

Laboratory Instrument Installation and Maintenance Engineers, Building No. 1590, 17<sup>th</sup> Main Road, J P Nagar, 2<sup>nd</sup> Phase, Bangalore, Karnataka

Accreditation Standard ISO/IEC 17025: 2005

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Validity 04.07.2018 to 24.04.2020 Last Amended on 01.02.2019

Sl.	Quantity Measured / Instrument	Range/Frequency	*Calibration Measurement Capability ( $\pm$ )	Remarks
<b><u>ELECTRO TECHNICAL CALIBRATION</u></b>				
<b>I.</b>	<b>SOURCE</b>			
1.	DC Voltage <sup>#</sup>	1mV to 100mV 100mV to 100V 100V to 1000V	0.12% to 0.004% 0.004 % 0.004% to 0.0025%	Using Multiproduct Calibrator Fluke 5520A & 5500A by Direct Method
2.	AC Voltage <sup>#</sup>	<b>45Hz to 10kHz</b> 1mV to 33mV 33mV to 33V 33V to 100V  <b>10kHz to 20kHz</b> 33mV to 33V 33V to 100V  <b>20kHz to 100kHz</b> 33mV to 33V 33V to 100V  <b>45Hz to 8kHz</b> 100V to 1000V	0.8% to 0.05% 0.05 % 0.03% to 0.035%  0.05% 0.03% to 0.04%  0.07 % to 0.17% 0.17% to 0.3%  0.035% to 0.04%	Using Multiproduct Calibrator Fluke 5520A & 5500A by Direct Method
3.	DC Current <sup>#</sup>	10 $\mu$ A to 330 $\mu$ A 0.33mA to 100mA 100mA to 3A 3A to 20A  20A to 1000A	0.26% to 0.025% 0.025% to 0.015% 0.015% to 0.07% 0.07% to 0.12%  1.4% to 0.66%	Using Multiproduct Calibrator Fluke 5520A & 5500A by Direct Method  Using Fluke 5500A & Current Coil by Direct Method

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4.	AC Current <sup>#</sup>	<b>45Hz to 1kHz</b> 33 $\mu$ A to 33mA 33mA to 330mA 0.33A to 3A  <b>1kHz to 5kHz</b> 33mA to 330mA 0.33A to 3A  <b>5kHz to 10kHz</b> 33mA to 330mA 0.33A to 3A  <b>45Hz to 1kHz</b> 3A to 11A 11A to 20A  <b>1kHz to 5kHz</b> 3A to 11A 11A to 20A  <b>45Hz to 65Hz</b> 20A to 1000A	0.6% to 0.06% 0.06% 0.10% to 0.08%  0.12% to 0.14% 0.10% to 0.75%  0.30% 0.14% to 3.1%  0.15% to 0.14% 0.20% to 0.21%  0.15% to 3.5% 0.23% to 3.5%  2.1% to 0.77%	Using Multiproduct Calibrator Fluke 5520A & 5500A by Direct Method       Using Fluke 5500A & Current Coil by Direct Method
5.	DC Resistance <sup>#</sup>	400 $\mu$ $\Omega$ to 40k $\Omega$ (Fixed Values)  1 $\Omega$ to 100 $\Omega$ 100 $\Omega$ to 100k $\Omega$ 100k $\Omega$ to 11M $\Omega$ 11M $\Omega$ to 110M $\Omega$ 110M $\Omega$ to 500M $\Omega$  500M $\Omega$ to 10G $\Omega$	0.12% to 0.012%  0.12% to 0.005% 0.005% to 0.004% 0.004% to 0.02% 0.02% to 0.10% 0.10% to 1.9%  1.9% to 2.3%	Using Cropico MTS-2 (Fixed Resistance) by Direct Method      Using Multiproduct Calibrator Fluke 5520A & 5500A by Direct Method   Using Resistance Boxes by Direct Method

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Sl.	Quantity Measured / Instrument	Range/Frequency	*Calibration Measurement Capability ( $\pm$ )	Remarks
6.	Frequency <sup>#</sup>	1Hz to 1 MHz 1 MHz to 10MHz 10MHz to 990MHz	0.006% to 0.0003% 0.0003% to 0.003% 0.003% to 0.0003%	Using Multiproduct Calibrator Fluke 5520A & 5500A, Function Generator & Signal Generator by Direct Method
7.	Oscilloscope <sup>#</sup> Amplitude  Time Base  Bandwidth	<b>10 Hz to 10kHz</b> 5mV <sub>pp</sub> to 50V <sub>pp</sub>  2ns to 500ms 500ms to 5s  Up to 600MHz	2.6% to 0.3%  0.04% to 0.06% 0.06% to 0.6%  6%	Using Multiproduct Calibrator Fluke 5500A by Direct Method  Using Multiproduct Calibrator Fluke 5500A by Direct Method  Using Multiproduct Calibrator Fluke 5500A, Signal Generator HP 8656B by Direct Method
8.	Capacitance <sup>#</sup>	<b>1kHz</b> 0.19nF to 330nF  <b>100Hz</b> 330nF to 1.09mF	6.6% to 0.45%  0.45% to 0.7%	Using Multiproduct Calibrator Fluke 5520A & 5500A by Direct Method

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9.	Temperature Simulation <sup>#</sup> (Calibration of Temperature Indicator, Controller, Recorder Process Calibrator)			Using Multiproduct Calibrator Fluke 5520A, 5500A , Loop Calibrators Druck DPI 812 & 822 by Direct Method
	RTD	(-)200°C to 800°C	0.015°C	
	T Type Thermocouple	(-)200°C to 400°C	0.20°C	
	J Type Thermocouple	(-)200°C to 1200°C	0.20°C	
	K Type Thermocouple	(-)200°C to 1372°C	0.20°C	
	R Type Thermocouple	0°C to 1765°C	0.38°C	
	S Type Thermocouple	0°C to 1765°C	0.43°C	
	B Type Thermocouple	600°C to 1800°C	0.40°C	
	C Type Thermocouple	0°C to 2300°C	0.35°C	
	E Type Thermocouple	(-)200°C to 1000°C	0.20°C	
	L Type Thermocouple	(-)200°C to 900°C	0.16°C	
	N Type Thermocouple	(-)200°C to 1300°C	0.27°C	
U Type Thermocouple	(-)200°C to 600°C	0.23°C		
10.	DC Power <sup>#</sup>	5V to 750V 0.02A to 20 A 10mW to 15kW	0.07% to 0.08%	Using Multiproduct Calibrator Fluke 5520A & 5500A by Direct Method

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11.	AC Power <sup>#</sup> (1 $\phi$ ) Upf  Pf=0.8  Pf=0.5	<b>50Hz</b> <b>50V to 600V</b> <b>0.02A to 20A</b> 1.0W to 12kW  <b>50Hz</b> <b>100V to 600V</b> <b>0.1A to 20A</b> 8W to 9.6kW  <b>50Hz</b> <b>100V to 600V</b> <b>0.1A to 20A</b> 5W to 6kW	0.12%  0.24%  0.46%	Using Multiproduct Calibrator Fluke 5520A by Direct Method
II.	<b>MEASURE</b>			
1.	DC Voltage <sup>#</sup>	0.1mV to 100mV 100mV to 100V 100V to 1000V	0.35% to 0.0012% 0.0012% to 0.0008% 0.0008% to 0.0012%	Using Agilent 3458A 8 1/2 DMM & Fluke 8846A 6 1/2 DMM and Keithley 2000, 2700 by Direct Method
2.	DC High Voltage <sup>#</sup>	1kV to 10kV	3% to 3.5%	Using HV Probe Fluke 80K-40, Tektronix P6015A Oscilloscope TDS 2012B by Direct Method

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Sl.	Quantity Measured / Instrument	Range/Frequency	*Calibration Measurement Capability ( $\pm$ )	Remarks
3.	AC Voltage <sup>#</sup>	<b>50Hz to 20kHz</b> 1mV to 100mV 100mV to 100V  <b>20kHz to 100kHz</b> 1mV to 100mV 100mV to 100V  <b>50 Hz to 10kHz</b> 100V to 1000V	0.29% to 0.025% 0.025%  0.30% to 0.1% 0.025% to 0.15%  0.03% to 0.10%	Using Agilent 3458A 8 ½ DMM & Fluke 8846A 6 ½ DMM and keithley 2000, 2700 by Direct Method
4	AC High Voltage <sup>#</sup>	<b>50Hz</b> 1kV To 10kV	4.0% to 4.5%	Using HV Probe Fluke 80K-40, Tektronix P6015A Oscilloscope TDS 2012B by Direct Method
5.	DC Current <sup>#</sup>	10µA to 10mA 10mA to 1A 1A to 10A  10A to 30A	0.01% to 0.0035% 0.0035% to 0.02% 0.02% to 0.20%  0.20% to 0.40%	Using Agilent 3458A 8 ½ DMM & Fluke 8846A 6 ½ DMM and keithley 2000, 2700 by Direct Method  Using Agilent 34330A Current Shunt DC by Direct Method
6.	AC Current <sup>#</sup>	<b>50Hz to 5kHz</b> 29µA to 10mA 10mA to 1A  <b>50Hz to 1kHz</b> 1A to 10A	0.45% to 0.09% 0.1% to 0.14%  0.14% to 0.25%	Using Agilent 3458A 8 ½ digit multimeter & Fluke 8846A 6 ½ digit multimeter and keithley 2000, 2700 by Direct Method

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Sl.	Quantity Measured / Instrument	Range/Frequency	*Calibration Measurement Capability (±)	Remarks
		50Hz to 1kHz 10A to 30A	0.25% to 0.55%	Using Agilent 34330A Current Shunt AC by Direct Method
7.	DC Resistance <sup>#</sup>	1Ω to 1kΩ 1kΩ to 100kΩ 100kΩ to 1MΩ 1MΩ to 1000MΩ	0.05 % to 0.0015 % 0.0015% 0.0015% to 0.003% 0.003% to 0.57%	Using Agilent 3458A 8 ½ DMM & Fluke 8846A 6 ½ DMM and Keithley 2000, 2700 by Direct Method
8	Frequency <sup>#</sup>	1Hz to 10MHz 10MHz to 500MHz	0.0001% to 0.00015% 0.00015% to 0.00012%	Using Agilent 3458A 8 ½ digit multimeter & Fluke 8846A 6 ½ digit multimeter and Keithley 2000, 2700 by Direct Method
9.	Period <sup>#</sup>	1 Sec to 100nSec 100nSec to 2 nSec	0.005% to 0.00012% 0.00012%	Using Pendulum CNT 90 counter, Oscilloscope Tektronix TDS 2012b by Direct Method
10.	Time <sup>#</sup>	1 Sec to 9900Sec	0.06% to 0.0065%	Using Pendulum CNT 90 counter by Direct Method
11.	Temperature Simulation <sup>#</sup> (Calibration of Temperature Simulators, Process Calibrator)			
	RTD	(-)200°C to 800°C	0.003°C	Using Agilent 8 ½ Digit DMM, Fluke 8446A, Keithley 2700 & 2000 by Direct Method
	T Type Thermocouple	(-)200°C to 400°C	0.013°C	
	J Type Thermocouple	(-)200°C to 1200°C	0.010°C	
	K Type Thermocouple	(-)200°C to 1370°C	0.011°C	
	R Type Thermocouple	0°C to 1765°C	0.033°C	
	S Type Thermocouple	0°C to 1765°C	0.033°C	
	B Type Thermocouple	600°C to 1800°C	0.040°C	
	C Type Thermocouple	0°C to 2310°C	0.028°C	
	E Type Thermocouple	(-)200°C to 1000°C	0.010°C	
	L Type Thermocouple	(-)200°C to 900°C	0.010°C	
	N Type Thermocouple	(-)200°C to 1300°C	0.015°C	
	U Type Thermocouple	(-)200°C to 600°C	0.012°C	

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<b><u>MECHANICAL CALIBRATION</u></b>				
<b>I. PRESSURE INDICATING DEVICES</b>				
1.	Pressure-Pneumatic <sup>#</sup> (Dial and Digital Pressure Gauges , Pressure Transmitter)	10mbar to 700mbar 0.7bar to 2bar 2bar to 20bar	0.5mbar 0.003bar 0.015bar	Using Digital Pressure Indicator with Pneumatic pump by Comparison Method based on DKD-R6-1
2.	Pressure-Hydraulic <sup>#</sup> (Dial and Digital Pressure Gauges, and Pressure Transmitter)	0 bar to 700 bar	0.5bar	Using Digital Pressure Indicator 0-700 & Hydraulic Pump by Comparison Method based on DKD-R6-1
3.	Vacuum <sup>#</sup> (Dial and Digital Vacuum Gauges Indicators, Vacuum Transmitter)	-0.9 bar to 0 bar	0.003 bar	Using Digital Pressure Indicator with Vacuum pump by Comparison Method based on DKD-R6-2
<b>II. ACCELERATION AND SPEED</b>				
1.	RPM Indicators <sup>s</sup> / Tachometers (Non-Contact )	60 to 750RPM 750 to 15000 RPM	2.1% rdg 0.3% rdg	Using Digital Non-Contact RPM meter with Mechanical RPM generation source by Comparison method

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<b><u>THERMAL CALIBRATION</u></b>				
<b>1.</b>	<b>TEMPERATURE</b>			
1.	RTD/ Thermocouple With & without indicator <sup>#</sup>	(-)35°C to 200°C	0.30°C	Comparison Method
2.	RTD/ Thermocouple With & without indicator <sup>#</sup>	200°C to 350°C	0.60°C	Comparison Method
3.	RTD/ Thermocouple With & without indicator <sup>#</sup>	350°C to 1000°C	2.01°C	Using Digital Pressure Indicator with Vacuum pump by Comparison Method based on DKD-R6-2
4.	Thermal chambers, ovens, incubators, autoclaves, freezers, cooling cabinet, water bath <sup>*</sup> etc.	(-)35°C to 200°C	0.5°C	Using Single point calibration by Comparison method
5.	Thermal chambers, ovens, Furnace etc <sup>*</sup> .	200°C to 400°C	1°C	Using Single point calibration by Comparison method
6.	Thermal chambers, ovens, incubators, autoclaves, freezers, cooling cabinet, water bath etc <sup>*</sup>	400°C to 1000°C	2°C	Using Single point calibration by Comparison method
7.	Glass thermometer/ <sup>#</sup> temperature gauges	-10°C to 110°C	0.35°C	Using Comparison method

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8.	Thermal mapping of Thermal chamber, oven, cooling cabinets, Incubators, water bath, Autoclave, furnace, room etc. *	(-)40°C to 200°C	1°C	Using Multi point calibration
9.	Thermal mapping of mapping of Thermal chamber, oven, furnace etc. *	200°C to 400°C	2°C	Using Multi point calibration
10.	Thermal mapping of Thermal chamber, oven, furnace etc. *	400°C to 1000°C	3°C	Using Multi point calibration

\* 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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