

Laboratory Eltel Calibration Laboratory, Plot #39, KIADB Industrial Area,
Veerapura, Doddballapur, Bengaluru, Karnataka

Accreditation Standard ISO/IEC 17025: 2005

Certificate Number CC-2749 (In lieu of C-1079)

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Validity 16.06.2018 to 15.06.2020

Last Amended on 22.06.2018

| Sl. | Quantity Measured / Instrument | Range/Frequency | *Calibration Measurement Capability (\pm) | Remarks |
|---|--|---|---|--|
| <u>ELECTRO TECHNICAL CALIBRATION</u> | | | | |
| 1. | SOURCE | | | |
| 1. | DC Resistance ^s (Discrete) | 10 $\mu\Omega$ 100 $\mu\Omega$ 1m Ω 10m Ω 100m Ω 2 Ω 10 Ω 1000 Ω | 0.2% 0.12% 0.065% 0.065% 0.02% 0.07% 0.02% 0.02% | Using Vaiseshika STD & HEPC Resistors by Direct Method |
| 2. | DC High Resistance ^s (Discrete)) | 1k Ω to 1M Ω 10M Ω 100M Ω 1G Ω 10G Ω 100G Ω 1T Ω | 31ppm 100ppm 0.02% 0.6% 0.6% 1.2% 2.4% | Using IET-VRS High Resistance STD by Direct Method |
| 3. | Capacitance and Tan Delta ^s | 200pF, 0.05% to 10% 2kV to 10kV @ 50Hz | Cap:0.24pF, Tan δ :0.008% to 0.072% | Using Eltel STD Capacitance and Tan Delta Standard Set Up by Direct Method |
| 4. | DC Voltage ^s | 329mV to 32V 32V to 1000V | 0.019% to 0.012% 0.012% to 0.016% | Using Fluke Calibrator-5080A by Direct Method |

Dheeraj Chawla
Convenor

Avijit Das
Program Manager

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|-----|---------------------------------------|---|--|---|
| 5. | DC Current [§] | 329µA to 3.2mA 3.2mA to 32mA 32mA to 329mA 329mA to 1A 1A to 20A | 0.12% to 0.075% 0.075% to 0.059% 0.059% to 0.077% 0.077% to 0.17% 0.17% to 0.58% | Using Fluke Calibrator-5080A by Direct Method |
| 6. | AC Voltage [§] | 50Hz 32mV to 329mV 329mV to 32V 32V to 1000V | 0.64% to 0.19% 0.19% to 0.12% 0.12% to 0.37% | Using Fluke Calibrator-5080A by Direct Method |
| 7. | AC Current [§] | 50Hz 329µA to 3.2mA 3.2mA to 2.99A 2.99A to 10A 10A to 20A | 0.55% to 0.26% 0.26% to 0.12% 0.12% to 0.3% 0.3% to 0.6% | Using Fluke Calibrator-5080A by Direct Method |
| 8. | DC Resistance (Discrete) [§] | 1Ω to 10Ω 10Ω to 100Ω 100Ω to 10kΩ 10kΩ to 1MΩ 1MΩ to 100MΩ 100MΩ to 190MΩ | 1.3% to 0.18% 0.18% to 0.047% 0.047% to 0.03% 0.03% to 0.052% 0.052% to 0.58% 0.58% to 1.3% | Using Fluke Calibrator-5080A by Direct Method |
| 9. | Frequency [§] | 45Hz to 1kHz | 0.011% to 0.006% | Using Fluke Calibrator-5080A by Direct Method |
| 10. | Turns Ratio [§] | 1 to 5000 | 0.14% to 0.07% | Using Eltel TRS-5000 STD by Direct method |
| 11. | AC Power [§] | 120V-240V, 0.01A-20A @50Hz,Unity, 0.8lead, 0.5lag, 0.2lag | 0.31% to 1.6% | Using Fluke Calibrator-5080A by Direct Method |

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| 12. | Instrument Transformer Test Set (VT) Ratio & Phase Error # | 100V@50Hz- Ratio Error: $\pm 0\%$ to 3% Phase Error: ± 0 crad to 3crad | R.E: 85ppm to 245ppm P.E: 0.4min to 0.84min | Using Eltel CVRPS-2013 Calibrator By Direct method |
| 13. | Instrument Transformer Test Set (CT 1A & 5A) Ratio & Phase Error# | 1A & 5A @ 50Hz Ratio Error: $\pm 0\%$ to 3% Phase Error: ± 0 crad to 3crad | R.E: 80ppm to 247ppm P.E: 0.4min to 0.82min | Using Eltel CVRPS-2013 Calibrator By Direct method |
| 14. | Capacitance & Tan Delta # | Cap.:230pF & 1000pF @ 50Hz Tan Delta:0%,0.05%,0.1%, 0.5%,1%,2% & 5% @ 50Hz, 2kV to 10kV | 230pF@50Hz: 0.51pF 1000pF@50Hz: 1.47pF Tan δ :- 0%:0.024% 0.05%:0.025% 0.1%:0.025% 0.5%:0.028% 1%:0.031% 2%:0.040% 5%:0.055% | Using Eltel Precision C&DF calibrator by Direct Method |
| II. | MEASURE | | | |
| 1. | DC Voltage ^s | 100mV to 10V 10V to 100V 100V to 1000V | 100ppm to 34ppm 34ppm to 51ppm 51ppm to 60ppm | Using Fluke 61/2 DMM 8846A by Direct Method |
| 2. | DC Current ^s | 100 μ A to 1mA 1mA to 100mA 100mA to 1A 1A to 10A | 0.09% to 0.086% 0.086% to 0.064% 0.064% to 0.082% 0.082% to 0.21% | Using Fluke 61/2 DMM 8846A by Direct Method |
| 3. | AC Voltage ^s | 50Hz 100mV to 1000V | 0.12% to 0.11% | Using Fluke 61/2 DMM 8846A by Direct Method |

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|-----|--|---|--|--|
| 4. | AC Current [§] | 50Hz 100µA to 10mA 10mA to 1A 1A to 10A | 0.18% 0.18% 0.18% to 0.25% | Using Fluke 61/2 DMM 8846A by Direct Method |
| 5. | DC Resistance [§] (2 Wire) | 10Ω to 100 Ω 100 Ω to 1MΩ 1MΩ to 100MΩ 100MΩ to 1GΩ 1GΩ to 1TΩ | 0.046% to 0.016% 0.016% to 0.013% 0.013% to 0.047% 2.3% 2.3% to 6.2% | Using Fluke 61/2 DMM 8846A /Eltel ADTR by Direct Method |
| 6. | Frequency [§] | 40 Hz to 1kHz | 0.012% | Using Fluke 61/2 DMM 8846A by Direct Method |
| 7. | Capacitance & Tan Delta [§] (Upto 2kV) | Cap: 100pF to 1000pF Tan Delta: 1x10 ⁻⁴ to 1.2X10 ⁻³ | 0.4% to 0.14% 0.00016 | Using Eltel ADTR test set by Direct method |
| 8. | Ratio & Phase Error [§] (Calibration of CT VT Ratio/Phase Error STD) | 100V@ 50Hz R.E:0% to 3% P.E:0crad to 3crad 1A & 5A @50Hz R.E:0% to 3% P.E:0crad to 3crad | R.E:82ppm to 230ppm P.E:0.0088 to 0.023crad | Using Eltel AITTS by Direct Method |
| 9. | Current Transformer Burden [#] (1A & 5A) | 1VA-5VA@UPF 2.5VA-75VA@0.8pF | 0.34% 0.8 to 0.38% | Using Yokogawa-WT-210 Power Analyzer & DMM8846A by Direct method |
| 10. | Voltage Transformer Burden [#] (110V & 63.5V) | 1.25VA to 10VA @UPF 1.25VA to 200VA @0.8pF | 0.29% to 0.27% | Using Yokogawa-WT-210 Power Analyzer & DMM8846A by Direct method |

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| 11. | Current Transformer Ratio & Phase Error [#] | Primary: 5A to 6000A Secondary:5A & 1A | Ratio Error: 120% to 10%:89 to 91ppm 10% to 5%: 91 to 148ppm 5% to 1%: 148 to 249ppm Phase Error 120% to 10%: 0.63 to 0.74min 10%to 5%:0.74 to 1.25min 5% to 1%: 1.25 to 2.35min | Using Eltel STD CT-2509A,STD AITTS by Comparison method |
| 12. | Potential Transformer Ratio & Phase Error [#] | 1.1kV to 33kV | R.E: 0.06% P.E:2.36min | Using Eltel EPD, Capacitor and AITTS by Comparison method |

* Measurement Capability is expressed as an uncertainty (\pm) at a confidence probability of 95%

^{\$} Only in Permanent Laboratory

[#] 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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