper | 0 mm - 300 mm | 0.01 mm | U.ID#(LLC/APCIC/CP/003)<br>Technique: Direct Comparison Gauge Block Set # 0403970,<br>Mitutoyo, Japan |
| Micrometer | 0 mm - 25 mm | 0.001 mm | U.ID#(LLC/APCIC/CP/004)<br>Technique: Direct Comparison Gauge Block Set # 0403970,<br>Mitutoyo, Japan |
| Gauge Blocks | 0.5 mm - 100 mm | 0.2 μm | U.ID#(LLC/APCIC/CP/005)<br>Technique: Direct Comparison<br>Micrometer, Vernier Caliper CD-12// C, Gauge Block Set # 0408006 Mitutoyo, Japan, Tesa Tronic Amplifier Type: 04430008, Swiss-Made |
| **Masses and Weighing Balances** | | | |
| Masses | 1 mg - 200mg<br>1g - 200g<br>1kg- 10 Kg | 0.1 mg<br>0.1 mg<br>0.1 g | U.ID#(LLC/APCIC/CP/006)<br>Technique: Direct Loading<br>Set of Standard Masses<br>Weighing Balance SARTORIUS ME235S<br>Weighing Balance OHAUS, USA<br>Weighing Balance GP-30K, AND,Japan,<br>Weighing Balance, DIGI D-I 30N, Japan |

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| Measured Quantity | Range | Best Measurement Capability Expressed as Uncertainty | Brief Description of measurement and equipment used |
|---|---|---|---|
| Weighing Balance | 1 mg - 200mg<br>1g - 200g<br>5 g - 10 kg | 0.1 mg<br>0.1 mg<br>0.1 g | Technique: Direct Loading<br>Set of Standard Masses, Cal Lab. M25, M26 China |
| **Temperature** | | | |
| Liquid in Glass Thermometer | -10°C - 375°C | 1 °C | U.ID#(LLC/APCIC/CP/007)<br>Technique: Direct comparison<br>Dry Well Calibrator 9100S, Precision Thermometer, WA57497 |
| Temperature Probe / Temperature Controller | -10 °C<br>0 °C - 800 °C | 0.1 °C<br>1 °C | U.ID#(LLC/APCIC/CP/007)<br>Technique: Direct comparison<br>Dry Well Calibrator 9100S, Precision Thermometer, WA57497 |
| ***Pressure*** | | | |
| Pressure Gauge | -10 psi - 100psi<br>100 psi - 3000 psi<br>1000psi - 10000 psi | 0.1 psi<br>1 psi<br>5 psi | U.ID#(LLC/APCIC/CP/009)<br>Technique: Direct Comparison<br>• *Pressure Calibrator PPC-3300*<br>• *Hydraulic Pressure Calibrator, H540/193,* |
| **Volume** | | | |
| Pipette | 0ml - 2 ml<br>0 ml - 20 ml | *0.0058* ml<br>*0.038* ml | U.ID#(LLC/APCIC/CP/010)<br>Hydrostatic weighing using certified masses / Balances and distilled water at 20° C |
| Burette | 0 ml- 50 ml<br>0 ml - 100 ml | *0.13* ml<br>*0.5* ml | U.ID#(LLC/APCIC/CP/010)<br>Hydrostatic weighing using certified masses / Balances and distilled water at 20° C |
| Beaker | 25 ml, 50 ml,<br>100 ml, 250 ml<br>500 ml, | ---- | U.ID#(LLC/APCIC/CP/010)<br>Hydrostatic weighing using certified masses / Balances and distilled water at 20° C |
| Cylinder | 25 ml<br>50 ml<br>100 ml<br>250 ml<br>500 ml<br>1 000 ml | 0.3 ml<br>0.6 ml<br>0.8 ml<br>1.2 ml<br>4 ml<br>12 ml | U.ID#(LLC/APCIC/CP/010)<br>Hydrostatic weighing using certified masses / Balances and distilled water at 20° C |

| Measured Quantity | Range | Best Measurement Capability Expressed as Uncertainty | Brief Description of measurement and equipment used |
|---|---|---|---|
| **Frequency** | | | |
| Frequency | 1 Hz<br>10 Hz<br>100 Hz<br>1 kHz<br>10 kHz<br>100 kHz<br>1 MHz<br>10 MHz<br>50 rpm - 500rpm<br>1000 rpm -30000 rpm | 0.001 Hz<br>0.01 Hz<br>0.1 Hz<br>0.001 kHz<br>0.01 kHz<br>0.1 kHz<br>0.001 MHz<br>0.01 MHz<br>0.2 rpm<br>1 rpm | U.ID#(LLC/APCIC/CP/011)<br>Technique: Direct Comparison<br>• Universal Frequency Counter (Agilent, Malaysia) MY40004247, Cal.Lab-f6<br>• Frequency Counter Tektronix-Malaysia CMC-251TW54148,Cal.Lab-f2<br>• Digital tachometer 5600, Kyoritsu Japan, Cal.Lab-f7 |
| **Time** | | | |
| Time | *1s to 3600 s* | *± 0.038 s* | U.ID#(LLC/APCIC/CP/012)<br>• *Universal Frequency Counter (Agilent, Malaysia) MY40004247, Cal.Lab-f6*<br>• *Frequency Counter Tektronix-Malaysia CMC-251TW54148,Cal.Lab-f2*<br>• Technique: Direct comparison Digital Timer # 57120 USA. |
| **Electrical Parameters** | | | |
| A.C Voltage, | 0.1 V to 1 V<br>10 V to 100 V<br>200 V<br>600 V | 0.008 V<br>0.06 V<br>0.1 V<br>1 V | U.ID#(LLC/APCIC/CP/013)<br>Technique: Direct comparison<br>Digital Multimeter 3155A<br>Escort, Taiwan |
| D.C. Voltage | 1 mV - 100mV<br>1 V<br>10V<br>100 V - 200 V<br>200 V - 800 V | 0.01 mV<br>0.0002 V<br>0.001 V<br>0.01 V<br>0.1 V | • Digital Multimeter 3155A Escort, Taiwan<br>• D.C. High Voltage Probe<br>• Portable Calibrator 2422 Yokogawa, Japan |
| A.C Current | 1mA<br>10 - 100mA<br>1A - 10A<br>10A - 100A<br>100A - 1000A | 0.001 mA<br>0.1 mA<br>0.001 A<br>1 A<br>1 A | • Digital Multimeter 3155A Escort, Taiwan<br>• Digital Multimeter 45 Fluke<br>• AC/DC Clamp-on Meter, Kyortisu, Japan Cal.Lab-E60 |

| Measured Quantity | Range | Best Measurement Capability Expressed as Uncertainty | Brief Description of measurement and equipment used |
|---|---|---|---|
| D.C Current | 1mA<br>10 mA to 100 mA<br>1A to 10A<br>10A to 100A<br>100A to 1000A | 0.01 mA<br>0.1 mA<br>0.001 A<br>1 A<br>1 A | • Digital Multimeter 3155A Escort, Taiwan<br>• Digital Multimeter 45 Fluke<br>• AC/DC Clamp-on Meter, Kyortisu, Japan Cal.Lab-E60 |
| Resistance | 1Ω to 100Ω<br>1kΩ, 10kΩ<br>100kΩ<br>1MΩ, 10MΩ,<br>100MΩ<br>100MΩ to 1GΩ | 0.1Ω<br>0.001kΩ,<br>0.01kΩ<br>0.1KΩ<br>0.001MΩ,<br>0.1MΩ<br>1MΩ | • Standards Resistances<br>• Digital Insulation Tester, MIS-4D Japan<br>• LCR Meter PM6304, Fluke, USA |
| **Spectrophotometer** | | | |
| Spectrophotometer | 0% T -100% T | 0.1 %T | U.ID#(LLC/APCIC/CP/014)<br>Spectronic Standards<br>Model # 333150<br>Thermospectronics, USA |

* Best Measurement Capability expressed as Uncertainty, with k=2, providing a Level of Confidence of approximately 95%

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