Laboratory	**Autocal Solutions Pvt. Ltd., Plot No. BH – 74, Gala No. 1 & 2, Jai Talja Bhavani Indl. Premises, Telco Road, MIDC – Bhosari, Pune, Maharashtra**		
Accreditation Standard	**ISO/IEC 17025: 2005**		
Discipline	**Electro-Technical Calibration**	**Issue Date**	**11.09.2015**
Certificate Number	**C-1268**	**Valid Until**	**10.09.2017**
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	Quantity Measured/ Instrument	Range / Frequency	*Calibration Measurement Capability (±)	Remarks
	SOURCE			
1.	**DC VOLTAGE**♯	0.1mV to 1 mV	3.58% to 0.36%	Using Multifunction Calibrator, Fluke-5500E by Direct Method
		1mV to 10 mV	0.36% to 0.042%	
		10 mV to 100 mV	0.042% to 0.010%	
		100 mV to 1 V	0.010 % to 0.0017 %	
		1 V to 100 V	0.0017% to 0.0024%	Using Multifunction Calibrator, Fluke-5520A by Direct Method
		100 V to 1000 V	0.0024% to 0.0025%	
2.	**DC CURRENT**♯	10 µA to 100 mA	0.26%to 0.016%	Using Multifunction Calibrator, Fluke-5520A by Direct Method
		100 mA to 1 A	0.016% to 0.029%	
		1A to 10 A	0.029% to 0.064%	
		10 A to 20 A	0.064% to 0.12%	
		20 A to 1000 A	0.73% to 0.3%	Using Multifunction Calibrator, Fluke-5520A + 50Turn Current Coil, by Direct Method
3.	**AC VOLTAGE**♯	**45 Hz to 10 kHz**		
		2 mV to 10 mV	2.53% to 0.41%	Using Multifunction Calibrator, Fluke-5500E by Direct Method
		10 mV to 100 mV	0.41% to 0.082%	
		100 mV to 1 V	0.082% to 0.03%	
		45 Hz to 1 kHz		
		1 V to 10 V	0.03% to 0.026%	Using Multifunction Calibrator, Fluke-5520A by Direct Method
		10 V to 1000 V	0.026% to 0.037%	
		10 kHz to 100 kHz		
		1 V to 100 V	0.1% to 0.29%	

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Convenor

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Program Manager

Quantity Measured/ Instrument	Range / Frequency	*Calibration Measurement Capability (±)	Remarks
4. AC CURRENT♯	**45 Hz to 1 kHz**		
	30 µA to 3 A	0.62% to 0.08%	Using Multifunction Calibrator, Fluke-5520A by Direct Method
	3 A to 10 A	0.08% to 0.14%	
	10 A to 20 A	0.14% to 0.20%	
	50 Hz		Using Multifunction Calibrator, Fluke-5520A + 50Turn Current Coil, by Direct Method
	20 A to 1000 A	0.67% to 0.30%	
5. DC RESISTANCE♯	100 mΩ to 100 kΩ	1.31% to 0.0036%	Using Multifunction Calibrator, Fluke-5520A by Direct Method
	100 kΩ to 1MΩ	0.0036% to 0.0043%	
	1MΩ to 10 MΩ	0.0043% to 0.016%	
	10 MΩ to 100 MΩ	0.016% to 0.063%	
	100 MΩ to 1GΩ	0.063% to 1.8%	
6. HIGH RESISTANCE♯	0.1 Ω to 100 MΩ	2.31%	Using Standard Megohm Decade Box & Discrete High Resistance by Direct Method
	50 MΩ	2.32%	
	200 MΩ	2.32%	
	300 MΩ	2.32%	
	400 MΩ	2.32%	
	1 GΩ to 100 GΩ	2.33%	
7. CAPACITANCE♯	**1kHz**		Using Multifunction Calibrator, Fluke-5520A by Direct Method
	1 nF to 10 µF	1.73 % to 0.41 %	
	10 µF to 100 µF	0.41 % to 0.64 %	
	100 µF to 1 mF	0.64 % to 0.84 %	
8. INDUCTANCE♯	**1kHz**		Using Standard Discrete Inductance by Direct Method
	0.1 mH	1.67%	
	1 mH	1.16%	
	10 mH	1.16%	
	100 mH	1.16%	
	1000 mH	1.16%	

	Quantity Measured/ Instrument	Range / Frequency	*Calibration Measurement Capability (±)	Remarks
9.	**TEMPERATURE INDICATOR /CONTROLLER BY SIMULATION METHOD♯**			
	RTD (PT-100)	-200 °C to 800 °C	0.05 °C	Using Multifunction Calibrator, Fluke-5520A Conversion by using ITS-90 Scale for Ω to °C and mV to °C
	Thermocouple (K, J, N, E, T, R, S, B, C, L, U)	-200 °C to 1370 °C	0.12 °C	
10.	**POWER FACTOR♯**	**50Hz** 0.1 PF to UPF Lead/ Lag	0.008 PF	Using Multifunction Calibrator, Fluke-5520A by Direct Method
11.	**AC POWER♯ (1 phase)**	**50Hz**		
	@ UPF	120 V to 240 V 0.01 A to 20 A 1.2 W to 4.8 kW	0.65% to 0.18%	Using Multifunction Calibrator, Fluke-5520A + 50Turn Current Coil, by Direct Method
	@ 0.8PF (Lag/ Lead)	120 V to 240 V 0.1 A to 20 A 9.6 W to 3.8 kW	0.99% to 0.25%	
	@ 0.5PF (Lag/ Lead)	120 V to 240 V 0.1 A to 20 A 6 W to 2.4 kW	1.20% to 0.39%	
	@ 0.2PF (Lag/ Lead)	120 V to 240 V 0.1 A to 20 A 2.4 W to 960 W	3.09% to 1.16%	

	Quantity Measured/ Instrument	Range / Frequency	*Calibration Measurement Capability (±)	Remarks
12.	**FREQUENCY**♯	10 Hz to 250 MHz	0.58% to 0.023%	Using Multifunction Calibrator, Fluke-5520A by Direct Method
13.	**PERIOD**♯	0.1 s to 4 ns	0.577% to 0.023%	Using Multifunction Calibrator, Fluke-5520A by Direct Method
14.	**OSCILLOSCOPE**♯			
	DC AMPLITUDE	**50Ω output**		
		5 mV to 2.2 V	1.91% to 0.46%	Using Multifunction Calibrator, Fluke-5520A by Direct Method
		1MΩ output		
		5 mV to 33 V	0.53% to 0.23%	
		33 V to 100 V	1.75% to 0.78%	
	AC AMPLITUDE	**1MΩ output @ 1kHz (V p-p)**		
		5 mV p-p to 50 V p-p	1.81% to 0.2%	
		50 V p-p to 100 V p-p	0.2 % to 0.74%	
	TIME BASE	**50Ω output**		
		5 mV p-p to 2 V p-p	1.81% to 0.60%	
	BANDWIDTH	2 ns to 10 ms	0.32% to 0.64%	
		10 ms to 5 s	0.64% to 0.60%	
		50 kHz to 250 MHz	3.47% to 6%	

	Quantity Measured/ Instrument	Range / Frequency	*Calibration Measurement Capability (±)	Remarks
	MEASURE			
1.	**DC VOLTAGE**♯	100 µV to 1000 V	0.62% to 0.0012%	Using 81/2 Agilent 3458A DMM by Direct Method
		1 kV to 10 kV	5.09% to 2.39%	Using 80k-40 HV Probe with DMM by Direct Method
		10 kV to 90 kV	3.55% to 3.67%	Using HV Divider SEV & kV Meter by Direct Method
2.	**DC CURRENT**♯	10 µA to 10 mA 10 mA to 1 A	0.021% to 0.009% 0.009% to 0.014%	Using 81/2 Agilent 3458A DMM by Direct Method
		1 A to 20 A	0.36% to 0.35%	Using 81/2 Agilent 3458A DMM with Agilent shunt by Direct / Comparison Method
3.	**AC VOLTAGE**♯	**45 Hz to 1 kHz**		
		1 mV to 100 mV 100 mV to 700 V	0.91% to 0.03% 0.03% to 0.06%	Using 81/2 Agilent 3458A DMM by Direct Method
		45 Hz to 1 kHz		
		700 V to 1000 V	0.12% to 0.11%	Using 61/2 Fluke 8846A DMM by Direct Method
		1 kHz to 10 kHz		
		1 mV to 10 V 10 V to 700 V	0.24% to 0.035% 0.035% to 0.080%	Using 81/2 Agilent 3458A DMM by Direct Method
		50 Hz		
		1 kV to 10 kV	7.21% to 6.29%	Using 80k-40 HV Probe with DMM by Direct Method

	Quantity Measured/ Instrument	Range / Frequency	*Calibration Measurement Capability (±)	Remarks
		10 kV to 80 kV	4.27% to 3.64%	Using HV Divider SEV & kV Meter by Direct Method
4.	**AC CURRENT**♯	**45 Hz to 1 kHz**		
		30 µA to 100 mA	0.16% to 0.10%	Using 81/2 Agilent 3458A DMM by Direct Method
		100 mA to 1A	0.10% to 0.14%	
		1 A to 20 A	0.41% to 0.36%	Using 81/2 Agilent 3458A DMM with Agilent shunt By Direct / Comparison Method
5.	**DC RESISTANCE**♯	10 mΩ to 10 Ω	0.82% to 0.0028%	Using 81/2 Agilent 3458A DMM by Direct Method
		10 Ω to 10 MΩ	0.0028% to 0.007%	
		10 MΩ to 100 MΩ	0.007% to 0.065%	
		100 MΩ to 1 GΩ	0.065% to 0.58%	
6.	**AC RESISTANC**♯	**1kHz**		
		1 Ω to 100 kΩ	0.14% to 0.13%	Using RLC Meter PM6304 By Direct Method
7.	**FREQUENCY**♯	1 Hz to 250 MHz	0.024% to 0.0058%	Using Frequency Counter, Agilent 53220A Direct / Comparison Method
8.	**PERIOD**♯	5 ns to 2 s	0.06% to 0.03%	Using Frequency Counter, Agilent 53220A Direct / Comparison Method
9.	**CAPACITANCE**♯	**1kHz**		
		10 pF to 10 µF	1.16% to 0.23 %	Using RLC Meter PM6304 By Direct Method
		10 µF to 100 µF	0.23%	

	Quantity Measured/ Instrument	Range / Frequency	*Calibration Measurement Capability (±)	Remarks
10.	**INDUCTANCE**[#]	**1kHz** 100 µH to 1 H	1.29% to 0.12%	Using RLC Meter PM6304 by Direct Method
11.	**TIME**[#]	6 s to 30 min 30 min to 24 Hrs	0.1s to 1.2 s 1.2 s to 4.0 s	Using Digital Timer by Direct Method
12.	**PROCESS CALIBRATOR BY SIMULATION METHOD**[#]			
	RTD (PT-100)	-200 °C to 800 °C	0.008 °C to 0.024 °C	Using Multifunction Calibrator, Fluke-5520A
	Thermocouple (K, J, N, E, T, R, S, B, C, L, U)	-200 °C to 1370 °C	0.035°C to 0.032°C	Conversion by using ITS-90 Scale for Ω to °C and mV to °C
13.	**CURRENT TRANSFORMER RATIO ERROR / PHASE ERROR**[$]	5 A to 3200 A/ 5 A 2000 A to 6000 A/ 5 A	0.013 % 0.084 %	Using ELTEL Class 0.005 CT and ELTEL AITTS – 98 Bridge
14.	**CURRENT TRANSFORMER RATIO ERROR/ PHASE ERROR**[♣]	5 A to 2000 A/ 5 A 2000 A to 6000 A/ 5 A	0.066 % 0.084 %	Using ELTEL Class 0.05 CT and ELTEL AITTS – 98 Bridge
15.	**POTENTIAL TRANSFORMER RATIO ERROR/ PHASE ERROR**[#]	6.6 – 11 – 22 – 33 kV/ 110 V	0.10 %	Using Standard PT and ELTEL AITTS – 98 Bridge
16.	**CT BURDENS**[#]	1.25 VA to 30 VA	1.75 %	Using ELTEL AITTS – 98 Bridge

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	Quantity Measured/ Instrument	Range / Frequency	*Calibration Measurement Capability (±)	Remarks
17.	**PT BURDENS**[♯]	2.5 VA to 50 VA	2.0 %	Using ELTEL AITTS – 98 Bridge

*** 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.

Ram Ashray
Convenor

Avijit Das
Program Manager