Laboratory	**Acumen Measurements & Consultancy Pvt. Ltd., (Calibration Division), F-90/1, First Floor, Okhla Industrial Area, Phase – I, New Delhi**			
Accreditation Standard	**ISO/IEC 17025: 2005**			
Certificate Number	**CC-2364** ***(In lieu of C-0937, 0938, 0939)***	**Page**	**1 of 17**	
Validity	**07.08.2017 to 06.08.2019**	**Last Amended on**	**06.10.2017**	

Sl.	Quantity Measured / Instrument	Range/Frequency	*Calibration Measurement Capability (±)	Remarks
		ELECTRO-TECHNICAL CALIBRATION		
I.	**SOURCE**			
1.	DC Voltage[$]	1mV to 300mV 300mV to 1000V	0.76% to 0.011% 0.011%	Using Fluke 9100 Calibrator by Direct Method
2.	DC Current[$] DC Current[$] (Clamp on Meter)	1µA to 300µA 300µA to 300mA 300mA to 3A 3A to 20A 20A to 1000A	1.55% to 0.04% 0.04% 0.04% to 0.1% 0.1% 1.4%	Using Fluke 9100 Calibrator by Direct Method Current Coil (50 turn)
3.	AC Voltage[$]	**50Hz to 10kHz** 10mV to 300mV 300mV to 3V 3V to 300V 300V to 1000V	 1.55% to 0.06% 0.06% to 0.15% 0.06% to 0.1% 0.1% to 0.12%	Using Fluke 9100 Calibrator by Direct Method
4.	AC Voltage[$]	**10kHz to 100kHz** 300mV to 100V	 0.4% to 0.6%	Using Fluke 9100 Calibrator by Direct Method
5.	AC Current[$]	**50Hz to 5kHz** 20µA to 300µA 300µA to 3mA 3mA to 300mA 300mA to 3A 3A to 20A **50Hz** 20A to 1000A	2.2% to 0.4% 0.4% to 0.2% 0.2% to 0.3% 0.3% to 0.5% 0.5% to 0.8% 0.8%	Using Fluke 9100 Calibrator by Direct Method Current Coil (50 turn)

Ashish Kakran
Convenor

Avijit Das
Program Director

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6.	Frequency[$]	1 Hz to 10 MHz 10 MHz to 120 MHz	0.07% to 0.003% 0.051%	Using Fluke 9100 Calibrator & STD Signal Generator by Direct Method
7.	Resistance[$]	1Ω to 40Ω 40Ω to 400Ω 400Ω to 4MΩ 4MΩ to 400MΩ	2.5% to 0.1% 0.1% to 0.06% 0.06% 0.06% to 0.4%	Using Fluke 9100 Calibrator by Direct Method
8.	RF Level[$]	**50 to 120 MHz** 60 dBµV to 100 dBµV	2.05 dbµV to 1.37 dbµV	Using Signal Generator by Direct Method
9.	Oscilloscope [$] Amplitude (Deflection Factor) Time Base (Marker)	**100 Hz** 10 mV to 100 V **1 kHz** 1 mV to 100 V **10 kHz** 10 mV to 100 V 50 nSec to 1 Sec	 0.96% to 0.58% 0.82% to 0.58% 0.96% to 0.58% 120 ppm to 600 ppm	Using Leader Oscilloscope Calibrator by Direct Method
10.	DC Resistance[$] (4 Wire) DC Resistance[$] (2 Wire)	1mΩ 10mΩ 100mΩ 1Ω 10Ω 100Ω 1kΩ 2MΩ	0.013 mΩ 0.067 mΩ 0.63 mΩ 0.013Ω 0.063 Ω 0.58 Ω 0.008 kΩ 0.07 MΩ	Using Resistance Box by Direct Method HV MΩ Resistance Box by Direct Method

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		20MΩ 200MΩ 2GΩ 20GΩ	0.8 MΩ 7 MΩ 0.06 GΩ 0.81 GΩ	
11.	AC Resistance[$]	**1kHz** 1Ω to 1kΩ 1kΩ to 10kΩ	 0.60% to 0.61% 0.61% to 0.58%	Using Resistance Decade Box by Direct Method
12.	AC Capacitance[$]	**1kHz** 10pF to 100nF 100nF to 10µF	 1.4% to 0.7 % 0.7%	Using Capacitance Decade Box by Direct Method
13.	AC Inductance[$]	**1kHz** 10µH to 100mH 100mH to 10H	 0.85 % to 0.62% 0.62% to 0.85 %	Using Inductance Decade Box by Direct Method
14.	Temperature Simulation[#] (Temperature Indicator / Controller / Recorder) PT-100 Type B Type E Type N Type J Type K Type T Type R Type S Type	 (-) 200^{0}C to 700^{0}C 100ºC to 1000ºC (-)250^{0}C to 1000^{0}C 50^{0}C to 1300^{0}C (-)200^{0}C to 1050^{0}C 0^{0}C to 1350^{0}C (-)200^{0}C to 400^{0}C 0^{0}C to 1750^{0}C 200^{0}C to 1700^0 C	 0.68^0 C 0.92^0 C 0.63^0 C 0.3^0 C 0.65^0 C 0.35^0 C 0.35^0 C 0.62^0 C 0.85^0 C	 Using Fluke 9100 Calibrator by Direct Method

Sl.	Quantity Measured / Instrument	Range/Frequency	*Calibration Measurement Capability (±)	Remarks
II.	**MEASURE**			
1.	DC Voltage[$]	1mV to 1V 1V to 1000V	0.42% to 0.01% 0.01%	Using 6 ½ Dig. Multimeter
	DC High Voltage[#]	1kV to 15kV	2.8%	DMM + H.V. Probe by Direct Method
2.	AC Voltage[$]	**50Hz to 1kHz** 10mV to 1V 1V to 750V	 0.55% to 0.12% 0.12% to 0.11%	Using 6 ½ Dig. Multimeter
	AC High Voltage[#]	**50Hz** 1kV to 10kV 10kV to 15kV	 6.4%	Using DMM + H.V. Probe by Direct Method
3.	DC Current[$]	1µA to 1mA 1mA to 1A 1A to 20A	3.1% to 0.2% 0.2% to 0.1% 0.1% to 0.4%	Using 6 ½ Dig. Multimeter by Direct Method
4.	AC Current[$]	**50Hz to 5kHz** 100µA to 1mA 1mA to 1A 1A to 10A	 0.25% to 0.20% 0.20% to 0.17% 0.17% to 0.28%	Using 6 ½ Dig. Multimeter by Direct Method
5.	DC Resistance[$]	1mΩ to 1Ω 1Ω to 10MΩ 10MΩ to 100MΩ	0.1% to 0.98% 1.08% to 0.02% 0.02% to 0.96%	Using 6 ½ Dig. Multimeter, Fluke 9100 Calibrator V/I Method 6 ½ Dig. Multimeter By Direct Method

Sl.	Quantity Measured / Instrument	Range/Frequency	*Calibration Measurement Capability (±)	Remarks
6.	Frequency[$]	1Hz to 1MHz 1MHz to 1.1GHz	0.05% to 0.01 % 0.01%	Using Philips 6665 Frequency counter by Direct Method
7.	Signal Generator[$] (Period)	1 µsec. to 1sec.	0.04% to 0.38 %	Using Philips 6665 Frequency counter by Direct Method
8.	AC Resistance[$] 2 terminal	**1kHz** 1Ω to 10 kΩ	1.0% to 0.8%	Using LCR METER by Direct Method
9.	Capacitance[$]	**1 kHz** 10 pF to 10 µF	1.54% to 1.3%	Using LCR METER by Direct Method
10.	Inductance[$]	**1 kHz** 10 µH to 10 H	0.85%	Using LCR METER by Direct Method
11.	Stop Watch / Timer[#] (Digital / Analog)	10 s to 60 sec 1 min to 60 min	0.7% 0.7%	Using Digital Time Interval Meter by Comparison Method
12.	RF Level[$]	**50 MHz to 120 MHz** 60 dBµV to 100 dBµV	1.37dBµV	Using Signal Level Meter by Direct Method
13.	Temperature Simulation[♣] (Calibration of Process Calibrator) PT-100 Type B Type E Type N Type J Type K Type	 (-)200^{0}C to 600^{0}C 450^{0}C to 1750^{0}C (-)200^{0}C to 500^{0}C (-)200^{0}C to 1000^{0}C (-)190^{0}C to 700^{0}C 50^{0}C to 950^{0}C	 0.7ºC 1ºC 0.7ºC 0.7ºC 1ºC 0.7ºC	Using Process Calibrator Metravi by Direct Method

Sl.	Quantity Measured / Instrument	Range/Frequency	*Calibration Measurement Capability (±)	Remarks
	R Type S Type	150^{0}C to 1700^{0}C 150^{0}C to 1700^{0}C	1.0 ^{0}C 1.0 ^{0}C	
14.	DC Power$ 220V,2A	440 Watt	0.67%	Using Hi-Tester Hioki 3193 by Direct Method
15.	AC Power$ @50Hz at UPF (300V, 0.5 to 20A)	5 watt to 6 kwatt	0.4%	Using Hi-Tester Hioki 3193 by Direct Method
16.	AC Power$ @50Hz at CosΦ:0.5 Lag, 0.5Lead (300V, 0.5 to 20A)	3.75 watt to 3 kwatt	0.7% to 0.5%	Using Hi-Tester Hioki 3193 by Direct Method
17.	AC Energy# @ 50Hz 1 Ø & 3Ø at UPF	220V, 1A UPF,50Hz	6% to 1.5%	Using Fluke 1730 Energy Logger by Direct Method
18.	Power Factor$	**50Hz** Cosφ ±0.2 to 1	0.004pF	Using Hi-Tester Hioki 3193 by Direct Method

Sl.	Quantity Measured / Instrument	Range/Frequency	*Calibration Measurement Capability (±)	Remarks
	MECHANICAL CALIBRATION			
I.	**DIMENSION (BASIC MEASURING INSTRUMENT, GAUGE ETC.)**			
1.	Caliper[$] L.C. 0.01 mm [Φ]	0 to 150 mm 0 to 300 mm 0 to 600mm 0 to 1000mm	11.2 µm 11.2 µm 18.4 µm 35 µm	Using Slip Gauge, Length Bar & Length Bar Holder
2.	External Micrometer[$] L.C. 0.001 mm L.C. 0.01 mm	Up to 100 mm Up to 300mm 300 to 600mm	1.5 µm 9.5 µm 14.2 µm	Using Slip Gauge Set Slip Gauge Set, Length Bar
3.	Height Gauge[$] L.C. 0.01 mm [Φ]	Up to 300mm Up to 600mm Up to 1000mm	18 µm 18 µm 28.7 µm	Using Slip Gauge Set & Length Bars
4.	Depth Micrometer[$] L.C. 0.001 mm [Φ]	Up to 200mm	12.3 µm	Using Length Bar, Set of Slip Gauge
5.	Internal/Inside Micrometer[$] L.C. 0.01 mm	Upto 300 mm	8 µm	Using Length Bar, Set of Slip Gauge

Sl.	Quantity Measured / Instrument	Range/Frequency	*Calibration Measurement Capability (±)	Remarks
6.	Digimatic Depth Caliper / Depth Gauge[$] L.C. 0.01 mm [Φ]	Up to 300mm	13 µm	Using Length Bar, Set of Slip Gauge
7.	Plunger Type Dial Gauge / Digimatic Indicator[$] L.C.0.001mm [Φ]	Up to 25mm 25 to 50mm	5 µm 9 µm	Using Set of Slip Gauge
8.	Lever Type Dial Gauge[$] L.C. 0.001 mm L.C. 0.01 mm	0 to 0.6 mm 0 to 2 mm	5 µm 8 µm	Using Set of Slip Gauge
9.	Plain Plug Gauge[$]	Up to 100 mm	6.5 µm	Using Slip Gauge Set & Plunger Type Dial Gauge
10.	Setting Rod[$]	Up to 150 mm >150 mm to 600 mm	4.2 µm 8.4 µm	Using Plunger Type Dial Gauge, Slip gauge Set & Length Bar
11.	Thread Plug Gauge[$] (Effective Dia / Major Dia.)	0 to 50mm	5 µm	Using Digital Ext. Micrometer, Three Wire Pin Set
12.	Feeler Gauge[$]	Up to 2mm	1.9µm	Using Digital Ext. Micrometer

Sl.	Quantity Measured / Instrument	Range/Frequency	*Calibration Measurement Capability (±)	Remarks
13.	Bevel Angle Protector $ L.C. 1 min	360^0	3.5 min	Using Angle Gauge Block
14.	Angle Protector / Combination Set $ L.C - 1 deg	0^o-180^o-0^o	35 min	Using Angle Gauge Block
15.	Snap Gauge $	0 to100mm	1.7 µm	Using Slip gauge with accessories
16.	Inside Dial Caliper$ L.C. – 0.01 mm Φ	10 mm to 22 mm	6.4 µm	Using Slip gauge with accessories
17.	Standard Foil $	Up to 855 µm	2 µm	Using Digital Ext. Micrometer
18.	Coating Thickness Gauge $ L.C. – 0.001 mm	Up to 855 µm	1.4 µm	Using Standard foils
19.	Straight Edge $ (for straightness)	Up to 1000mm	0.958(√L/125) Where L is in mm	Using Slip gauge Set
20.	V-Block $	200x150x150 mm	12.6 µm (Flatness) 12.6µm (Parallelism) 12.6 µm (Symmetry)	Using Cylindrical Mandrill, Plunger Dial Gauge
21.	Dial Thickness Gauge $ L.C.-0.01mm	0 to 50mm	6.2 µm	Using Slip gauge Set

Sl.	Quantity Measured / Instrument	Range/Frequency	*Calibration Measurement Capability (±)	Remarks
22.	Radius Gauge $	Up to 25mm	11.2 µm	Using Profile Projector
23.	Thread Pitch Gauge $ Angle Pitch	 Up to 60 ° Up to 15 mm	 2.32 min 2.28 µm	 Using Profile Projector
24.	Test Sieve $ (aperture Size)	32 µm to 100 µm 0.1 mm to 4 mm 4 mm to 100 mm	2.0 2.0 16.0	Using Profile Projector Using Digital Caliper
25.	Wire Gauge $ (Diameter Measurement)	Up to 10 mm	8.5 µm	Using Profile Projector
26.	Straight Edge # (Straightness)	Up to 1000mm	0.958(√L/125) Where L is in mm	Using Electronic Level
27.	Surface Plate♣ (Flatness)	Up to 1000 mm x1000 mm	1x(√L+W/125) Where L and W R in mm	Using Electronic Level
II.	**ACOUSTICS**			
1.	Sound Level Meter$	94dB & 114dB	0.7 dB	Using Sound Level Calibrator
III.	**DIMENSION (PRECISION INSTRUMENTS)**			
1.	Profile Projector♣ Linear Angle Magnification	 upto 200mm upto 360deg. upto 100X	 4.11 µm 1min 4 sec 2.2%	 Using Glass Scales & Angle Gauges

Sl.	Quantity Measured / Instrument	Range/Frequency	*Calibration Measurement Capability (±)	Remarks
IV.	**PRESSURE INDICATING DEVICES**			
1.	Low Pressure $ (Differential Gauges, Manometer, Pressure, Transmitter)	0 to ±340 mbar	1.043 mbar	Using Digital Manometer with Pump Direct Compression as per DKD R6-1
2.	Vacuum $ (Gauges, Transmitter)	(-) 0.9 bar to 0 bar	0.008 bar	Using Digital Vacuum Gauge with Pump Direct Compression as per DKD R6-1
3.	Pneumatic Pressure $ (Gauges, Transmitter)	0 to 3bar	0.0075 bar	Using Digital Pressure Gauge with Pump Direct Compression as per DKD R6-1
4.	Hydraulic Pressure$ (Gauges, Transmitter)	0 to 70bar	0.07 bar	Using Digital Pressure Gauge with Pump Direct Compression as per DKD R6-1
5.	Hydraulic Pressure# (Gauges, Transmitter)	0 to 600 bar	1.62 bar	Using Digital Pressure Gauge with Pump Direct Compression as per DKD R6-1

Sl.	Quantity Measured / Instrument	Range/Frequency	*Calibration Measurement Capability (±)	Remarks
V.	**WEIGHTS**			
1.	Mass [$] (weights)	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 50 g 100 g 200 g	0.03 mg 0.03 mg 0.03 mg 0.03 mg 0.03 mg 0.03 mg 0.03 mg 0.03 mg 0.03 mg 0.03 mg 0.03 mg 0.03 mg 0.03 mg 0.03 mg 0.03 mg 0.24 mg 0.24 mg	Using STD. Weights (E2 Class), Semi micro balance with readability(d) 0.01 mg / 0.1 mg (By ABBA Method , as per OIML R-111-1
	F1 Cl. Wt. W.B. , d=1 mg	500 g	3.0 mg	
	F1 Cl. Wt. W.B. , d=1 mg	1 kg	3.2 mg	
	F1 Cl. Wt. W.B. d=10 mg	2 kg	0.175 g	
	F1 Cl. Wt. W.B. d=10 mg	5 kg	0.175 g	
	F1 Cl. Wt. W.B. d=100 mg	10 kg	0.33 g	
	F1 Cl. Wt. W.B. d=1 g.	20 kg	1.5 g	
	F1 Cl. Wt. W.B. d=1 g.	50 kg	1.9 g	

Sl.	Quantity Measured / Instrument	Range/Frequency	*Calibration Measurement Capability (±)	Remarks
VI.	**WEIGHING SCALE AND BALANCE**			
1.	Weighing Balance #			
	d =0.01 mg and coarser	upto 60g	0.05 mg	Using STD. Weights (E2 Class) As per OIML R-76-1 &
	d = 0.1 mg and coarser	upto 200g	0.12 mg	
	d = 1mg and coarser	upto 1 kg	1.5 mg	STD. Weights (E2 & F1 Class)
	d = 10 mg and coarser	upto 4 kg	14.0 mg	F1 Class Wt.
	d =100 mg and coarser)	upto 10 kg	852 mg	F1 Class Wt.
	d = 20 g and coarser	upto 100 kg	11.6 g	F1 Class Wt.

Sl.	Quantity Measured / Instrument	Range/Frequency	*Calibration Measurement Capability (±)	Remarks
VII.	**VOLUME**			
1.	Volumetric Glassware $ (Micropipette)	>10 µl to 100 µl >100 µl to 1 ml	0.1µl 0.3µl	Using Gravimetric as per IS/ISO 4787 (2010) & STD Weights (E2 Class), Weighing balance readability 0.01mg/0.1mg
	(Pipettes / Burrets / Measuring Flasks / Cylinders/ Beakers) $	>1 ml to 100 ml >100 ml to 500 ml >500 ml to 5000 ml	1.4 µl 0.3ml 3ml	STD Weights (E2/F1 Class) & Electronics Balance STD Weights (F1 Class) & Electronics Balance

Sl.	Quantity Measured / Instrument	Range/Frequency	*Calibration Measurement Capability (±)	Remarks
	THERMAL CALIBRATION			
I.	**TEMPERATURE**			
1.	Glass/Digital Thermometer, RTD Sensor & Thermocouples (with / without read unit) Temperature Transmitter, Temp. Gauge, Recorder #	(-)40^{0}C to 50^{0}C	0.72ºC	Using RTD (PT-100) 4 Wire with Digital Thermometer, Temperature Calibrator by Comparison Method
2.	Glass/Digital Thermometer, RTD Sensor & Thermocouples (with / without read unit) Temperature Transmitter, Temp. Gauge, Recorder #	>50^{0}C to 100^{0}C	0.72ºC	Using RTD (PT-100) 4 Wire with Digital Thermometer, Temperature Calibrator by Comparison Method
3.	Thermocouples with / without read unitTemperature Transmitter, Temp. Gauge, Recorder #	>100^{0}C to 1000^{0}C	2.30ºC	Using S -Type Thermocouple with Indicator + Temperature Calibrator by Comparison Method

Sl.	Quantity Measured / Instrument	Range/Frequency	*Calibration Measurement Capability (±)	Remarks
4.	Digital & Analog Hygrometer, RH Sensors/ Transmitters with Controller / Indicator/ Recorder/ Datalogger, Humidity, Calibrator/ Generator/ Chamber[$]	10ºC to 55ºC 15 %RH to 95 %RH	0.85ºC 1.96%RH	Using Humidity Chamber & Dig. Thermo Hygrometer with Sensor by Comparison Method
5.	Radiation Pyrometer (Non Contact Type) [$]	50ºC to 500ºC	4.96ºC	Using Infra red Thermometer with Black Body Source
6.	Black Body Pyro Meter[$]	50ºC to 500ºC	4.37ºC	Using Infra red Thermometer
7.	Temperature Indicator of Freezers / Oven / Environment Chamber/ Incubator / BOD Incubator / Liquid Bath / Dry Block Furnaces [♣]	(-)80^{0}C to 250^{0}C	0.8ºC	Using RTD (PT-100) 4 Wire Sensor with Indicator & 'S' Type T/C. (Single Position Calibration) by Comparison Method
8.	Temperature Indicator of Muffle Furnace/Dry Block Furnace / Oven[♣]	>250^{0}C to 1200^{0}C	2.30ºC	Using S-type Thermocouple with Indicator (Single Position Calibration) by Comparison Method

Laboratory	**Acumen Measurements & Consultancy Pvt. Ltd., (Calibration Division), F-90/1, First Floor, Okhla Industrial Area, Phase – I, New Delhi**		
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9.	Humidity Chamber / Environment chamber♣	10^0C to 55^0C 20 %RH to 95 %RH	0.85ºC 1.92%RH	Using Dig. Thermo Hygrometer with Sensor (Single Position Calibration) by Comparison Method

*** 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.
Φ Laboratory can also calibrate instruments/devices of coarser resolution / least count within the accredited range using same reference standard/ master equipment under the scope of accreditation.

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Convenor

Avijit Das
Program Director