

PT. CALTESYS INDONESIA

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Temperature

No.	Instrument to be calibrated	Measurement Range	CMC	Methods/Specifications	
1	Liquid In Glass Thermometer	-30 °C ~ 0 °C	0.27 °C	in house procedure TG-01	
		0 °C ~ 100 °C	0.09 °C		
		100 °C ~ 200 °C	0.09 °C		
2	temperature Sensor with display unit	-30 °C ~ 0 °C	0.27 °C	in house procedure TI-01	
		0 °C ~ 100 °C	0.09 °C		
		100 °C ~ 200 °C	0.09 °C		
		200 °C ~ 600 °C	0.8 °C		
3	Temperature Indicator (without sensor) for Thermocouple Sensor :			in house procedure INTC-01	
		K-type	-270 °C ~ 1372 °C		0.10 °C
		J-type	-210 °C ~ 1200 °C		0.10 °C
		T-type	-270 °C ~ 400 °C		0.10 °C
		E-type	-270 °C ~ 1000 °C		0.09 °C
		R-type	-50 °C ~ 1768 °C		0.3 °C
		S-type	-50 °C ~ 1768 °C		0.3 °C
		B-type	0 °C ~ 1820 °C		1.4 °C
	for Resistance Thermometer Sensor	-200 °C ~ 800 °C	0.08 °C	in house procedure RTD-01	
4	Thermocouple	-30 °C ~ 0 °C	0.28 °C	in house procedure EVT-01	
		0 °C ~ 200 °C	0.12 °C		
		200 °C ~ 600 °C	0.8 °C		
		600 °C ~ 1000 °C	2.8 °C		
5	Resistance Thermometer	-30 °C ~ 0 °C	0.27 °C	In house procedure TTP-01	
		0 °C ~ 200 °C	0.08 °C		
6	temperature Enclosure			in house procedure WOB-01, OB-01, FN-01	
		Waterbath	-30 °C ~ 100 °C		0.09 °C
		Oilbath	0 °C ~ 200 °C		0.08 °C
		Oven, Incubator	-30 °C ~ 200 °C		0.5 °C
			200 °C ~ 500 °C		4.1 °C
		Furnace	0 °C ~ 1000 °C		1.4 °C
7	Thermohygrometer	30 % ~ 95 %	2.5 %RH	In house procedure THM-01	
		15 °C ~ 40 °C	0.4 °C		
8	Thermometer Radiasi (infrared)	0 °C ~ 100 °C	1.3 °C	In house procedure IRT-01	
		100 °C ~ 200 °C	1.3 °C		
		200 °C ~ 300 °C	1.6 °C		
		300 °C ~ 400 °C	2.1 °C		
		400 °C ~ 500 °C	2.6 °C		
	500 °C ~ 650 °C	3.2 °C			

Mass

No.	Instrument to be calibrated	Measurement Range	CMC	Methods/Specifications
1	Weights (conventional mass)	0.001 g ~ 5 g	0.01 mg	in house procedure MWB-01
		5 g ~ 20 g	0.01 mg	
		50 g	0.03 mg	
		100 g	0.03 mg	
		200 g	0.05 mg	
		500 g	0.6 mg	
		1 kg	0.9 mg	
		2 kg	7 mg	
		5 kg	10 mg	
		10 kg	70 mg	
		20 kg	0.08 g	
		30 kg	0.19 g	
		2	Balance (electronic, mechanic)	
20 g ~ 50 g	0.04 mg			
50 g ~ 100 g	0.05 mg			
100 g ~ 200 g	0.1 mg			
200 g ~ 500 g	0.8 mg			

Mass (continued)

No.	Instrument to be calibrated	Measurement Range	CMC	Methods/Specifications
2	Balance (electronic, mechanic)	500 g ~ 1000 g	1.2 mg	in house procedure MWB-03
		1000 g ~ 2000 g	2.4 mg	
		2000 g ~ 3000 g	5.0 mg	
		3000 g ~ 5000 g	9 mg	
		5 kg ~ 10 kg	0.02 g	
		10 kg ~ 30 kg	0.1 g	
		30 kg ~ 60 kg	0.2 g	
		60 kg ~ 100 kg	1 g	
		100 kg ~ 300 kg	6 g	
		300 kg ~ 500 kg	30 g	
		500 kg ~ 1000 kg	60 g	
		1000 kg ~ 3000 kg	120 g	
3000 kg ~ 5000 kg	300 g			
5000 kg ~ 10000 kg	600 g			

Volume

No.	Instrument to be calibrated	Measurement Range	CMC	Methods/Specifications
1	Piston Pipette	10 uL ~ 1000 uL	0.3 uL	in house procedure PIP-01
		1 mL ~ 10 mL	1.3 uL	
	Volumetric Glassware; Volumetric Measures	0 mL ~ 0.5 mL	0.0003 mL	in house procedure MVL-01
		0.5 mL ~ 1 mL	0.001 mL	
		1 mL ~ 5 mL	0.001 mL	
		5 mL ~ 25 mL	0.005 mL	
		25 mL ~ 100 mL	0.01 mL	
		100 mL ~ 500 mL	0.07 mL	
		500 mL ~ 1000 mL	0.13 mL	
		1000 mL ~ 5000 mL	0.66 mL	
		5000 mL ~ 20000 mL	2.8 mL	

Density

No.	Instrument to be calibrated	Measurement Range	CMC	Methods/Specifications
1	Hydrometer	0.650 g/ml ~ 1.000 g/ml	0.0011 g/ml	in house procedure HD-01
		1.000 g/ml ~ 1.500 g/ml	0.0017 g/ml	
		1.500 g/ml ~ 2.000 g/ml	0.0018 g/ml	

Force

No.	Instrument to be calibrated	Measurement Range	CMC	Methods/Specifications
1	Universal Testing Machine	0 kgf ~ 500 kgf	0.13 %	in house procedure UTM-01
		0 kgf ~ 2000 kgf	0.2 %	
		0 kgf ~ 10000 kgf	0.4 %	
		0 kgf ~ 30000 kgf	0.1 %	
2	Push Pull Gauge	0 gf ~ 500 gf	0.3 gf	in house procedure PP-01
		0 gf ~ 1000 gf	0.59 gf	
		0 kgf ~ 10 kgf	0.006 kgf	
		0 kgf ~ 20 kgf	0.007 kgf	
		0 kgf ~ 50 kgf	0.11 kgf	
		0 kgf ~ 100 kgf	0.6 kgf	
		1 kgf = 9,80665 N		
3	Load Cell / Proving Ring	5 kN	0.02 kN	In house procedure LC-01
		20 kN	0.12 kN	
		100 kN	0.25 kN	
		300 kN	1.1 kN	

Torque

No.	Instrument to be calibrated	Measurement Range	CMC	Methods/Specifications
1	Torque Wrench	0 Nm ~ 30 Nm	0.23 Nm	in house procedure TWM - 01
		30 Nm ~ 50 Nm	0.24 Nm	
		50 Nm ~ 100 Nm	0.4 Nm	
		100 Nm ~ 500 Nm	1.1 Nm	
		500 Nm ~ 1100 Nm	3.4 Nm	
2	Torque Meter	0 Nm ~ 1 Nm	0.0001 Nm	
		1 Nm ~ 10 Nm	0.023 Nm	
		10 Nm ~ 50 Nm	0.04 Nm	
		50 Nm ~ 100 Nm	0.1 Nm	
		100 Nm ~ 400 Nm	0.4 Nm	
400 Nm ~ 1000 Nm	0.99 Nm			

Pressure

No.	Instrument to be calibrated	Measurement Range	CMC	Methods/Specifications
1	Dead Weight Tester	100 PSI ~ 16000 PSI	0.06 %	in house procedure TK DWT-01
2	Pressure Test Gauge (hydraulic)	0 bar ~ 60 bar	0.05 %	in house procedure TK TGG-01
		0 bar ~ 100 bar	0.04 %	
		0 bar ~ 250 bar	0.03 %	
		0 bar ~ 600 bar	0.02 %	
		0 bar ~ 1000 bar	0.02 %	
3	Pressure Gauge (hydraulic)	0 bar ~ 60 bar	0.2 bar	in house procedure TK PG-01
		0 bar ~ 100 bar	0.9 bar	
		0 bar ~ 250 bar	1.0 bar	
		0 bar ~ 600 bar	2.7 bar	
		( 1 bar = 10 <sup>5</sup> Pa)		
4	Pressure Gauge (pneumatic)	0 bar ~ 1 bar	0.005 bar	in house procedure TK PG-01
		0 bar ~ 5 bar	0.03 bar	
		0 bar ~ 10 bar	0.07 bar	
		0 psi ~ 300 psi	0.7 psi	
		( 1 psi = 6894.76 Pa)		
5	Vacuum Gauge	0 cmHg ~ -76 cmHg	0.3 cmHg	in house procedure TK VG-01
		( 1 cmHg = 1 333, 224 Pa)		

Hardness

No.	Instrument to be calibrated	Measurement Range	CMC	Methods/Specifications
1	Hardness Tester	0 HRB ~ 100 HRB	0.72 HRB	In house procedure HT - 01
		0 HRC ~ 70 HRC	0.4 HRC	
		0 HV ~ 900 HV	4.7 HV	
		0 HBW ~ 550 HBW	4.8 HBW	
2	Durometer	0 skala ~ 100 skala	0.6 skala	In house procedure HDT - 01

Length

No.	Instrument to be calibrated	Measurement Range	CMC	Methods/Specifications
1	Outside Micrometer	0 mm ~ 100 mm	1 µm	in house procedure ML 16
		100 mm ~ 1500 mm	7 µm	
2	Inside Micrometer	0 mm ~ 100 mm	1.1 µm	in house procedure ML 15
		100 mm ~ 1500 mm	6 µm	
3	Depth Micrometer	0 mm ~ 150 mm	1.1 µm	in house procedure ML 10
		150 mm ~ 300 mm	6 µm	
4	Height Gauge	0 mm ~ 1500 mm	18 µm	in house procedure ML 17
5	Calliper	0 mm ~ 1500 mm	18 µm	in house procedure ML 09
6	Thickness Gauge	0 mm ~ 10 mm	0.6 µm	in house procedure ML 14
		10 mm ~ 100 mm	6 µm	
7	Steel Ruler	0 mm ~ 1000 mm	651 µm	in house procedure ML 03
8	Bevel Protractor	0 <sup>o</sup> ~ 90 <sup>o</sup>	0.6 menit	in house procedure ML 13
9	Feeler Gauge	0 mm ~ 10 mm	2 µm	in house procedure ML 11
10	Measuring Microscope: Scale deviation	200 mm x 200 mm	3.3 µm	in house procedure ML 19
11	Measuring Projector (Profile Projector) Scale deviation	0 <sup>o</sup> ~ 360 <sup>o</sup>	4.4 menit	in house procedure ML 20
		200 mm x 200 mm	3.3 µm	
12	Dial Indicator	0 mm ~ 10 mm	2 µm	in house procedure ML 04
		10 mm ~ 25 mm	7 µm	
13	Dial Gauge Tester	0 mm ~ 5 mm	0.9 µm	in house procedure ML 05
		0 mm ~ 25 mm	1 µm	
14	Roll Meter	0 m ~ 1 m	0.7 mm	In house procedure ML 06
		1 m ~ 10 m	2 mm	
		10 m ~ 20 m	3 mm	
		20 m ~ 100 m	7 mm	
		100 m ~ 200 m	10 mm	
15	Cylinder Gauge (Bore Gauge) Anvil	0 mm ~ 25 mm	1 µm	In house procedure ML 18
		0 mm ~ 800 mm	2.6 µm	
16	Pin Gauge	0 mm ~ 60 mm	1.2 µm	In house procedure ML 01
17	Thread Plug Gauge: average diameter	M 1 ~ M 150	5.1 µm	In house procedure ML 02
	Thread Plug Gauge: Major & minor diameter	M 1 ~ M 150	1.2 µm	
	Thread Plug Gauge: Pitch Annel	M 1 ~ M 150	0.07 menit	

Length (continued)

No.	Instrument to be calibrated	Measurement Range	CMC	Methods/Specifications
18	Snap Gauge	0 mm ~ 500 mm	1.9 $\mu$ m	In house procedure ML 07
19	Theodolite:			In house procedure ML 08
	Angular Scale verification	0 ° ~ 360 °	5 sec	
	Liquid level sensitivity	0 mm/m ~ 0.5 mm/m	0.02 mm/m	
20	Gap Gauge	0 mm ~ 300 mm	3.7 $\mu$ m	In house procedure ML 29
21	Autolevel:			In house procedure ML 12
	optic level verification	100 mm/m ~ 300 mm/m	5 sec	
	Liquid level sensitivity	0 mm/m ~ 0.5 mm/m	0.02 mm/m	
22	Gauge Block	0.5 mm ~ 10 mm	0.12 $\mu$ m	In house procedure ML 30
		10 mm ~ 25 mm	0.13 $\mu$ m	
		25 mm ~ 50 mm	0.14 $\mu$ m	
		50 mm ~ 75 mm	0.16 $\mu$ m	
		75 mm ~ 100 mm	0.18 $\mu$ m	
23	Water Pass	0.02 mm/m ~ 10 mm/m	0.01 mm/m	In house procedure ML 31
24	Ring Gauge	0 mm ~ 300 mm	3.7 $\mu$ m	In house procedure ML 21
25	Test Sieve	0 mm ~ 10 mm	4.1 $\mu$ m	In house procedure ML 22
26	Coating Thickness	0 mm ~ 8 mm	1.5 $\mu$ m	In house procedure ML 23
27	Scale Loupe	0 mm ~ 20 mm	4 $\mu$ m	In house procedure ML 25
28	Thickness Film	0 mm ~ 10 mm	1.2 $\mu$ m	In house procedure ML 27
29	Plug Gauge	0 mm ~ 50 mm	1 $\mu$ m	In house procedure ML 28
		50 mm ~ 300 mm	4.4 $\mu$ m	
30	Graticule/ Calibration Grid	0 mm ~ 200 mm	4.4 $\mu$ m	In house procedure ML 25
31	Three Point Internal Micrometer/ Holtest	0 mm ~ 100 mm	4.6 $\mu$ m	In house procedure ML 26
32	Standar Scale	0 mm ~ 300 mm	4.4 $\mu$ m	in house procedure ML 46
33	Head Micrometer	0 mm ~ 25 mm	1.2 $\mu$ m	in house procedure ML 44
34	Pitch Gage	0.2 mm ~ 10 mm	4.1 $\mu$ m	in house procedure ML 47
35	Depth Gauge	0 mm ~ 300 mm	18 $\mu$ m	in house procedure ML 48
36	Taper Gauge	0 mm ~ 200 mm	4.4 $\mu$ m	in house procedure ML 38
37	Roughness Tester	0.05 $\mu$ mRa ~ 12.5 $\mu$ mRa	0.075 $\mu$ mRa	in house procedure ML 41
38	Ultrasonic Thickness Meter	0.5 mm ~ 100 mm	6 $\mu$ m	in house procedure ML 37
39	Radius Gauge	0.1 mm ~ 150 mm	4.1 $\mu$ m	in house procedure ML 42
40	Microscope	0.002 mm ~ 10 mm	2.4 $\mu$ m	in house procedure ML 32
		0.35 x ~ 100 x	0.22 %	
41	Coordinate Measuring Machine	~ 500 mm	1.5 $\mu$ m	in house procedure ML 45
42	Angle Block	0.2 ° ~ 90 °	4.4 sec	in house procedure ML 24
43	3-Wire	0.17 mm ~ 3.2 mm	3.7 $\mu$ m	in house procedure ML 43
44	Setting Bar	0 mm ~ 300 mm	4.6 $\mu$ m	in house procedure ML 33
45	Straight Edge (Straightnes (Ketinggian) (Keparallelan) (Lebar)	0 mm ~ 500 mm	2.3 $\mu$ m	in house procedure ML 36
			6.6 $\mu$ m	
			2.3 $\mu$ m	
			6.6 $\mu$ m	
46	Square (Squareness)	0 mm ~ 500 mm	3.4 $\mu$ m	in house procedure ML 35
47	Step Gauge / Caliper Checker	20 mm ~ 600 mm	3.8 $\mu$ m	in house procedure ML 34
48	V- Block (Flatness-Permukaan bawah) (Flatness-Permukaan V) (Keparallelan-permukaan bawah & cylinder permukaan V block)) (Kemiringan-jalur V dari permukaan bawah) (Keparallelan-diantara permukaan sis & cylinder permukaan V block)	0 mm ~ 150 mm	1.8 $\mu$ m	in house procedure ML-40
49	Surface Plate	1000 mm x 1000 mm	0.4 $\mu$ m	in house procedure ML-39

Electrical

No.	Instrument to be calibrated	Measurement Range	CMC	Methods/Specifications
1	DC Current Source	0.1 mA ~ 10 mA	1.1 $\mu$ A	in house procedure ECL 01
		10 mA ~ 100 mA	9 $\mu$ A	
		100 mA ~ 1 A	95 $\mu$ A	
		1 A ~ 3 A	1.2 mA	
2	AC Current Source	f = 45 Hz ~ 1kHz		in house procedure ECL 01
		0.1 A ~ 1 A	0.2 mA	
		1 A ~ 3 A	4.1 mA	
3	Resistor	1 $\Omega$ ~ 10 $\Omega$	2.9 m $\Omega$	in house procedure ECL 01
		10 $\Omega$ ~ 100 $\Omega$	7 m $\Omega$	
		100 $\Omega$ ~ 1000 $\Omega$	0.35 $\Omega$	
		1 k $\Omega$ ~ 10 k $\Omega$	0.62 $\Omega$	
		10 k $\Omega$ ~ 100 k $\Omega$	1 $\Omega$	
		100 k $\Omega$ ~ 1 M $\Omega$	0.12 k $\Omega$	
		1 M $\Omega$ ~ 10 M $\Omega$	0.5 k $\Omega$	
		10 M $\Omega$ ~ 100 M $\Omega$	37 k $\Omega$	

Electrical (continued)

No.	Instrument to be calibrated	Measurement Range	CMC	Methods/Specifications	
4	AC Ammeter	f = 45 Hz ~ 1 kHz		in house procedure ECL 02	
		0 $\mu$ A ~ 200 $\mu$ A	150 nA		
		0.2 mA ~ 2 mA	1 $\mu$ A		
		2 mA ~ 20 mA	11 $\mu$ A		
		20 mA ~ 200 mA	107 $\mu$ A		
		0.2 A ~ 2 A	1 mA		
		2 A ~ 10 A	4 mA		
		f = 45 Hz ~ 500 Hz			
10 A ~ 20 A	15 mA				
6	DC Ammeter	0 $\mu$ A ~ 200 $\mu$ A	14.1 nA	in house procedure ECL 03	
		0.2 mA ~ 2 mA	0.1 $\mu$ A		
		2 mA ~ 20 mA	4 $\mu$ A		
		20 mA ~ 200 mA	10.0 $\mu$ A		
		0.2 A ~ 2 A	0.3 mA		
		2 A ~ 10 A	1.1 mA		
		10 A ~ 20 A	2.4 mA		
7	AC Voltmeter	45 Hz ~ 10 kHz		in house procedure ECL 04	
		1 mV ~ 200 mV	75 $\mu$ V		
		0.2 V ~ 2 V	0.2 mV		
		2 V ~ 20 V	1 mV		
		20 V ~ 200 V	3.2 mV		
		200 V ~ 700 V	250 mV		
		45 Hz ~ 1 kHz			
		700 V ~ 1000 V	173 mV		
8	DC Voltmeter	0 mV ~ 200 mV	3 $\mu$ V	in house procedure ECL 03	
		200 mV ~ 2 V	0.02 mV		
		2 V ~ 20 V	0.11 mV		
		20 V ~ 200 V	3 mV		
		200 V ~ 1000 V	5 mV		
9	Ohm Meter	0.1 $\Omega$	2 m $\Omega$	in house procedure ECL 05	
		1 $\Omega$	2 m $\Omega$		
		10 $\Omega$	2 m $\Omega$		
		100 $\Omega$	2 m $\Omega$		
		1 k $\Omega$	0.02 $\Omega$		
		10 k $\Omega$	0.1 $\Omega$		
		100 k $\Omega$	1 $\Omega$		
		1 M $\Omega$	0.1 k $\Omega$		
		10 M $\Omega$	1.2 k $\Omega$		
		100 M $\Omega$	76.9 k $\Omega$		
1000 M $\Omega$	6932 k $\Omega$				
10	Inductance Meter	f = 1 kHz		in house procedure ECL 08	
		1 mH	0.06 mH		
		10 mH	0.12 mH		
		19 mH	0.2 mH		
		29 mH	0.3 mH		
		50 mH	0.29 mH		
		100 mH	0.98 mH		
		1 H	57.5 mH		
10 H	114 mH				
11	Capacitance Meter	f = 1 kHz		in house procedure ECL 09	
		1 nF	0.023 nF		
		10 nF	0.024 nF		
		20 nF	0.026 nF		
		50 nF	0.041 nF		
		100 nF	0.07 nF		
		1 $\mu$ F	0.8 nF		
		10 $\mu$ F	0.013 $\mu$ F		
100 $\mu$ F	0.11 $\mu$ F				
12	AC Watt Meter	V = 20 V ~ 1000 V; I $\geq$ 1A f = 45 Hz ~ 400 Hz; cos $\phi$ = 1		in house procedure ECL 10	
		0 kW ~ 1 kW	0.3 W		
		1 kW ~ 10 kW	2.9 W		
		10 kW ~ 100 kW	28.6 W		
		100 kW ~ 1000 kW	147.3 W		

Electrical (continued)

No.	Instrument to be calibrated	Measurement Range	CMC	Methods/Specifications
13	AC HV Source	f = 50 Hz		In house procedure ECL 11
		0 kV ~ 1 kV	0.07 kV	
		1 kV ~ 5 kV	0.09 kV	
		5 kV ~ 10 kV	0.14 kV	
		10 kV ~ 15 kV	0.23 kV	
14	DC HV Source	0 kV ~ 1 kV	0.06 kV	In house procedure ECL 12
		1 kV ~ 5 kV	0.09 kV	
		5 kV ~ 10 kV	0.12 kV	
		10 kV ~ 15 kV	0.21 kV	
		15 kV ~ 20 kV	0.24 kV	
15	Insulation Tester	1 kΩ	0.6 Ω	In house procedure ECL 13
		10 kΩ	5.8 Ω	
		100 kΩ	13 Ω	
		1 MΩ	0.6 kΩ	
		10 MΩ	9 kΩ	
		100 MΩ	253 kΩ	
		1 GΩ	10 MΩ	
		10 GΩ	148 MΩ	
		100 GΩ	1982 MΩ	
16	AC Clamp Meter	f = 50 Hz ~ 60 Hz		In house procedure ECL 14
		10 A ~ 50 A	0.11 A	
		50 A ~ 100 A	0.13 A	
		100 A ~ 200 A	0.2 A	
		200 A ~ 500 A	0.34 A	
		500 A ~ 800 A	0.5 A	
17	DC Clamp Meter (Hall Effect Clamp)	f = 50 Hz ~ 60 Hz		In house procedure ECL 15
		10 A ~ 50 A	0.11 A	
		50 A ~ 100 A	0.12 A	
		100 A ~ 200 A	0.16 A	
		200 A ~ 500 A	0.3 A	
		500 A ~ 800 A	0.46 A	
18	AC High Current Source	f = 50 Hz ~ 60 Hz		In house procedure ECL 16
		10 A ~ 200 A	4.4 A	
		200 A ~ 400 A	8.1 A	
		400 A ~ 600 A	9 A	
		600 A ~ 800 A	12 A	
19	DC High Current Source	10 A ~ 200 A	4.3 A	In house procedure ECL 16
		200 A ~ 400 A	10.5 A	
		400 A ~ 600 A	12 A	
		600 A ~ 800 A	15 A	
		800 A ~ 1000 A	13 A	
20	DC Voltage Source	1 mV ~ 100 mV	0.01 mV	in house procedure ECL 01
		100 mV ~ 1 V	0.01 mV	
		1 V ~ 10 V	0.06 mV	
		10 V ~ 100 V	2.17 mV	
		100 V ~ 1000 V	12.9 mV	
21	AC Voltage Source	f = 10 Hz ~ 20kHz		in house procedure ECL -01
		1 mV ~ 100 mV	0.01 mV	
		100 mV ~ 1 V	0.4 mV	
		1 V ~ 10 V	7.0 mV	
		10 V ~ 100 V	23 mV	
22	DC Current Source	0.1 mA ~ 10 mA	1.1 μA	in house procedure ECL 01
		10 mA ~ 100 mA	9 μA	
		100 mA ~ 1 A	95 μA	
		1 A ~ 3 A	1.2 mA	
23	AC Current Source	f = 10 Hz ~ 5kHz		in house procedure ECL-01
		0.1 A ~ 1 A	0.2 mA	
		1 A ~ 3 A	4.1 mA	

Electrical (continued)

No.	Instrument to be calibrated	Measurement Range	CMC	Methods/Specifications
24	Resistor	1 $\Omega$ ~ 10 $\Omega$	2.9 m $\Omega$	in house procedure ECL-01
		10 $\Omega$ ~ 100 $\Omega$	7 m $\Omega$	
		100 $\Omega$ ~ 1000 $\Omega$	0.35 $\Omega$	
		1 k $\Omega$ ~ 10 k $\Omega$	0.62 $\Omega$	
		10 k $\Omega$ ~ 100 k $\Omega$	1 $\Omega$	
		100 k $\Omega$ ~ 1 M $\Omega$	0.12 k $\Omega$	
		1 M $\Omega$ ~ 10 M $\Omega$	0.5 k $\Omega$	
10 M $\Omega$ ~ 100 M $\Omega$	37 k $\Omega$			

Time and Frequency

No.	Instrument to be calibrated	Measurement Range	CMC	Methods/Specifications
1	Frequency Meter	100 Hz	4.3 mHz	in house procedure ECL 07
		1 kHz	1.2 Hz	
		10 kHz	11.35 Hz	
		20 kHz	11.36 Hz	
		50 kHz	11.43 Hz	
		100 kHz	113.47 Hz	
		1 MHz	0.13 kHz	
2	Frequency Source	3 Hz ~ 5 Hz	20 mHz	in house procedure ECL 01
		10 Hz ~ 50 Hz	19.66 mHz	
		100 Hz ~ 500 kHz	23 mHz	
		1 kHz ~ 5 kHz	0.15 Hz	
		10 kHz ~ 50 kHz	1.07 Hz	
		100 kHz ~ 300 kHz	3.72 Hz	
3	Stopwatch	10 s ~ 24 jam	0.83 s	in house procedure STP 01
4	RPM-Meter (optical sensor)	100 rpm ~ 500 rpm	0.6 rpm	in house procedure TCH 01
		500 rpm ~ 1000 rpm	0.6 rpm	
		1000 rpm ~ 5000 rpm	1.0 rpm	
		5000 rpm ~ 10000 rpm	1.5 rpm	
		10000 rpm ~ 20000 rpm	2.6 rpm	
		20000 rpm ~ 50000 rpm	5.7 rpm	
		50000 rpm ~ 60000 rpm	10.5 rpm	
5	RPM-Meter (mechanical)	500 rpm ~ 5000 rpm	13.7 rpm	in house procedure TCH - 02

Analytical Instruments

No.	Instrument to be calibrated	Measurement Range	CMC	Methods/Specifications
1	pH Meter	0 pH ~ 14 pH	0.02 pH	in house procedure PH 01
2	Viscosity	5 cP ~ 104320 cP	1.1 %	In house procedure VIS 01
3	Conductivity	84 $\mu$ S ~ 1.4 mS	1 $\mu$ S	In house procedure CD 01
		1.4 mS ~ 5 mS	6 $\mu$ S	
		5 mS ~ 12.8 mS	23 $\mu$ S	
		12.8 mS ~ 111.8 mS	57 mS	
4	Spectrophotometer Transmittance	51.7 %T	0.8 %T	In house procedure FTM - 01
		49.8 %T		
		9.8 %T		
	Panjang Gelombang ( $\lambda$ )	404.6 nm	1.5 nm	
		531.2 nm		
		792.0 nm		
		SRE		
SRE	SRE 220	0.5 nm		
	SRE 340			
	SRE 400			
5	Refractometer	0 Brix ~ 60 Brix	0.13 Brix	In house procedure RFT 01

Notes:

Calibration & Measurement Capability is stated as *Expanded Uncertainty* at approximately 95% confidence level, calculated using *coverage factor* of  $k = 2$ , includes uncertainty contribution due to reference standards used by the laboratory, measurement process at the laboratory, and contribution due to typical characteristic of nearly ideal device under calibration respective to the laboratory

The actual characteristic of device under calibration shall also be considered for individual calibration certificate issued by the laboratory