

**Laboratory** Electrical Research and Development Association, ERDA Road,  
GIDC , Makarpura, Vaodara, Gujarat

**Accreditation Standard** ISO/IEC 17025: 2005

**Certificate Number** CC-2162

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**Validity** 28.06.2018 to 27.06.2020

**Last Amended on** -

Sl.	Quantity Measured / Instrument	Range/Frequency	*Calibration Measurement Capability ( $\pm$ )	Remarks
<b><u>ELECTRO TECHNICAL CALIBRATION</u></b>				
<b>I.</b>	<b>MEASURE</b>			
1.	DC Voltage <sup>§</sup>	1 mV to 1000 V	0.06% to 0.001%	Using 8 ½ Digital Multimeter Fluke 8508 By Direct/ Comparison Method
	DC Voltage <sup>*</sup>	1 mV to 1000 V	0.42% to 0.01%	Using 6 ½ Digital Multimeter Agilent 34401A , By Direct/ Comparison Method
	DC High Voltage <sup>#</sup>	1 kV to 100 kV	1.10 %	Using 0-200 kV AC/DC HV Divider With kV Meter By Comparison Method (Hipotronics)
2.	DC Current <sup>§</sup>	1 $\mu$ A to 20 mA 20 mA to 2 A 2 A to 20 A	0.06% to 0.003% 0.003% to 0.011% 0.011% to 0.009%	Using 8 ½ Digital Multimeter Fluke 8508, By Direct/ Comparison Method
	DC Current <sup>*</sup>	10 mA to 20 A	0.01% to 0.15%	Using 6 ½ Digital Multimeter Agilent 34401A / Digital Power meter WT 3000, By Direct/ Comparison Method

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3.	AC Voltage <sup>§</sup>	<b>10 mV to 200 mV</b> 10 Hz to 50 Hz 50Hz to 30 kHz 30 kHz to 100 kHz	0.13% to 0.004% 0.004% to 0.14% 0.1% to 0.05%	Using 8 ½ Digital Multimeter Fluke 8508,  Three Phase Reference Standard Meter, ZERA COM 3003, EPZ-303-5, EPZ-303-05-3, MTE SRS 400.3, PRS 400.3  RADIAN RD-30-233, CALMET C300 By Direct/Comparison Method
		<b>200 mV to 200 V</b> 10 Hz to 50 Hz 50Hz to 100 kHz	0.004% to 0.01% 0.01% to 0.022%	
		<b>200 V to 1000 V</b> 40 Hz to 1 kHz	0.005% to 0.01%	
	AC Voltage <sup>*</sup>	<b>50Hz</b> 10 mV to 1000 V	0.94% to 0.093%	Using 6 ½ Digital Multimeter Agilent 34401A /Digital Power Meter WT 3000 By Direct/ Comparison Method
AC High Voltage <sup>§</sup>	1 kV to 150 kV	1.20 %	Using 0-200 kV AC/DC HV Divider With kV Meter By Comparison Method (Hipotronics)	
AC High Voltage <sup>*</sup>	1 kV to 160 kV	1.20 %	Using 0-200 kV AC/DC HV Divider With kV Meter By Comparison Method (Hipotronics)	
	161 kV to 200 kV	2.61 %		

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4.	AC Current <sup>§</sup>	<b>50 Hz to 5 kHz</b> 10 $\mu$ A to 200 mA AC 200 mA to 2 A AC	0.18% to 0.03% 0.03% to 0.05%	Using 8 ½ Digital Multimeter Fluke 8508
		<b>50 Hz to 1 kHz</b> 2 A to 20 A AC	0.05% to 0.02%	ZERA COM 3003, EPZ 303-5, EPZ303-05-3, MTE SRS 400.3, PRS400.3, RADIANT RD-30-233, CALMET C300, By Direct/Comparison Method
		<b>50 Hz</b> 1mA to 120 A AC	0.028% to 0.015%	
	AC Current <sup>*</sup>	<b>50 Hz</b> 50 mA to 20 A 1 mA to 120A AC	0.6% to 0.1% 0.12% to 0.04%	Using 6 ½ Digital Multimeter Agilent 34401A, /Digital Power Meter WT 3000, Three Phase Reference Standard Meter, ZERA COM 3003, MTE PRS 400.3, RADIANT RD-30-233, CALMET C300 By Direct/ Comparison Method
5.	Frequency <sup>§</sup>	10 Hz to 2 MHz	0.006% to 0.001%	Using 8 ½ Digital Multimeter Fluke 8508
		45 Hz to 55 Hz	0.015%	Three Phase Reference Standard Meter, ZERA COM 3003, EPZ-303-5, EPZ-303-05-3, MTE SRS 400.3, PRS 400.3, RADIANT RD-30-233, CALMET C300 By Direct/Comparison Method

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	Frequency *	20 Hz to 1 MHz 45 Hz to 55 Hz	0.06% 0.015%	Using 6 ½ Digital Multimeter Agilent 34401A/Digital Power Meter WT 3000, Three Phase Reference Standard Meter, ZERA COM 3003, MTE PRS 400.3, RADIAN RD-30-233, CALMET C300 By Direct/Comparison Method
6.	Resistance \$	10 $\mu\Omega$ to 1 $\Omega$ 1 $\Omega$ to 20 M $\Omega$ 20 M $\Omega$ to 200 M $\Omega$ 200 M $\Omega$ to 10 G $\Omega$	0.7% to 0.002% 0.002% to 0.004% 0.004% to 0.03% 0.03% to 0.59%	Using 8 ½ Digital Multimeter Fluke 8508, Fluke 9100A/ Multiproduct Calibrator 5500 & standard Resistor, Tettex 3200 A, By Direct/ Comparison Method
	Resistance *	1 m $\Omega$ to 10 M $\Omega$ 10 M $\Omega$ to 100 M $\Omega$	0.062% to 0.11% 0.11% to 0.25%	Using 6 ½ Digital Multimeter Agilent 34401A/ Universal calibration system Wavetek 9100 / FLUKE 5500A By Direct/ Comparison Method
7.	DC Power #	1.5 V to 1000 V 0.05 A to 20 A	0.26%	Using Digital Power Meter Yokogawa, WT 3000 By Direct/Comparison Method

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8.	AC Power <sup>§</sup>	10 V to 575 V, 0.05 A to 20 A, 0.01PF-UPF-0.01PF Lead/Lag 0.25W to 11.5kW	0.11% to 1.36%	Using Digital Power Meter Yokogawa, WT 3000
	AC Power/Energy (Single & Three Phase) Active Power/Energy 50Hz	55V to 290V, 0.25PF- UPF-0.25PF Lead/ Lag 10mA to 200A 0.20W to 58kW	0.015% to 0.05%	Three Phase Reference Standard Meter, ZERA COM 3003, EPZ- 303-5, EPZ-303-05-3, MTE SRS 400.3, PRS 400.3, RADIAN RD-30-233, CALMET C300 By Direct/ Comparison Method
	AC Power – Active <sup>*</sup>	10 V to 575 V, 0.05 A to 20 A, 0.01PF-UPF-0.01PF Lead/Lag 0.25W to 11.5kW	0.11% to 1.81%	Using Digital Power Meter Yokogawa, WT 3000
	AC Power – Reactive	10 V to 575 V, 0.05 A to 20 A, 0.01PF-UPF-0.01PF 0.3VAr to 11.5kVAr Lead/Lag	0.11% to 0.36%	
	AC Power/Energy (Single & Three Phase) Active & Reactive Power/Energy 50Hz	55V to 290V, 0.25PF- UPF-0.25PF Lead/ Lag 10mA to 120A 0.20W to 34.8kW 0.20VAr to 34.8kVAr	0.015% to 0.02%	Three Phase Reference Standard Meter ZERA COM 3003,MTE PRS 400.3,RADIAN RD-30-233, CALMET C300 By Direct/Comparison Method

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9.	Reactive Power <sup>§</sup>	10 V to 575 V, 0.05 A to 20 A, 0.01PF-UPF-0.01PF Lead/Lag 0.3VAr to 11.5kVAr	0.11% to 0.36%	Using Digital Power Meter Yokogawa, WT 3000
	AC Power/Energy (Single & Three Phase) Reactive Power/Energy 50Hz	55V to 290V, 0.25PF- UPF-0.25PF Lead/ Lag 10mA to 200A 0.20VAr to 58kVAr	0.015% to 0.05%	Three Phase Reference Standard Meter, ZERA COM 3003, EPZ- 303-5, EPZ-303-05-3, MTE SRS 400.3, PRS 400.3, RADIANT RD-30-233, CALMET C300 By Direct/ Comparison Method
10.	Apparent Power <sup>#</sup>	10 V to 575 V, 0.05 A to 20 A, 0.5 VA to 11.5 kVA	0.12%	Using Digital Power Meter Yokogawa, WT 3000, Three Phase Reference Standard Meter ZERA COM 3003, EPZ- 303-5, EPZ-303-05-3, MTE SRS 400.3, PRS 400.3, RADIANT RD-30-233, CALMET C300 By Direct/ Comparison Method

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Sl.	Quantity Measured / Instrument	Range/Frequency	*Calibration Measurement Capability ( $\pm$ )	Remarks
11.	Power Factor <sup>§</sup>	<b>50Hz</b> 10 V to 575 V, 0.05 A to 20 A, 0.01PF-UPF-0.01PF Lead/Lag  55 V to 290 V, 10 mA to 120 A, 0.25PF-UPF-0.25PF Lead/Lag	0.09%to 1.36%	Using Digital Power Meter Yokogawa, WT 3000, Three Phase Reference Standard Meter, ZERA COM 3003, EPZ- 303-5, EPZ-303-05-3, MTE SRS 400.3, PRS 400.3 RADIAN RD-30-233, CALMET C300 By Direct/ Comparison Method
	Power Factor *	<b>50Hz</b> 10 V to 575 V, 0.05 A to 20 A, 0.01PF-UPF-0.01PF Lead/Lag  55 V to 290 V, 10 mA to 120 A, 0.25PF-UPF-0.25PF Lead/Lag	0.09% to 1.91%	Using Digital Power Meter Yokogawa, WT 3000 Three Phase Reference Standard Meter, ZERA COM 3003, MTE PRS 400.3, RADIAN RD-30-233, CALMET C300 By Direct/ Comparison Method
12.	Time / Period #	1 ms to 45 s.	0.5%	Using Digital Oscilloscope By Direct/Comparison Method
13.	Time #	10 s. to 90000 s.	0.1% to 0.05%	Using Digital Time Interval Meter, ADI Make By Direct/Comparison Method

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14.	Capacitance <sup>\$</sup>	1kHz 100pF to 33 $\mu$ F	0.29% to 0.36%	Using Precision LCR Meter Quadtech By Direct/ Comparison Method
15.	Temperature <sup>\$</sup> (By Comparison method) Thermocouple RTD	(-)100°C to 1300°C (-)200°C to 800°C	0.14°C 0.02°C	Using 8 ½ Digital Multimeter Fluke 8508, Digital Precision Thermometer, Cropico 3000 By Direct/ Comparison Method
	Temperature* (By Simulation method) Thermocouple RTD	(-)100°C to 1300°C (-)200°C to 800°C	0.26°C 0.08°C	Using 6 ½ Digital Multimeter Agilent 34401A By Direct/Comparison Method
16.	Harmonics of Fundamental Frequency 50 Hz <sup>\$</sup>	1 – 41 <sup>th</sup> order (0 to 500 V) 1 – 41 <sup>th</sup> order (0 to 10A)	0.2%	Using Digital Power Meter Yokogawa, WT 3000 By Direct/Comparison Method
17.	Inductance <sup>\$</sup>	1kHz 100 $\mu$ H to 10H	0.4% to 0.2%	Using Precision LCR Meter By Direct/Comparison Method

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18.	Impulse Voltage/ Measuring System/ Voltage Divider # (Peak Magnitude, Front time, tail Time for LI, SI and Peak Magnitude, chopping time for LIC)	For LI 80 Vp to 1600 Vp 0.84 $\mu$ S & 60 $\mu$ S  For SI 100 Vp to 1600 Vp 20 $\mu$ S & 4000 $\mu$ S  For Chopping 400 Vp to 1250 Vp	LI: 0.72 % Front Time: 1.89 % Tail Time: 2.23 %  SI: 0.66 % Front Time: 2.30 % Tail Time: 2.16 %  Peak Magnitude LIC: 1.12% Chopping Time : 2.57 %	Using Reference Impulse Calibrator & Digital Oscilloscope By Standard Comparison Method (Haefely)
	Impulse Voltage # (Peak Magnitude)	Peak Magnitude 0 to 500 kVp	1.56 %	Using Universal Voltage Divider By Standard Comparison Method (High Volt)
19.	Current Transformer \$  Ratio error and Phase angle error	2.5-3200A/1-5A	$\pm$ 0.016% in RE $\pm$ 0.77 Min in PAE	Using Std. current transformer, Bridge/ Analyzer (Make: Eltel/ Tettex/Omicron) by using comparison method and using Portable injection kit.
		3200-6300A/1-5A	$\pm$ 0.017% in RE $\pm$ 1.31 Min in PAE	
		6300-8000A/1-5A	$\pm$ 0.025% in RE $\pm$ 2.40 Min in PAE	
20.	Voltage Transformer \$  Ratio error and Phase angle error	Primary: 110V to 66000V 110V/ $\sqrt{3}$ to 220kV/ $\sqrt{3}$  Secondary: 110/3V to 110V	$\pm$ 0.027% in RE $\pm$ 1.32 Min in PAE	Using Std. potential transformer, Bridge/ Analyzer (Make: Zera, Epro, Pragati electrical, Moonlight electrical, Eltel/ Tettex, Omicron) by using comparison method and by portable injection kit.

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21.	Ratio Meter <sup>§</sup>	1 to 2000	$\pm 0.026\%$ in RE	Direct Method (Make: Zera, Epro, Pragati electrical, Moonlight electrical)
22.	CT-PT Test <sup>§</sup> set/Analyzer	CT Mode: 1A-5A  PT Mode: 110-110/3V	$\pm 0.011\%$ in RE $\pm 0.46$ Min in PAE  $\pm 0.011\%$ in RE $\pm 0.37$ Min in PAE	Using CT-PT comparison method. (Make: Eltel/Tettex)
23.	Capacitance & Tan $\delta$ <sup>#</sup>  For Standard Capacitor Direct measurement <sup>#</sup>	10 pF to 1000 pF & 1 x 10 <sup>-5</sup> to 3.5 100 V to 100kV At 50 Hz  10 pF to 1000 pF & 1 x 10 <sup>-5</sup> to 3.5 100 V to 100kV At 50 Hz	Cap: $\pm 0.13\%$ Tan $\delta$ : $\pm 3.90 \times 10^{-5}$  Cap: $\pm 0.13\%$ Tan $\delta$ : $\pm 1.12 \times 10^{-4}$	Using C & Tan delta bridge By Comparison Method  Using C & Tan delta bridge by direct measurement of standard capacitor
24.	Partial Discharge Calibrator <sup>§</sup>	From 5 pC to 10 nC	$\pm 3.00\%$	Using Oscilloscope with resistor as per IEC:60270
25.	Current Transformer <sup>*</sup>  Ratio error and Phase angle error	2.5-3200A/1-5A  3200-6300A/1-5A	$\pm 0.016\%$ in RE $\pm 0.77$ Min in PAE  $\pm 0.017\%$ in RE $\pm 1.31$ Min in PAE	Using Std. current transformer, Bridge/ Analyzer (Make: Eltel, Eltel/Tettex, Omicron) by using comparison method and using Portable injection kit.

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26.	Voltage Transformer * Ratio error and Phase angle error	Primary: 110V to 33000V 110V/ $\sqrt{3}$ to 220kV/ $\sqrt{3}$  Secondary: 110/3V to 110V	$\pm 0.027\%$ in RE $\pm 1.32$ Min in PAE	Using Std. potential transformer, Bridge/ Analyzer (Make: Zera, EPRO, Pragati, Moonlight, Eltel/ Tettex, Omicron) by using comparison method and using portable injection kit.
27.	Ratio Meter *	1 to 300	$\pm 0.026\%$ in RE	Direct Method (Make: Zera, Pragati electrical , Moonlight electrical)
28.	CT-PT Test * set/Analyzer	CT Mode: 1A-5A  PT Mode: 110-110/3V	$\pm 0.011\%$ in RE $\pm 0.46$ Min in PAE  $\pm 0.011\%$ in RE $\pm 0.37$ Min in PAE	Using CT-PT comparison method. (Make: Eltel/Tettex)
<b>II.</b>	<b>SOURCE</b>			
1.	DC Voltage #	1 mV – 1000 V DC	0.12% to 0.009%	Using Universal calibration system Wavetek 9100 / FLUKE 5500A By Direct Method
2.	DC Current #	1 $\mu$ A – 320 mA 320 mA – 20 A 20 A – 1000 A	0.5% to 0.03% 0.03% to 0.1% 0.1% to 0.3%	Using Universal calibration system Wavetek 9100 / FLUKE 5500A With Current Coils By Direct Method

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3.	Resistance #	10 $\mu\Omega$ 100 $\mu\Omega$ 1 m $\Omega$ 10 m $\Omega$ 100 m $\Omega$ 1 $\Omega$ 1 $\Omega$ to 40 $\Omega$ 40 $\Omega$ to 40 k $\Omega$ 40 k $\Omega$ to 40 M $\Omega$ 40 M $\Omega$ to 100 M $\Omega$ 100 M $\Omega$ to 10 G $\Omega$ 10 G $\Omega$ to 1 T $\Omega$	0.3% 0.02% 0.02% 0.02% 0.02% 0.06% 0.01% 0.01% to 0.02% 0.02% to 0.18% 0.18% to 0.3% 0.3% to 0.7% 0.7% to 1.5%	Using Standard Resistors Ohm Lab/Tettex / YEW, Decade Resistance Box, Tettex Universal Calibration System Wavetek 9100 / FLUKE 5500 Megohm Decade Box Tinsley By Direct Method
4.	AC Voltage #	<b>10 mV to 300 mV AC</b> 20 Hz to 50 Hz, 50Hz to 100kHz  <b>300 mV to 100 V AC</b> 20 Hz to 10 kHz 10 kHz to 100 kHz,  <b>100 V to 1000 V AC</b> 20 Hz to 10 kHz  <b>10 V to 575 V AC,</b> 50 Hz	0.49% to 0.12% 0.06% to 0.12%  0.1% to 0.06% 0.06% to 0.55%  0.06% to 0.12%  0.01% to 0.02%	Using Universal Calibration System Wavetek 9100 / FLUKE 5500  Electrical Power Standard Master / FLUKE 6105 By Direct Method

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5.	AC Current #	<b>30 <math>\mu</math>A to 300 mA AC</b> 50 Hz to 5 kHz  <b>300 mA to 3 A AC</b> 50 Hz to 5 kHz  <b>3 A to 20 A AC</b> 50 Hz to 1 kHz  <b>50 Hz</b> 0.01 to 80 A AC 80 to 1000 A AC	0.76% to 0.14%  0.05% to 0.17%  0.04% to 0.54%  0.02 % 0.24 %	Using Universal Calibration System Wavetek 9100 / FLUKE 5500  Electrical Power Standard Master / FLUKE with Current Coil By Direct Method
6.	Frequency/ Time #	10 Hz to 10 MHZ	0.006% to 0.0008%	Using Universal Calibration System Wavetek 9100 / FLUKE 5500 By Direct Method
7.	Oscilloscope #	10 mV to 120 V AC 10 mV to 100 VDC 40 Hz to 250 MHz 4 ns to 5 s Time base 4% to 95% Duty Cycle	0.5% 0.3% 2.7% 0.45% 0.15%	Using Universal Calibration System Wavetek 9100 with scope option By Direct Method
8.	Capacitance #	0.33 $\eta$ F to 100 $\mu$ F	2.90% to 0.64%	Using Universal Calibration System Wavetek 9100 / FLUKE 5500 By Direct Method
9.	DC Power #	100 mV to 1000V 100mA to 11 A 0.01 W to 11 kW	0.58% to 0.1%	Using FLUKE 5500 By Direct Method

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10.	AC Power # 1- Phase	10 V to 575 V, 0.05 A to 1000 A, UPF - 0.01 PF 0.25 W to 575 kW	0.02% to 0.8%	Using Electrical Power Standard Master / FLUKE & Auxiliaries with Current Coil, Universal Calibration System, 9100 A By Direct Method
11.	Apparent Power #  1-Phase	10 V to 575 V, 0.05 A to 80 A, 0.01PF-UPF-0.01PF Lead/Lag 0.25 VA to 46 kVA	0.02% to 0.6%	Using Electrical Power Standard Master / FLUKE By Direct Method
12.	Reactive Power # 1-Phase	10 V to 575 V, 0.05 A to 80 A, UPF - 0.01 PF 0.3 VAR to 46 kVA	0.03% to 0.9%	Using Electrical Power Standard Master / FLUKE By Direct Method
13.	Power Factor # 1-Phase	<b>50Hz</b> 10 V to 575 V, 0.05 A to 80 A, UPF - 0.01 PF 10 V to 575 V, 20 A to 1000 A, UPF - 0.01 PF	0.02% to 0.8%	Using Electrical Power Standard Master / FLUKE, Universal Calibration System, 9100 A By Direct Method
14.	Temperature # (By stimulation of the sensor output by appropriate electric stimuli) Thermocouple RTD	(-)100°C to 1300°C (-)200°C to 800°C	0.13°C 0.06°C	Using Universal Calibration System Wavetek 9100 / FLUKE 5500 By Direct Method

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15.	Harmonics of Fundamental Frequency 50 Hz #	0 – 41 <sup>th</sup> order (0 to 500 V) 0 – 41 <sup>th</sup> order (0 to 10A) 0 – 41 <sup>th</sup> order (10 to 500A)	0.1%  0.3%	Using Electrical Power Standard Master / FLUKE 6105/6100 with current coils By Direct Method
16.	Counter #	100 Counts to 999999 Counts	0.6% to 0.08%	Using Universal Calibration System Wavetek 9100 / FLUKE 5500, Digital Time Interval Meter, ADI Make By Direct Method
17.	Sweep Frequency Response Analyser #	0dB, -40dB, -60dB, 10 kHz,	1.76dB	Using Doble M5150 By Direct Method
<b>MOBILE FACILITY</b>				
<b>I.</b>	<b>MEASURE</b>			
1.	Current Transformer  Ratio error and Phase angle error	2.5-3200A/1-5A  3200-6300A/1-5A	0.020% in RE 0.92 Min in PAE  0.017% in RE 1.31 Min in PAE	Using Std. current transformer, Bridge/ Analyzer (Make: Eltel, Eltel/ Tettex, Omicron) by using comparison method and using Portable injection kit.

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GIDC , Makarpura, Vaodara, Gujarat

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Sl.	Quantity Measured / Instrument	Range/Frequency	*Calibration Measurement Capability ( $\pm$ )	Remarks
2.	Voltage Transformer Ratio error and Phase angle error	Primary: 110V to 33000V 110V/ $\sqrt{3}$ to 33kV/ $\sqrt{3}$  Secondary: 110/3V to 110V	0.027% in RE 1.32 Min in PAE	Using Std. potential transformer, Bridge/ Analyzer (Make: Zera, Pragati electrical, Moonlight electrical, Eltel/Tettex, Omicron) by using comparison method and using portable injection kit.
3.	Ratio Meter	1 to 300	0.026% in RE	Direct Method (Make: Zera, Pragati electrical, Moonlight electrical)
4.	CT-PT Test set/Analyzer	CT Mode: 1A-5A  PT Mode: 110-110/3V	0.011% in RE 0.46 Min in PAE  0.011% in RE 0.37 Min in PAE	Using CT-PT comparison method. (Make: Eltel/Tettex)
5.	AC POWER/ENERGY (Single & Three Phase) Active, Reactive & apparent Power/Energy 45Hz to 55 Hz	55V to 290V, 0.25PF- UPF-0.25PF Lead/ Lag 10mA to 120A 0.20W to 34.8kW 0.20VAr to 34.8kVAr	0.04% to 0.06%	Using Three Phase Reference Standard Meter, MTE PRS 400.3, CALMET C300, Digital Power Meter Yokogawa, WT 3000 By Direct/ Comparison method

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6.	Voltage	50 Hz 50V to 400V	0.05%	Using Three Phase Reference Standard Meter, MTE PRS 400.3, CALMET C300, Digital Power Meter Yokogawa, WT 3000 By Direct/ Comparison method
7.	Current	50 Hz 10mA to 120A	0.05%	Using Three Phase Reference Standard Meter, MTE PRS 400.3, CALMET C300, Digital Power Meter Yokogawa, WT 3000 By Direct/ Comparison method
8.	Power Factor	50 Hz 0.25PF- UPF-0.25PF Lead/ Lag	$\pm 0.001$ PF	Using Three Phase Reference Standard Meter, MTE PRS 400.3, CALMET C300, Digital Power Meter Yokogawa, WT 3000 By Direct/ Comparison method
9.	Frequency	45Hz to 55Hz	0.05%	Using Three Phase Reference Standard Meter, MTE PRS 400.3, CALMET C300, Digital Power Meter Yokogawa, WT 3000 By Direct/ Comparison method

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<b><u>MECHANICAL CALIBRATION</u></b>				
<b>I.</b>	<b>DIMENSION (BASIC MEASURING INSTRUMENT, GAUGE ETC.)</b>			
<b>1.</b>	External Micrometer \$ L. C. : 0.001 mm  L. C. : 0.01 mm	0 to 25 mm 25 mm to 150 mm  150mm to 300 mm 300mm to 600 mm	1.2 $\mu$ m 6.0 $\mu$ m  13.0 $\mu$ m 20.0 $\mu$ m	Using Gauge Block Grade '0' And  Using Steel Long Slip Gauge Comparison method IS 2967
<b>2.</b>	Vernier Caliper \$ L. C.: 0.01 mm	0 to 300 mm 300mm to 600 mm 600mm to 1000 mm	12.3 $\mu$ m 20.0 $\mu$ m 30.0 $\mu$ m	Using Gauge Block Grade '0' Caliper Checker IS 3651(Part I &II)
<b>3.</b>	Dial Gauges \$ (Plunger Type) L. C.: 0.001 mm	0 to 50 mm	2.0 $\mu$ m	Using Gauge Block Grade '0' IS 2092

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<b>II.</b>	<b>UTM, TENSION CREEP AND TORSION TESTING MACHINE</b>			
<b>1.</b>	Static Uniaxial Testing Machine * Tension	100 N to 200 kN	0.35%	Using Load Cell with Display (Class 0.5 & Class 1 accuracy) For UTM of accuracy class 1 and coarser as per IS 1828 : Part- I
	Compression	100 N to 500 kN	0.35%	Using Load Cell with Display (Class 0.5 & Class 1 accuracy) For UTM of accuracy class 1 and coarser as per IS 1828 : Part- I
<b>III.</b>	<b>ACCELERATION AND SPEED</b>			
<b>1.</b>	Speed \$ (Non-Contact-Tachometer)	10 to 60000 RPM	1.2%	Using Digital Tachometer By comparison method

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<b><u>THERMAL CALIBRATION</u></b>				
<b>I.</b>	<b>TEMPERATURE</b>			
1.	Temperature # (PRT/ Thermocouple with or without temperature indicator)	(-)45°C to 150°C >150°C to 300°C >300°C to 600°C >600°C to 1000°C	0.11°C 0.44°C 1.26°C 2.25°C	Using 4 wire PRT, Digital Precision Thermometer with sensor (PRT/Thermocouple), 'S' type Thermocouple, 6 ½ digit multimeter, Using liquid bath / Dry block bath, High Temperature Dry block bath. (By Comparison Method)
2.	Glass Thermometer #	(-)30°C to 100°C	0.11°C	Using 4 wire PRT, Digital Precision Thermometer with RTD/ liquid bath Based on existing scope using liquid bath (By Comparison Method)
3.	Lab Oven, Climatic Chamber, Environment Chamber #	(-)45°C to 200°C  >200°C to 300°C	1.14°C  5.30°C	Using data acquisition system with sensors (RTD Type & T-Type)  Using data acquisition system with sensors (K-Type) Based on existing scope (Multi Position Calibration)

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4.	Temperature Indicator with sensor of Temperature bath, Oven, Furnaces, Liquid bath, Dry block #	(-)45°C to 150°C >150°C to 300°C >300°C to 600°C >600°C to 1000°C	0.11°C 0.44°C 1.26°C 2.25°C	Using 4-Wires SPRTS, Precision Digital Thermometer with Sensor (RTD/Thermocouple) / 6 ½ digit Multimeter, "S" Type thermocouple (Single Point)
5.	Temperature # (Non-contact type Pyrometer, IR Thermometer, Thermo vision camera)	0°C to 140°C >140°C to 300°C >300°C to 600°C >600°C to 1000°C	1.6°C 2.7°C 3.2°C 4.2°C	Using Standard Pyrometer, IR Thermometer, Black body Temperature source (By Comparison Method)
<b>II. SPECIFIC HEAT AND HUMIDITY</b>				
1.	Humidity & Temperature # (Climatic Chamber, Environment Chamber)	20% to 95% RH (25°C to 55°C)	3% RH @ 25°C 0.7 °C	Using Humidity/ Temperature data logger (multi points) (By Comparison Method)
2.	Humidity / Temperature Indicator with sensor of Climatic Chamber / Environment Chamber #	20% to 95% RH (25°C to 85°C)	1.5% RH 0.7°C	Using Humidity/ Temperature Indicator with Sensor/ Data logger (Single Point) (By Comparison Method)

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3.	Thermo Hygrometer, Hygrometer, Temperature & Humidity data logger, Humidity Indicator with probe #	20% to 95% RH (25°C to 85°C) 10°C to 85°C (25% to 95% RH)	2% RH @ 25 °C 0.7°C	Using 4-Wires SPRTS, Precision Digital Thermometer with Sensor (RTD/Thermocouple) / 6 ½ digit Multimeter, Humidity Indicator with Sensor, Humidity data logger, Humidity Generator (By Comparison Method)

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<b><u>OPTICAL CALIBRATION</u></b>				
1.	Luminous Flux / Chromaticity Co-Ordinates / Correlated Color Temperature / Color Rendering Index Of Lamps \$	350 nm to 1050 nm for spectral flux (i.e.10 lm to 100000 lm for luminous flux, 2000 Kelvin color temperature to 8000 Kelvin color temperature for correlated color temperature, $x=0.0001$ to 1 ; $y=0.0001$ to 1 for chromaticity coordinates, & 0 to 100 index for color rendering index)	1.5 % of the value of the Luminous flux,  $x = 0.003$ $y = 0.003$ of the value of Chromaticity co-ordinates  50 Kelvin of the value of the Correlated Color Temperature  2 index of the value of the Color Rendering Index	Using Reference standard lamp 28W, 75V Tungsten Halogen lamp, 36W TFL, 14.5 LED Lamp, spectral flux measurement system with integrator and Type C Gonio-photometer with reference lamp

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

\$Only in Permanent Laboratory.

\*Only for Site Calibration.

# Both Permanent Laboratory & Site. 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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