Laboratory	**The Automotive Research Association of India, S. No. 102, Vetal Hill, Off. Paud Road, Kothrud, Pune, Maharashtra**			
Accreditation Standard	**ISO/IEC 17025: 2005**			
Certificate Number	**CC-2742** ***(In lieu of C-0120, C-0121, C-0136, C-1115)***	**Page**	**1 of 31**	
Validity	**28.06.2018 to 27.06.2020**	**Last Amended on**	**06.08.2018**	

Sl.	**Quantity Measured / Instrument**	**Range/Frequency**	***Calibration Measurement Capability (±)**	**Remarks**
	ELECTRO TECHNICAL CALIBRATION			
	SOURCE			
1.	Impedance Line Impedance Stabilization network(LISN), Coupling/ Decoupling Network(CDN) etc.	**10kHz to 230MHz** 2.72 to 200 Ω	7.3% to 14%	Using network Analyzer (ENA-5071) by Direct method
2.	Insertion loss RF Attenuation, cable loss Isolation Voltage division Factor Coupling Decoupling factor LISN, Attenuator, Bulk Current Injection probe, Directional Coupler, Cables etc. Gain for DUC's like Preamplifier	**9kHz to 6GHz** 0.1dB to 65 dB	0.63dB	Using network Analyzer (ENA-5071) by Direct method

Dheeraj Chawla
Convenor

Avijit Das
Program Manager

Sl.	Quantity Measured / Instrument	Range/Frequency	*Calibration Measurement Capability (±)	Remarks
3.	Return Loss (VSWR) Attenuator, Antenna, Load/Termination, Directional Coupler, Amplifier, etc	**9kHz to 6GHz** 1.0023 to 3.5	7.3% to 13%	Using network Analyzer (ENA-5071) Direct method
4.	Electro static Discharge Generator (ESD) Contact Discharge current First Peak current Current @30nsec or $t_1$ns Current @60nsec or $t_2$ns Rise /Fall time Air discharge DC voltage positive and negative	Contact Discharge current ±2kV to 30 kV±10% (0.15 A to 112.5A) I at 30 ns or I at t_1 ns & I at 60ns or I at t_2 ns (±30%) Rise/fall time 0.7 to 1ns Air discharge DC voltage ±(2-30kV)	4.86% to ±8.2% 6.96% to ±7.45% 2.69%	Using Digital Storage Oscilloscope Tektronix-DPO-7104, HV Probe with DMM & current target-Noiseken attenuator Chain by Direct method As per ISO 10605 :2008 Ed2.0

Sl.	Quantity Measured / Instrument	Range/Frequency	*Calibration Measurement Capability (±)	Remarks
5.	Electrical Fast transient Test system For generator output and CDN Pulse Amplitude Pulse Rise time Pulse width Repetition Frequency Burst duration Burst period For open ckt and 1000 ohm up to ± 4 kV and 50 ohm up to ±2Kv	±25V to ±4kV (±20%) 5 ns ±1.5ns 50ns (–15 ns to +100 ns) 150ns±45ns 4kHz-120kHz ±20% 0.7 ms-18 ms ±20% 300ms±20%	3 %(Amplitude) 4 %(Rise Time) 4% (Width) 4% (Frequency) 4% (Burst Duration) 4% (Burst period)	Using Digital Storage Oscilloscope Tektronix-DPO-7104 and Load Resistors by Direct Method as per IEC 61000-4-4:2012-04 Ed .3.0,ISO 7637-2:2004 and ISO 7637-2:2011
6.	Combination wave Surge test system Voltage amplitude Voltage front/rise time Voltage pulse width Current amplitude Current front /rise time Current pulse width	Voltage (±0.5kV to ±5kV) ±10% Front/Rise 1.2/1 μs±30% Width 50μs±20% Current (0.25 kA to 2kA) ±10% Front/Rise 8/6.4 us ±20% Width 20 /16 μs ±20%	3 %(Amplitude) 4%(Rise time) 4%(width) 5%(Current amplitude) 4%(Rise time) 4%(width)	Using Digital Storage Oscilloscope Tektronix-DPO-7104, HV Differential probe & current probe by Direct method as per IEC 61000-4-5 2014-05 Ed.3.0

Sl.	Quantity Measured / Instrument	Range/Frequency	*Calibration Measurement Capability (±)	Remarks
7.	Voltage Dips and interruption Voltage Time Output Voltage With load (up to 16A)	0-100 % 10 ms-5sec	3 %(Amplitude) 4% (time)	Using Digital Storage Oscilloscope Tektronix-DPO-7104, HV Differential Probe- Key sight Technologies-N2891A, current probe, DMM Direct Method IEC 61000-4-11:2004-03 Ed.2.0
8.	Voltage drop simulator DC Voltage Peak current Rise/Fall time Pulse width Open circuit Voltage	±(0-60 V) 0-40A Rise time 1ms- 10ms (±50%) 5ms to 5sec (±20%)	1% 4% (Amplitude) 4% (time) 4% (width)	Using Digital Storage Oscilloscope Tektronix-DPO-7104, HV Differential Probe-Keysight Technologies-N2891A, DMM, Clamp meter by Direct Method as per ISO 7637-2:2004 and ISO 7637-2:2011
9.	Micro pulse Generator output without load & With 10 & 50 ohm load Voltage Rise /Fall time Pulse width	±(20-600V) ±10%(w/o load) ±20%(with load) 1 μs-60 μs (+0%/-50%) 1.75 ms-6ms ±20%	3% (Amplitude) 4% (rise time) 4% (width)	Using Digital Storage Oscilloscope Tektronix-DPO-7104, HV probe, DMM, Load resistors By Direct method as per ISO 7637-2:2004 and ISO 7637-2:2011

Sl.	Quantity Measured / Instrument	Range/Frequency	*Calibration Measurement Capability (±)	Remarks
10.	Load Dump Generator output without load & With 2 ohm load Voltage Rise time Pulse width	(20 V to 200V) ±10% (w/o load) ±20% (with load) Rise time 5ms-10ms (+0%/-50%) Pulse width 40-400 ms ±20%	3% (Amplitude) 4% (rise time) 4% (width)	Using Digital Storage Oscilloscope Tektronix-DPO-7104, HV probe, DMM, Load resistors by Direct method ISO 7637-2:2004 and ISO 7637-2:2011
I.	**SOURCE**			
1.	DC Voltage[$]	0.1 mV to 1 mV 1 mV to 200 mV 200 mV to 22 V 22 V to 1000 V	0.49% to 0.049% 0.049% to 0.0012% 0.0012% to 0.0006% 0.0006% to 0.0009%	Using Multifunction Calibrator Fluke 5720A & 5725A By Direct method.
2.	DC Current[$]	10 µA to 220 µA 220 µA to 22 mA 22 mA to 2.2 A 2.2 A to 11 A 11A to 20 A 20 A to 1000 A	0.074% to 0.0084% 0.0084% to 0.0044% 0.0044% to 0.010% 0.010% to 0.047% 0.047%to 0.090% 0.86%	Using Multifunction Calibrator Fluke 5720A & 5725A By Direct method. Using Fluke 9100 & Current Coil By Direct method
3.	Resistance[$]	1 Ω to 19 Ω 19 Ω to 190 kΩ 190 kΩ to 1.9 MΩ 1.9 MΩ to 19 MΩ 19 MΩ to 100 MΩ 100 MΩ to 400 MΩ 400 MΩ to 999.9 MΩ	0.013% to 0.0027% 0.0027% to 0.0015% 0.0015% to 0.0027% 0.0027% to 0.0059% 0.0059% to 0.018% 0.018% to 0.36% 0.36 %to 0.55%	Using Multifunction Calibrator Fluke 5720 Discrete value 1 Ω, 1.9 Ω, 10 Ω, 19 Ω … up to 100 MΩ / Fluke 5502A By Direct method

Sl.	Quantity Measured / Instrument	Range/Frequency	*Calibration Measurement Capability (±)	Remarks
		1 GΩ 25 Ω 100 Ω 300 Ω 400 Ω	0.057% 4.6 ppm 4.6 ppm 4.6 ppm 4.6 ppm	Using Discrete AC / DC Resistors By Direct method.
4.	AC Voltage $	**10 Hz to 50 kHz** 1 mV to 2.2 mV 2.2 mV to 100 V	 0.49% to 0.29% 0.29% to 0.022%	Using Multifunction Calibrator Fluke 5720A & 5725A By Direct method.
		10 Hz to 20 kHz 100 V to 200 V	 0.033% to 0.0094%	
		50 kHz to 100 kHz 1 mV to 22 mV 22 mV to 100 V	 0.68% to 0.049% 0.10% to 0.022%	
		100 kHz to 300 kHz 1 mV to 2.2 mV 2.2 mV to 220 mV 220 mV to 22 V	 1.3% to 0.39% 0.79% to 0.064% 0.12% to 0.016%	
		300 kHz to 500 kHz 1 mV to 22 V	 2.5% to 0.042%	
		500 kHz to 1 MHz 1 mV to 22 V	 2.7% to 0.14%	
		40 Hz to 20 kHz 200 V to 1000 V	 0.01% to 0.03%	

Sl.	Quantity Measured / Instrument	Range/Frequency	*Calibration Measurement Capability (±)	Remarks
5.	AC Current[$]	**10 Hz to 1 kHz** 10 µA to 220 µA 220 µA to 220 mA	 0.22 % to 0.02% 0.039 to 0.019%	Using Multifunction Calibrator Fluke 5720 A & 5725 A by Direct Method
		40 Hz to 1 kHz 220 mA to 10 A	0.02% to 0.059%	Using Multifunction Calibrator Fluke 5720A & 5725A/ By Direct method.
		1 kHz to 5 kHz 20 mA to 220 mA 220 mA to 10 A	0.04 %to 0.019% 0.03 % to 0.12%	
		5 kHz to 10 kHz 20 mA to 10 A	0.03% to 0.42%	
		40 Hz to 1 kHz 10 A to 20 A	0.1 %to 0.3% 0.2 %	
		50 Hz 20 A to 1000 A	0.8%	Using Fluke 9100 & Current Coil By Direct Method.
6.	AC Power [$]	120V to 240V/10 mA to 20A @ UPF, 50 Hz) 1.2 W to 120 W 120 W to 1200 W 1200 W to 4800 W	 0.094 % 0.094 % to 0.18 % 0.18 %	Using Fluke 5502A By Direct Method.
7.	DC Power[$]	1 W to 12 kW	0.055% to 0.13%	Using Fluke 5502A By Direct Method
8.	Power Factor/ Phase Angle [$]	0 - 1	0.32 – 0.18 (0.2 pF – UPF 50 Hz)	Using Fluke 5502A By Direct Method

Sl.	Quantity Measured / Instrument	Range/Frequency	*Calibration Measurement Capability (±)	Remarks
9.	Temperature Simulation[$]			Using Multifunction Calibrator Fluke 5720 & 5725A Simulation mV / Ω Measurement
	K Type Thermocouple	(-)250 °C to (-)200 °C (-)200 °C to 1370 °C	0.15 to 0.06°C 0.06 to 0.03°C	
	J Type Thermocouple	(-)210 °C to (-)200 °C (-)200 °C to 1200 °C	0.03 to 0.02 °C 0.02°C	
	E Type Thermocouple	(-)250 °C to (-)200 °C (-)200 °C to 1000 °C	0.06 to 0.03°C 0.03 to 0.02°C	
	N Type Thermocouple	(-)250 °C to (-)200 °C (-)200 °C to 1300 °C	0.20 to 0.08°C 0.08 to 0.03°C	
	R Type Thermocouple	0 °C to 100 °C 100 °C to 1768 °C	0.1 to 0.06°C 0.06°C	
	S Type Thermocouple	0 °C to 100 °C 100 °C to 1768 °C	0.1 to 0.07°C 0.07°C	
	B Type Thermocouple	200 °C 201 °C to 1820 °C	0.24°C 0.24 to 0.06°C	
	T Type Thermocouple	(-)250 °C to (-)200 °C (-)200 °C to 400 °C	0.09 to 0.04°C 0.04 to 0.02°C	
	RTD	(-)200 °C to 850 °C	0.03°C	Using Fluke 5502A, Discrete Resistance & 8 ½ Digital Multimeter By Simulation method

Sl.	Quantity Measured / Instrument	Range/Frequency	*Calibration Measurement Capability (±)	Remarks
10.	DC Capacitance $	0.4 nF to 3.2 nF 3.2 nF to 320 nF 320 nF to 320 µF 320 µF to 32 mF 32 mF to 110 mF	3.59 to 0.97 0.97 to 0.44 0.44 to 0.65 0.65 to 1.00 1.00 to 1.40	Using Fluke 5502A By Direct method.
11.	Frequency $	1 Hz to 350 MHz	12ppm to 1.5 ppm	Using Function Generator with Keysight Counter 53220 Comparison
12.	Period $	5 ns to 5.0 s	14 ppm to 0.58 % (5 ns – 5s)	Using Function Generator with Keysight Counter 53220 Comparison
13.	Vertical Deflection$ (Square Wave, DC Function & Sine Function) Horizontal Deflection Bandwidth	2 mVpp to 120 Vpp 4 ns to 5.5 s 50 kHz to 600 MHz	0.3% 0.0015% 1.5% to 6.3%	Using Fluke 9100 Direct
14.	DC Voltage♣	1 mV to 10 mV 10 mV to 1000 V	0.50% to 0.043% 0.043% to 0.009%	Using Fluke 9100 By Direct method
15.	DC Current♣	32 µA to 320 µA 320 µA to 320 mA 320 mA to 20 A 20 A to 1000 A	0.07% to 0.021% 0.021% to 0.026% 0.026% to 0.09% 0.86%	Using Fluke 9100 By Direct method. With Current Coil
16.	Resistance♣	1 Ω to 40 Ω 40 Ω to 400 kΩ 400 kΩ to 320 MΩ 320 MΩ to 1100 MΩ	0.08% to 0.011% 0.011% to 0.02% 0.02 %to 0.4% 0.4% to 1.8%	Using Fluke 9100 By Direct method.

Sl.	Quantity Measured / Instrument	Range/Frequency	*Calibration Measurement Capability (±)	Remarks
17.	AC Voltage♣	**10 Hz to 10 kHz** 32 mV to 3.2 V 3.2 V to 100 V **40 Hz to 10 kHz** 100 V to 750 V **40 Hz to 1 kHz** 750 V to 1000 V **10 kHz to 30 kHz** 32 mV to 300 V	 0.25% to 0.06% 0.06% to 0.08% 0.08% to 0.1% 0.1% 1% to 0.2%	Using Fluke 9100 / 5502A By Direct method.
18.	AC Current♣	**10 Hz to 1 kHz** 100 µA to 300 µA **10 Hz to 3 kHz** 300 µA to 300 mA 300 mA to 3A **10 Hz to 3 kHz** 3 A to 10 A **40 Hz to 1 kHz** 10 A to 20 A **50 Hz** 20 A to 1000 A	 0.43% to 0.2% 0.2% to 0.12% 0.12% to 0.3% 0.2% 0.27% 0.8%	Using Fluke 9100 By Direct method Using Fluke 9100 & Current Coil By Direct method.

Sl.	Quantity Measured / Instrument	Range/Frequency	*Calibration Measurement Capability (±)	Remarks
19.	AC Power♣	120V to 240V/10 mA to 20A @ UPF, 50 Hz) 1.2 W to 120 W 120 W to 1200 W 1200 W to 4800 W	 0.094 % 0.094 % to 0.18 % 0.18 %	Using Fluke 5502A By Direct method.
20.	Dc Power ♣	1 W to 12 kW	0.055 to 0.13	
21.	Power Factor/Phase Angle ♣	0 to 1	0.32 to 0.18 (0.2 to UPF 50Hz)	Using Fluke 5502A By Direct method.
22.	Capacitance ♣	0.4 nF to 3.2 nF 3.2 nF to 320 nF 320 nF to 400 µF 400 µF to 32 mF 32 mF to 110 mF	3.59% to 0.97% 0.97% to 0.44% 0.44% to 0.65% 0.65% to 1.00% 1.00% to 1.4%	Using Fluke 5502A By Direct method.
23.	Frequency ♣	1 Hz to 350 MHz	12 ppm to 1.5 ppm	Using Function Generator with Keysight Counter 53220 Comparison
24.	Period ♣	5 ns to 5 s	0.0014 to 0.58 (5 ns – 5 s)	Using Function Generator with Keysight Counter 53220 Comparison

Sl.	Quantity Measured / Instrument	Range/Frequency	*Calibration Measurement Capability (±)	Remarks
25.	Temperature Simulation♣			Using Beamex Calibrator mV / Ω Measurement Simulation
	K Type Thermocouple	(-)200 °C to(-)100 °C (-)100 °C to 400 °C 400 °C to 1370 °C	0.36°C 0.36°C °C 0.2°C 0.2°C °C 0.4°C	
	J Type Thermocouple	(-)210 °C to -200 °C (-)200 °C to 200 °C 200 °C to 1200 °C	0.28°C °C 0.25°C 0.23°C °C 0.1°C 0.1°C °C 0.25°C	
	E Type Thermocouple	(-)250 °C to (-)200 °C (-)200 °C to 400 °C 400 °C to 800 °C 800 °C to 1000 °C	0.6°C 0.6°C °C 0.1°C 0.1°C °C 0.2°C 0.3°C	
	B Type Thermocouple	500°C to 1820 °C	2.3°C °C 0.6°C	
	R Type Thermocouple	0 °C to 200 °C 200 °C to 1768 °C	0.8°C 0.8°C °C 0.4°C	
	S Type Thermocouple	0 °C to 200 °C 200 °C to 1768 °C	0.8°C 0.8°C °C 0.5°C	
	T Type Thermocouple	(-)250 °C to (-)200 °C (-)200 °C to 400 °C	0.8°C 0.8°C °C 0.2°C	
	N Type Thermocouple	(-)200 °C to 100 °C 100 °C to 1200 °C	0.5°C 0.5°C °C 0.2°C	
	RTD	(-)200 °C to 100 °C 100 °C to 400 °C 400 °C to 850 °C	0.1°C 0.1°C °C 0.2°C 0.2°C °C 0.3°C	

Sl.	Quantity Measured / Instrument	Range/Frequency	*Calibration Measurement Capability (±)	Remarks
26.	Vertical deflection♣ (Square Wave, DC Function & Sine Function) Horizontal Deflection Bandwidth	2 mVpp to 120 Vpp 4 ns to 5.5 s 50 kHz to 600 MHz	0.3 0.0015% 1.5% to 6.3%	Using Fluke 9100 By Direct method.
II.	**MEASURE**			
1.	DC Voltage$	0.1 mV to 1 mV 1 mV to 200 mV 200 mV to 1000 V 1 kV to 5 kV	0.13% to 0.013% 0.013% to 0.0007% 0.0007% to 0.001% 2.5%	Using 8 ½ Digital Multimeter By Direct method.
2.	DC Current$	10 µA to 200 µA 200 µA to 200 mA 200 mA to 2 A 2 A to 20 A	0.0071% to 0.0026% 0.0026% to 0.0063% 0.0063% to 0.022% 0.022% to 0.049%	Using 8 ½ Digital Multimeter By Direct method.
3.	Resistance$	1 Ω to 200 kΩ 200 kΩ to 20 MΩ 20 MΩ to 200 MΩ 200 MΩ to 1 GΩ	0.0063% to 0.0011% 0.0011% to 0.0038% 0.0038% to 0.023% 0.023% to 0.29%	Using 8 ½ Digital Multimeter By Direct method.
4.	AC Voltage $	**10 Hz to 10 kHz** 1 mV to 200 mV 200 mV to 200 V	 0.78% to 0.019% 0.017% to 0.026%	Using 8 ½ Digital Multimeter By Direct method.
		40 Hz to 20 kHz 200 V to 1000 V	 0.02% to 0.036%	
		10 kHz to 100 kHz 1 mV to 200 mV 200 mV to 100 V	 2.4% to 0.019% 0.04% to 0.12%	

Sl.	Quantity Measured / Instrument	Range/Frequency	*Calibration Measurement Capability (±)	Remarks
		100 kHz to 1 MHz 2 V to 20 V	2.3 % to 3.5%	
		50 Hz 1 kV to 10 kV	4.6%	
5.	AC Current $	**10 Hz to 1 kHz** 10 µA to 200 mA 200 mA to 20 A **1 kHz to 5 kHz** 100 µA to 20 A	 0.31% to 0.055% 0.055% to 0.1% 0.080% to 0.3%	
6.	Frequency #	1 Hz to 350 MHz	5 ppm to 1.6 ppm	Using Counter 53220 Comparison
7.	Period $	5 ns to 5 s	0.0032 to 0.58 (5 ns to 5 s)	Using Counter 53220 Comparison
8.	Time #	6 s to 24 hour	0.03 s	Using Counter 53131A Comparison

Sl.	Quantity Measured / Instrument	Range/Frequency	*Calibration Measurement Capability (±)	Remarks
9.	Temperature Simulation[$]			Using 8 ½ Digital Multimeter mV / Ω Measurement Simulation
	K Type Thermocouple	(-)250 °C to (-)200 °C (-)200 °C to 1370 °C	0.05°C to 0.02°C 0.02°C	
	J Type Thermocouple	(-)210 °C to 1200 °C	0.014°C to 0.012°C	
	E Type Thermocouple	(-)250 °C to (-)200 °C (-)200 °C to 1000 °C	0.028°C to 0.02°C 0.02°C to 0.012°C	
	N Type Thermocouple	(-)250 °C to (-)200 °C (-)200 °C to 1300 °C	0.06°C 0.06°C to 0.014°C	
	B Type Thermocouple	200 °C 201 °C to 1820 °C	0.07°C 0.07°C to 0.02°C	
	R Type Thermocouple	0 °C to 100 °C 100 °C to 1768 °C	0.05°C 0.05°C to 0.02°C	
	S Type Thermocouple	0 °C to 100 °C 100 °C to 1768 °C	0.05°C 0.05°C to 0.02°C	
	T Type Thermocouple	(-)250 °C to 400 °C	0.03°C	
	RTD	(-)200°C (-)199.99°C to 850°C	0.02°C 0.01°C to 0.016°C	

Sl.	Quantity Measured / Instrument	Range/Frequency	*Calibration Measurement Capability (±)	Remarks
10.	DC Voltage♣	1 mV to 100 mV 100 mV to 1000V 1 kV to 5 kV	0.42% to 0.0099% 0.0099% to 0.0064% 2.5%	Using 6 ½ Digital Multimeter By Direct method. Using 4 ½ Digital Multimeter with HV Probe By Direct method
11.	DC Current♣	100 µA to 100 mA 100 mA to 10 A 10 A to 20 A	0.7% to 0.06% 0.06% to 0.19% 0.19% to 0.36%	Using 6 ½ Digital Multimeter By Direct method.
12.	Resistance♣	1 Ω to 100 Ω 100 Ω to 100 kΩ 100 kΩ to 10 MΩ 10 MΩ to 100 MΩ 100 MΩ to 1000 MΩ	0.48% to 0.016% 0.016% to 0.013% 0.013% to 0.048% 0.048% to 0.93% 0.93% to 2.3%	Using 6 ½ Digital Multimeter By Direct method.
13.	AC Voltage♣	**10 Hz to 20 kHz** 1 mV to 100 mV 100 mV to 100 V **40 Hz to 1 kHz** 100 V to 1000 V **20 kHz to 50 kHz** 1 mV to 100 mV 100 mV to 100 V **40 Hz to 50 Hz** 1 kV to 10 kV	 5.05% to 0.12% 0.12% to 0.45% 0.1% to 0.2% 4.7% to 0.11% 0.11% to 0.2% 4.6%	Using 6½ Digital Multimeter By Direct method.

Sl.	Quantity Measured / Instrument	Range/Frequency	*Calibration Measurement Capability (±)	Remarks
14.	AC Current♣	**10 Hz to 5 kHz** 100 µA to 1 A 1 A to 10 A **50 Hz to 5 kHz** 10 A to 20 A	 0.5% to 0.2% 0.2% 0.4%	Using 6½ Digital Multimeter By Direct method Using 6½ Digital Multimeter & Shunt by V/I Method
15.	Period♣	5 ns to 5 s	0.0032 to 0.58 (5 ns – 5s)	Using Counter 53220 by Comparison Method

Sl.	Quantity Measured / Instrument	Range/Frequency	*Calibration Measurement Capability (±)	Remarks
16.	Temperature Simulation♣			Using 6 ½ Digital Multimeter mV / Ω Measurement Simulation
	K Type Thermocouple	(-)200 °C to (-)100 °C (-)100 °C to 400 °C 400 °C to 1370 °C	0.28°C 0.28°C to 012°C 0.12°C to 0.22°C	
	J Type Thermocouple	(-)210 °C to (-)200 °C (-)200 °C to 1200 °C	0.24°C to 0.2°C 0.2°C to 0.1°C	
	E Type Thermocouple	(-)250 °C to (-)100 °C (-)100 °C to 1000 °C	0.5°C to 0.1°C 0.1°C	
	B Type Thermocouple	500 °C to 800 °C 800 °C to 1820 °C	0.8°C to 0.6°C 0.6°C to 0.4°C	
	R Type Thermocouple	0 °C to 50 °C 50 °C to 1768 °C	0.8°C to 0.6°C 0.6°C to 0.4°C	
	S Type Thermocouple	0 °C to 50 °C 50 °C to 1768 °C	0.8°C to 0.7°C 0.7 °C to 0.5°C	
	T Type Thermocouple	(-)250 to (-)200 °C (-)200 °C to (-)100 °C (-)100 °C to 400 °C	0.6°C to 0.3°C 0.3°C to 0.25°C 0.25°C to 0.1°C	
	N Type Thermocouple	(-)250 to (-)100 °C (-)100 °C to 1300 °C	0.5°C to 0.2°C 0.2°C	
	RTD	(-)200 °C to 0 °C 0 °C to 400 °C 400 °C to 850 °C	0.04°C 0.04°C to 0.1°C 0.1°C to 0.2°C	

Sl.	Quantity Measured / Instrument	Range/Frequency	*Calibration Measurement Capability (±)	Remarks
	FLUID FLOW CALIBRATION			
I.	**VOLUMETRIC FLOW METERS**			
1.	Air[$] 10 upto ≤ 30 LPM >30 upto ≤ 100 LPM > 100 upto ≤ 200 LPM	 10 to 200 LPM 10 to 200 LPM 10 to 200 LPM	 1.5% Rdg 1.05% Rdg 1.02%Rdg	1. Laminar Flow Element 2. Differential Pressure Sensor 3. Absolute Pressure Sensor 4. Temperature Sensor 5. Data Logger 6. Humidity Sensor (Meteo station) 7. Blow by Calibration rig By Comparison Method

Sl.	Quantity Measured / Instrument	Range/Frequency	*Calibration Measurement Capability (±)	Remarks
	MECHANICAL CALIBRATION			
I.	**PRESSURE INDICATING DEVICES**			
1.	Digital / Analogue Pressure Gauges, Manometer, Pressure Transmitter, Pressure Indicating Instruments #	0 to 25 bar	0.013 % rdg.	Using Fluke Pressure Controller, 7252i or Process Calibrator with different modules with comparator Based on DKD-R6-1
2.	Digital / Analogue Pressure Gauges, Manometer, Pressure Transmitter, Pressure Indicating Instruments #	0 to (±) 250 mbar	0.12 % rdg.	Using Pressure Controller Mensor / Wika having different modules of 25 mbar to 25 bar or Process Calibrator with different modules with comparator Based on DKD-R6-1
3.	Digital / Analogue Vacuum Gauges, Manometer, Vacuum Transmitter, Pressure Indicating Instruments #	0 to -0.90 bar	0.016 % rdg.	Using Fluke Pressure Controller, 7252i or Process Calibrator with different modules with comparator Based on DKD-R6-1

Sl.	Quantity Measured / Instrument	Range/Frequency	*Calibration Measurement Capability (±)	Remarks
4.	Absolute Pressure Indicating Devices Including Manometer & Barometer#	0 to 2.5 bar (abs)	0.01 % rdg.	Using Fluke Pressure Controller, 7252i or Process Calibrator with different modules with comparator Based on DKD-R6-1 and Manufacturers Manual
5.	Digital / Analogue Pressure Gauges, Manometer, Pressure Transmitter, Pressure Indicating Instruments#	0 to 1000 bar	0.015 %rdg.	Using Digital Pressure Indicator (Mensor CPG 8000) Hydraulic Comparator Based on DKD-R6-1
II.	**UTM, TENSION CREEP AND TORSION TESTING MACHINE**			
1.	Static Uniaxial Testing Machines♣ (Compression % Tension modes)	1 kN to 100 kN	0.21 %	Using Force Proving Instruments of Class 1 or better Based on IS 1828-1

Sl.	Quantity Measured / Instrument	Range/Frequency	*Calibration Measurement Capability (±)	Remarks
III.	**WEIGHTS**			
1.	**MASS[$]**	1 mg 2 mg 5 mg 10 mg 20 mg 50 mg 100 mg 200 mg 500 mg 1 g 2 g 5 g 10 g 20 g	0.002 mg 0.002 mg 0.002 mg 0.002 mg 0.003 mg 0.004 mg 0.005 mg 0.006 mg 0.008 mg 0.010 mg 0.013 mg 0.016 mg 0.020 mg 0.026 mg	Using E1 Accuracy Class Standard Weights and Mass Comparator of d: 0.001 mg As per OIML R 111 - 1 : 2004 ABBA Cycle Substitution Method Calibration of E2 Accuracy Class weights and coarser
		50 g 100 g 200 g 500 g	0.03 mg 0.05 mg 0.11 mg 0.30 mg	Using E1 Accuracy Class Standard Weights and Mass Comparator of d: 0.01 mg as per OIML R 111 - 1 : 2004 based on ABBA Cycle Substitution Method & Calibration of E2 Accuracy Class weights and coarser
		1 kg 2 kg 5 kg	2 mg 2 mg 5 mg	Using E2 Accuracy Class Standard Weights and Mass Comparator of d: 0.001 g & Calibration of F1 Accuracy Class weights and coarser

Sl.	Quantity Measured / Instrument	Range/Frequency	*Calibration Measurement Capability (±)	Remarks
		10 kg	0.02 g	Using E2 Accuracy Class Standard Weights and Mass Comparator of d: 0.01 g Calibration of F1 Accuracy Class weights and coarser
		20 kg 50 kg	0.04 g 0.09 g	Using F1 Accuracy Class Standard Weights and Mass Comparator of d: 0.01 g Calibration of F2 Accuracy Class weights and coarser
		100 kg	1 g	Using F1 Accuracy Class Standard Weights and Weighing Balance 1 g Calibration of M1 Accuracy Class weights and coarser
IV.	**WEIGHING SCALE AND BALANCE**			
1.	Non – Automatic Weighing Balance / Scale♣	0 to 2 g	0.0044 mg	Using E1 Accuracy Class Standard Weights as per OIML R 76 – 1 & Weighing Balance Class I (d: 0.0001 mg)
		0 to 20 g	0.013 mg	Using E1 Accuracy Class Standard Weights Weighing Balance Class I (d: 0.001 mg)

Sl.	Quantity Measured / Instrument	Range/Frequency	*Calibration Measurement Capability (±)	Remarks
		0 to 200 g 0 to 600 g	0.08 mg 0.28 mg	Using Weighing Balance Class I &E1 Accuracy Class Standard Weights (d: 0.01 mg)
		0 to 5 kg	6 mg	Using Weighing Balance Class II & E2 Accuracy Class Standard Weights (d:1 mg)
		0 to 10 kg	0.08 g	Using Weighin g Balance Class II& E2 Accuracy Class Standard Weights (d:10 mg)
		0 to 20 kg 0 to 60 kg	0.08 g 0.16 g	Using Weighing Balance Class II & F1 Accuracy Class Standard Weights (d:10 mg)
		0 to 150 kg	3 g	Using Weighing Balance Class III(d: 1 g) & F1 Accuracy Class Standard Weights

Sl.	Quantity Measured / Instrument	Range/Frequency	*Calibration Measurement Capability (±)	Remarks
V.	**ACOUSTICS**			
1.	Mechanical / Sound Pressure Level - Calibration of Sound Level Meters, Microphones[$]	(@ 94 dB to 114 dB) 31.5 Hz to 8 kHz 8 kHz to 16 kHz	 0.30 dB 0.61 dB	Using Multifunction Acoustic Calibrator, Pulse System By Comparison Method
2.	Mechanical / Sound Pressure Level - Calibration of Acoustic Calibrators[$]	(@ 94 dB to 114 dB) 31.5 Hz to 16 kHz	0.24 dB	Using Reference Microphone and Pulse System By Comparison Method
3.	Mechanical / Sound Pressure Level for Calibration of Sound Level Meters, Microphones[♣] (@ 94 dB to 114 dB)	31.5 Hz to 8 kHz 8 kHz to 16 kHz	0.30 dB 0.61 dB	Using Multifunction Acoustic Calibrator By Comparison Method
4.	Mechanical / Sound Pressure Level for Calibration of Sound Level Meters Microphones [♣]	1 kHz	0.42 dB	Using Multifunction Acoustic Calibrator & Sound Level Meter By Comparison Method

Sl.	Quantity Measured / Instrument	Range/Frequency	*Calibration Measurement Capability (±)	Remarks
VI.	**ACCELERATION AND SPEED**			
1.	Mechanical / Vibration Amplitude - Calibration of Accelerometers for Acceleration$ (0.1 g to 10 g)	3 Hz to 10 Hz 10 Hz to 4 kHz 4 kHz to 7 kHz 7 kHz to 10 kHz	0.93% 0.85% 1.29% 1.80%	Using Vibration Transducer Calibration System Back to Back Comparison Method
2.	Mechanical / Vibration Amplitude - Calibration of Vibration Shakers / Excitor for Acceleration$ (0.1 g to 10 g)	159 Hz to 160 Hz 20 Hz to 10 kHz	1.27% 1.45%	Using Vibration Transducer Calibration System with Reference Transducer Comparison Method
3.	Mechanical / Vibration Amplitude - Calibration of Vibration Meters for Acceleration$ (0.5 g to 10 g)	10 Hz to 5 kHz	1.60%	Using Vibration Transducer Calibration System, Multimeter, Counter Comparison Method
4.	Mechanical / Vibration Amplitude - Calibration of Vibration Meters for Velocity$ (1 mm/s to 200 mm/s)	10 Hz to 5 kHz	1.60%	Using Vibration Transducer Calibration System, Multimeter, Counter Comparison Method

Sl.	Quantity Measured / Instrument	Range/Frequency	*Calibration Measurement Capability (±)	Remarks
5.	Mechanical / Vibration Amplitude - Calibration of Vibration Meters for Displacement[$] (0.01 mm to 5 mm)	10 Hz to 5 kHz	1.60%	Using Vibration Transducer Calibration System, Multimeter, Counter Comparison Method
6.	Mechanical / Vibration for Calibration of Accelerometers[♣]	20 Hz to 160 Hz 160 Hz to 3 kHz Hz	2.34% 5.50%	Using Portable Accelerometer Calibrator By Comparison Method
7.	Mechanical / Speed[#] - -Contact Type for Calibration of Tachometers - Non - Contact Type	100 rpm to 5000 rpm 100 rpm to 10000 rpm	1.20 rpm 1.22 rpm	Using Reference Tachometer and RPM Rig By Comparison Method

Sl.	Quantity Measured / Instrument	Range/Frequency	*Calibration Measurement Capability (±)	Remarks
	THERMAL CALIBRATION			
I.	**TEMPERATURE**			
1.	Calibration of SPRT / PRT by Fixed point method$			
	Boiling Point of LN_2	0 -196°C	0.015°C	Using SPRT, AC Bridge and LN2 Comparator By Comparison method
	Triple Point of Mercury	(-) 38.8344°C	0.0049°C	Using Fixed Point Cells with Maintenance Bath / Furnace, Transfer SPRT with AC Bridge by Fixed Point Method
	Triple Point of Water	0.01°C	0.004°C	
	Melting Point of Gallium	29.7646°C	0.005°C	
	Melting Point of Indium	156.5985°C	0.007°C	
	Melting Point of Tin	231.928°C	0.0058°C	
	Melting Point of Zinc	419.527°C	0.008°C	
	Melting Point of Aluminum$	660.323°C	0.016°C	

Sl.	Quantity Measured / Instrument	Range/Frequency	*Calibration Measurement Capability (±)	Remarks
2.	PRT, all types of Thermocouples with or without Indicator, Digital Thermometers, Thermisters , Temperature Transmitters, Temperature Indicators with Sensor of oil /Water baths, Incubators(for all non-medical applications), Ovens , Furnace , Chambers[$]	(-) 50°C to (-)40°C (-)40°C to 25°C 25°C to 660°C 660°C to 1000°C	0.1°C 0.06°C 0.1°C 1.3°C	Using PRT Pt-100 Sensor, Scanner, AC Bridge, Oil bath, Dry Block Calibrator By Comparison / single positioning calibration.
		1000°C to 1200°C	1.3°C	Using S Type T/C, Scanner, Dry Block Calibrator By Comparison Calibration / single positioning calibration.
3.	Calibration of Water Baths,Oil Baths & Dry Well Blocks [$]	10 to 100°C (-)50 to 250°C (-)45°C to 660°C	0.15 °C 0.15 °C 0.15°C	Using PRT Sensors & and scanners By Multipositioning Calibration
		660°C to 1200°C	1.6 °C	Using S type T/C and scanners by Multipositioning Calibration
II.	**SPECIFIC HEAT AND HUMIDITY**			
1.	Humidity Sensor with Indicator, Humidity Transmitters , Hygrometers etc. [$]	20% to 95% RH at 25 °C to 40 °C	1.0% RH @ 25°C to 40°C	Using Reference Combi Sensor with indicator and Temperature/ Humidity Chamber By Comparison method.

Sl.	Quantity Measured / Instrument	Range/Frequency	*Calibration Measurement Capability (±)	Remarks
2.	PRT, all types of Thermocouples with or without Indicator, Digital Thermometers, Thermisters , Temperature Transmitters, Temperature Indicators with Sensor of oil /Water baths, Incubators(for all non-medical applications), Ovens , Furnace , Chambers♣	(-) 40°C to 140°C 140°C to 660°C	0.1°C 0.25°C	Using PRT Pt-100 Scanner, Dry Block Calibrator & Oil Bath By Comparison Method / Single positioning calibration
		660°C to 1000°C 1000°C to 1200°C	1.3°C 2.2°C	Using Thermocouple, Scanner, Dry block calibrator By Comparison Method / Single positioning calibration
3.	Calibration of Water Baths, Oil Baths & Dry Well Blocks ♣	10 to 100°C (-)50 to 250°C (-)45°C to 660°C	0.15 °C 0.15 °C 0.15 °C	Using PRT Sensors & and scanners By Multipositioning Calibration
		660°C to 1200°C	1.9°C	Using S type T/C and scanners By Multipositioning Calibration
4.	Calibration of Temperature chambers ♣	(-)40 to 200°C	0.5°C	Using RTD Sensors and Data Logger By Multipositioning Calibration

Sl.	Quantity Measured / Instrument	Range/Frequency	*Calibration Measurement Capability (±)	Remarks
5.	Calibration of Humidity chambers ♣	20%RH to 95 % RH @ 25°C to 40°C	2% RH @ 25°C to 40°C	Using RTD & Humidity Sensor and Data Logger By Multipositioning Calibration

*** Measurement Capability is expressed as an uncertainty (±) 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.