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| **Laboratory** | **HTA Instrumentation (P) Ltd., #73, Ramachandra Agrahara, Chamarajpet, Bangalore, Karnataka** | | |
| **Accreditation Standard** | **ISO/IEC 17025: 2005** | | |
| **Certificate Number** | **CC-2166** | **Page** | **1 of 13** |
| **Validity** | **06.08.2018 to 05.08.2020** | **Last Amended on** | **-** |

| Sl. | Quantity Measured / Instrument | Range/Frequency | *Calibration Measurement Capability (±) | Remarks |
|---|---|---|---|---|
| | | **ELECTRO-TECHNICAL CALIBRATION** | | |
| **I.** | **SOURCE** | | | |
| | DC Voltage[$] | 1 mV to 10 mV<br>10 mV to 1000 V | 0.36 % to 0.05 %<br>0.05 % to 0.009 % | Using Fluke 5500A<br>MPC by Direct Method |
| | DC Voltage [♣] | 100 mV to 30 V | 0.04 % to 0.07 % | Using Yokogawa CA 71 Handy Calibrator by Direct Method |
| | | 0.2 mA to 2.2 A<br>2.2 A to 10 A | 0.05 % to 0.09 %<br>0.09 % to 0.07 % | Using Fluke 5500A<br>MPC by Direct Method |
| | | 10 A to 500 A | 0.67 % to 0.31 % | Using Fluke 5500A & Current Coil |
| | DC Current [♣] | 0.1 mA to 24 mA | 6.28 % to 0.04 % | Using Fluke 725 Process Calibrator by Direct Method |
| | | **45 Hz to 10 kHz**<br>1 mV to 33 V | 2.49 % to 0.24 % | Using Fluke 5500A<br>MPC by Direct Method |
| | | **45 Hz to 1 kHz**<br>33 V to 750 V | 0.24 % to 0.07 % | Using Fluke 5500A<br>MPC by Direct Method |
| | | **45 Hz to 1 kHz**<br>100 µA to 3.3 mA<br>3.3 mA to 330 mA<br>0.33 A to 10 A | <br>0.45 % to 0.23 %<br>0.23 % to 0.34 %<br>0.34 % to 0.41 % | Using Fluke 5500A<br>MPC by Direct Method |
| | | **50 Hz**<br>10 A to 550 A | 0.68 % to 0.36 % | Using Fluke 5500A & Current Coil |

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| **5.** | Resistance[$] | 2 Ω to 11 Ω<br>11 Ω to 1 KΩ<br>1 KΩ to 100 KΩ<br>100 KΩ to 1 MΩ<br>1 MΩ to 20 MΩ<br>20 MΩ to 100 MΩ | 0.48 % to 0.17 %<br>0.17 % to 0.01 %<br>0.01 % to 0.007 %<br>0.007 % to 0.02 %<br>0.02 % to 0.12 %<br>0.12 % to 0.58 % | Using Fluke 5500A MPC by Direct Method |
| | Resistance [♣] | 15 Ω to 500 Ω<br>500 Ω to 3.2 kΩ | 1.28 % to 0.22 %<br>0.22 % | Using Fluke 725 Process Calibrator by Direct Method |
| | | **1 kHz**<br>350 pF to 330 nF | 3.88 % to 0.61 % | |
| | | **100 Hz**<br>1 µF to 300 µF | 0.61 % to 0.95 % | |
| | Frequency[$] | **3 V**<br>45 Hz to 1 MHz | 0.01 % to 0.06 % | Using Fluke 5500A MPC by Direct Method |
| | Frequency [♣] | 45 Hz to 1 kHz<br>1 kHz to 10 kHz | 0.14 % to 0.06 %<br>0.06 % to 1.2 % | Using Fluke 725 Process Calibrator by Direct Method |
| **8.** | AC Power[$]<br>(Single Phase, UPF, 50 Hz) | 12 W to 2400 W<br>120 V (0.1 A to 10 A)<br>240 V (1 A to 10 A) | 0.18 % | Using Fluke 5500A MPC by Direct Method |
| | Temperature Simulation[$] | | | |
| | RTD (Pt 100)<br>Thermocouple :<br>K Type<br>J Type<br>R Type<br>S Type<br>T Type<br>N Type | (-) 200 °C to 600 °C<br><br>(-) 200 °C to 1300 °C<br>(-) 200 °C to 900 °C<br>0 °C to 1700 °C<br>0 °C to 1700 °C<br>(-) 200 °C to 400 °C<br>(-) 150 °C to 1300 °C | 0.16 °C<br><br>0.48 °C<br>0.33 °C<br>0.67 °C<br>0.57 °C<br>0.75 °C<br>0.49 °C | Using Fluke 5500A MPC by Direct Method |

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|---|---|---|---|---|
| **10.** | Temperature Simulation♣ | | | |
| | RTD (Pt 100)<br>Thermocouple :<br>K Type<br>J Type<br>T Type<br>R Type<br>S Type<br>N Type | (-) 200 °C to 800 °C<br><br>(-) 200 °C to 1350 °C<br>(-) 200 °C to 1200 °C<br>(-) 200 °C to 400 °C<br>0 °C to 1750 °C<br>0 °C to 1750 °C<br>(-) 200 °C to 1300 °C | 0.39 °C<br><br>1.40 °C<br>1.16 °C<br>1.46 °C<br>2.09 °C<br>2.11 °C<br>1.77 °C | Using Fluke 725 Process Calibrator by Direct Method |
| **II.** | **MEASURE** | | | |
| | DC Voltage$ | 1 mV to 10 V<br>10 V to 1000 V | 0.42 % to 0.005 %<br>0.005 % to 0.006 % | Using Fluke 8845A DMM by Direct Method |
| | DC Voltage♣ | 1 mV to 100 mV<br>100 mV to 1000 V | 0.28 % to 0.011 %<br>0.011 % | Using UNI-T UT-805 5½ DMM by Direct Method |
| | DC Current$ | 100 µA to 100 mA<br>100 mA to 10 A | 0.03 % to 0.06 %<br>0.06 % to 0.20 % | Using Fluke 8845A DMM by Direct Method |
| | DC Current♣ | 100 µA to 100 mA<br>100 mA to 1 A<br>1 A to 10 A | 0.15 % to 0.05 %<br>0.05 % to 1.62 %<br>1.62 % to 0.99 % | Using UNI-T UT-805 5½ DMM by Direct Method |
| | AC Voltage$ | **45 Hz to 1 kHz**<br>100 mV to 10 V<br>10V to 750V | <br>0.12 % to 0.1 %<br>0.1 % to 0.11 % | Using Fluke 8845A DMM by Direct Method |
| | AC Voltage♣ | **45 Hz**<br>10 mV to 1 V<br>**1 kHz**<br>1 V to 750 V | <br>1.75 % to 0.24 %<br><br>0.24 % to 0.50 % | Using UNI-T UT-805 5½ DMM by Direct Method |

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|---|---|---|---|---|
| **4.** | AC Current[$] | **1 kHz**<br>10 mA to 1 A<br>1 A to 10 A | <br>0.24 % to 0.17 %<br>0.17 % to 0.26 % | Using Fluke 8845A DMM by Direct Method |
| | | **45 Hz**<br>1 mA to 10 mA | 0.48 % to 1.55 % | |
| | | **1 kHz**<br>10 mA to 1 A<br>1 A to 10 A | 1.55 % to 4.63 %<br>4.63 % to 2.54 % | |
| | Frequency[$] | **1 V**<br>10 Hz to 100 kHz | 0.58 % to 0.01 % | Using Fluke 8845A DMM by Direct Method |
| | Frequency[♣] | 100 Hz to 2 MHz | 3.67 % to 0.53 % | Using UNI-T UT-805 5½ DMM by Direct Method |
| | Resistance[$] | 100 Ω to 100 MΩ | 0.02 % to 0.94 % | Using Fluke 8845A DMM by Direct Method |
| | Resistance[♣] | 10 Ω to 10 MΩ | 0.01% to 0.14% | Using UNI-T UT-805 5½ DMM by Direct Method |
| | Timer[$] | 60 s to 3600 s | 0.29 s to 0.72 s | Using Digital Stop Watch by Comparison Method |
| | Timer[♣] | 60 s to 3600 s | 0.17 s to 0.72 s | Using Digital Stop Watch by Comparison Method |

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|---|---|---|---|---|
| | **MECHANICAL CALIBRATION** | | | |
| **I.** | **DIMENSION (BASIC MEASURING INSTRUMENT, GAUGE ETC.)** | | | |
| **1.** | Pressure (Hydraulic)/ Pressure Gauges, Pressure Transmitters[$] | 0 bar to 700 bar | 0.03 % rdg | Using Digital Pressure Calibrator with External Transducer by Comparison Method as per DKD R-6-1 |
| **2.** | Pressure (Pneumatic) / Pressure Gauges, Pressure Transmitters[$] | 0 bar to 20 bar | 0.06 % rdg | Using Digital Pressure Calibrator by Comparison Method as per DKD R-6-1 |
| **3.** | Vacuum, Vacuum Gauges, Vacuum Transmitters[$] | (-) 0.85 bar to 0 bar | 0.20 % rdg | Using Digital Pressure Calibrator by Comparison Method as per ISO 3567 |
| **4.** | Differential Pressure (Pneumatic)/Gauges, Transmitters, Manometers[$] | (-) 25 mbar to 25 mbar | 0.15 % rdg | Using Digital Pressure Calibrator with Low Pressure Transducer by Comparison Method as per Euramet/ cg-17/v 2.0 |
| **5.** | Pressure (Hydraulic)/ Pressure Gauges , Pressure Transmitters[♣] | 0 bar to 700 bar<br>>700 bar to 1000 bar | 0.03 % rdg<br>0.07 % rdg | Using Digital Pressure Gauge by Comparison Method as per DKD R-6-1 |
| **6.** | Pressure(Pneumatic)/ Pressure Gauges, Pressure Transmitters[♣] | 0 bar to 3 bar<br>>3 bar to 30 bar | 0.24 % rdg<br>0.20 % rdg | Using Digital pressure Gauge by Comparison Method as per DKD R-6-1 |

| Sl. | Quantity Measured / Instrument | Range/Frequency | *Calibration Measurement Capability (±) | Remarks |
|---|---|---|---|---|
| **7.** | Vacuum, Vacuum Gauges, Vacuum Transmitters♣ | (-) 0.85 bar to 0 bar | 0.70 % rdg | Using Digital Pressure Gauge by Comparison Method as per ISO 3567 |
| **8.** | Differential Pressure (Pneumatic)/Gauges, Transmitters, Manometers♣ | (-) 20 mbar to 20 mbar | 0.32 % rdg | Using Digital Manometer by Comparison Method as per Euramet/ cg-17/v 2.0 |
| **9.** | RPM Tachometer - Contact Type$ | 100 rpm to 10000 rpm | 1.8 % to 0.17% rdg. | Using Digital Tachometer by Comparison Method - Based on SANAS TR 45-05 |
| **10.** | RPM Tachometer – Non-Contact Type$ | 60 rpm to 30000 rpm | 1.25 % to 0.01% rdg. | Using Digital Tachometer by Comparison Method – Based on SANAS TR 45-05 |
| **11.** | RPM Tachometer / Centrifuge/Rotating Machines (Non – Contact Type) ♣ | 60 rpm to 15000 rpm | 1.7 % to 0.06 % rdg. | Using Digital Tachometer by Comparison Method - SANAS TR 45-05 |
| **12.** | Vibration Meter$ (Velocity) | **1 kHz**<br>5.5 mm/s to 140 mm/s | 3.5 % rdg | Using Digital Vibration Meter by Comparison Method Based on OIML R 103 |
| **13.** | Sound Level Meter$ | 94 dB & 114 dB | 0.77 dB | Using Sound Level Calibrator by Comparison Method – Based on OIML R 58 Annexure B & C |

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|---|---|---|---|---|
| **14.** | Calipers[$] (Analog/Digital) L.C.: 0.01 mm | 0 to 150 mm | 8.9 µm | Using Gauge Block Comparison Method - based on IS: 3651 (Part-1 & 2) |
| **15.** | Micrometer[$] (Analog/Digital) L.C.: 0.001 mm | 0 to 25 mm | 1.7 µm | Using Gauge Block Comparison Method - based on IS:2967 |

| Sl. | Quantity Measured / Instrument | Range/Frequency | *Calibration Measurement Capability (±) | Remarks |
|---|---|---|---|---|
| | | **THERMAL CALIBRATION** | | |
| **I.** | **TEMPERATURE** | | | |
| | | (-) 100 °C to 140 °C | 0.14 ºC | Using Reference Thermometer Fluke 1523 with Fluke 5626 PRT Sensor, DMM Fluke 8845A and Field Metrology Dry Well Fluke 9190A as a Source by Comparison Method |
| | | 140 °C to 550 °C | 0.5 ºC | Using Reference Thermometer Fluke 1523 with Fluke 5626 PRT Sensor, DMM Fluke 8845A and Dry Block Calibrator as a Source By Comparison Method |
| | | 550 °C to 1000 °C | 3.48 ºC | Using Thermocouple Thermometer Delta Ohm HD 2108.1 with “R” Type Thermocouple, DMM Fluke 8845A and Dry Block Calibrator as a Source By Comparison Method |

| Sl. | Quantity Measured / Instrument | Range/Frequency | *Calibration Measurement Capability (±) | Remarks |
|---|---|---|---|---|
| **2.** | Temperature Indicator With Sensor[$] | (-) 100 °C to 140 °C | 0.12 ºC | Using Reference Thermometer Fluke 1523 with Fluke 5626 PRT Sensor, Field Metrology Dry Well Fluke 9190A as a Source By Comparison Method |
| | | 140 °C to 550 °C | 0.51 ºC | Using Reference Thermometer Fluke 1523 with Fluke 5626 PRT Sensor, Dry Block Calibrator as a Source By Comparison Method |
| | | 550 °C to 1000 °C | 3.44 ºC | Using Thermocouple Thermometer Delta Ohm HD 2108.1 with “R” type Thermocouple and Dry Block Calibrator as a Source By Comparison Method |
| **3.** | Temperature Gauge[$] | 0 °C to 550 °C | 1.25 ºC | Using Reference Thermometer Fluke 1523 with Fluke 5626 PRT Sensor, Dry Block Calibrator & Field Metrology Dry Well Fluke 9190A as a source By Comparison Method |
| **4.** | Infrared Thermometer[$] | 50 °C to 500 °C | 3.42 ºC | Using Precision RTD Thermometer Delta ohm HD 2107.1 By Comparison Method |

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|---|---|---|---|---|
| **5.** | Temperature & Humidity Meter/ Temperature & Humidity Data Logger/ Thermo Hygrometer[$] | Temp: 10 °C to 40 °C @ 50 %RH<br>RH: 30 %RH to 90 %RH @25 °C | Temp : 0.513 °C<br>Relative Humidity : 1.815 % | Using Temperature Humidity Meter Rotronic & HP22-A with portable Temperature Humidity Generator as a Source By Comparison Method |
| | | (-) 40 °C to 140 °C | 0.45 ºC | Using Digital Thermometer Delta Ohm HD 2307.0 & HD 2107.1 with SPRT Sensor, DMM UNI-T UT-805 and Metrology Well Fluke 9170 as a Source By Comparison Method |
| | | 140 °C to 500 °C | 1.00 ºC | Using Digital Thermometer Delta Ohm HD 2307.0 and HD 2107.1, with SPRT Sensor, DMM UNI-T UT-805 and Dry Block Calibrator and DMM as a Source By Comparison Method |
| | | 500 °C to 1100 °C | 3.48 ºC | Using Thermocouple Thermometer Delta Ohm HD 2128.2 with “S” Type Thermocouple, DMM UNI-T UT-805 and Dry Block Calibrator as a Source By Comparison Method |

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|---|---|---|---|---|
| **7.** | Temperature Indicator with Sensor♣ | (-) 40 °C to 140 °C | 0.35 ºC | Using Digital Thermometer Delta Ohm HD 2307.0 & HD 2107.1, with SPRT Sensor and Metrology Well Fluke 9170 as a Source By Comparison Method |
| | | 140 °C to 500 °C | 0.92 ºC | Using Digital Thermometer Delta Ohm HD 2307.0 & HD 2107.1 with SPRT Sensor and Dry Block Calibrator as a Source By Comparison Method |
| | | 500 °C to 1100 °C | 4.09 °C | Using Thermocouple Thermometer Delta Ohm HD 2128.2 with “S” Type Thermocouple and Dry Block Calibrator as a Source By Comparison Method |
| **8.** | Indicator of Oven, Incubator (for Non Medical Applications), Freezer, Autoclave, Cold Room, Liquid Bath, Dry Block Calibrator (Single Point) ♣ | (-)100 °C to 300 °C | 1.2 °C | Using Digital Thermometer Delta Ohm HD 2307.0 & HD 2107.1 with SPRT Sensor/RTD PT 100 Sensor along with Multichannel Paperless Recorder By Direct Method |

| Sl. | Quantity Measured / Instrument | Range/Frequency | *Calibration Measurement Capability (±) | Remarks |
|---|---|---|---|---|
| **9.** | Indicator of Muffle Furnace, Dry Block Calibrator (Single Point) ♣ | 300 °C to 1100 °C | 2.2 °C | Using Thermo couple Thermometer with "S" Type Thermocouple / "N"/T Type Thermocouple along with Multi-Channel Paperless Recorder By Direct Method |
| **10.** | Indicator of Climatic Chambers/ Humidity Chambers (Single Point) ♣ | 30 % RH to 90 % RH @ ~25 °C | 1.0 % RH @ 25 °C | Using Temperature Humidity Meter EQ-321S by direct method |
| **11.** | Oven, Incubator (for Non Medical Applications), Climatic Chamber, Freezer, Autoclave, Cold Room, Liquid Bath (Min 9 Point) ♣ | (-)100 °C to 150 °C | 3.0 °C | Using Multi Points RTD PT100 Sensor along with Multi-Channel Paperless Recorder. Spartial Mapping by Comparison Method & As per DKD-R-5-7, AMS 2750E |
| **12.** | Oven, Incubator (for Non Medical Applications), Chamber, Freezer, Autoclave, Cold Room, Liquid Bath (Min 9 Point) ♣ | 150 °C to 300 °C | 4.0 °C | Using Multi-Channel 'T' Type Thermocouple along with Multi-Channel Paperless Recorder. Spartial Mapping by Comparison Method & As per DKD-R-5-7, AMS 2750E |

| Sl. | Quantity Measured / Instrument | Range/Frequency | *Calibration Measurement Capability (±) | Remarks |
|---|---|---|---|---|
| **13.** | Muffle Furnace, Furnace (Min 9 Point) ♣ | 300 °C to 1100 °C | 10.2 °C | Using Multi-Channel 'N' Type Thermocouple along with Multi-Channel Paperless Recorder. Spartial Mapping by Comparison Method & As per DKD-R-5-7, AMS 2750E |

*** Measurement Capability is expressed as an uncertainty (±) at a confidence probability of 95%**
**$Only in Permanent Laboratory**
**♣Only for Site Calibration**

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