



## EMIRATES METROLOGY INSTITUTE

1. Calibration measurement capabilities( CMCs )
2. Standard Equipment capabilities per Lab

DIMENSION LAB			
Measuring parameter	Measurement std. instrument	Range and Expanded Uncertainty of the Measurement Std.	CMC (service, Range, expanded uncertainty)
Length	Iodine-stabilized He-Ne laser ( $\lambda$ :633 nm)	633 nm Rel. U = $2 \times 10^{-11}$	Service: Iodine Stabilized Laser Sources at 633 nm Range: 633 nm Uncertainty (95%): 0.04 fm  Service: Other Stabilized Laser Sources at 633 nm Range: 633 nm Uncertainty (95%): 0.7 fm
	Gauge block interferometer	0.5 to 300 mm U = 25 nm	Service: Calibration of gauge blocks by interferometry Range: 0.5 to 100 mm Uncertainty (95%): 25 to 50 nm  Service: Calibration of gauge blocks by interferometry Range: 100 to 300 mm Uncertainty (95%): 50 to 200 nm
	Gauge block comparator	0.5 to 100 mm U = 50 nm	Service: Calibration of gauge blocks by comparison Range: 0.5 to 100 mm Uncertainty (95%): 50 to 120 nm
Angle	Angle Encoder	Range: 360° U = 0.05 arc sec	Service: Calibration of angle gauge blocks Range: 0 to 90° Uncertainty (95%): 0.01°  Service: Calibration of angle indicating instruments Range: 0 to 90° Uncertainty (95%): 0.02°



MASS LAB			
Measuring parameter	Measurement std. instrument	Range and Expanded Uncertainty of the Measurement Std.	CMC (service, Range, expanded uncertainty)
Mass	Stainless steel mass standard	(500 kg to 100 kg) U = 8 g to 0.6 g	Service: Mass standards Range: (500 kg to 100 kg) Uncertainty (95%): 17 g to 1.5 g
		(100 kg to 10 kg) U = 50 mg to 1.6 mg	Service: Mass standards Range: (100 kg to 10 kg) Uncertainty (95%): 600 mg to 5 mg
		Nominal Value: 1 kg U = 70 µg	Service: Mass standards Range: (10 kg to 1 kg) Uncertainty (95%): 1.6 mg to 0.16 mg
		Nominal Value: 1 kg U = 45 µg	Service: Stainless steel mass standards Range: 1 kg Uncertainty (95%): 70 µg
		Nominal Value: 1 kg U = 70 µg	Service: Mass standards Range: (1 kg to 100 g) Uncertainty (95%): 160 µg to 16 µg
		Nominal Value: 100 g U = 16 µg	Service: Mass standards Range: (100 g to 10 g) Uncertainty (95%): 16 µg to 6 µg
		Nominal Value: 10 g U = 6 µg	Service: Mass standards Range: (10 g to 1 g) Uncertainty (95%): 6 µg to 3 µg
		Nominal Value: 1 g U = 3 µg	Service: Mass standards Range: (1 g to 100 mg) Uncertainty (95%): 3 µg to 1.6 µg
		Nominal Value: 100 mg U = 1.6 µg	Service: Mass standards Range: (100 mg to 10 mg) Uncertainty (95%): 1.6 µg to 1 µg
		Nominal Value: 10 mg U = 1 µg	Service: Mass standards Range: (10 mg to 1 mg) Uncertainty (95%): 1 µg to 0.7 µg



<b>VOLUME and FLOW LABS</b>			
Measuring parameter	Measurement std. instrument	Range and Expanded Uncertainty of the Measurement Std.	CMC (service, Range, expanded uncertainty)
Density of Solid @ 20 °C	Density artefact (Si sphere)	(2300 kg/m <sup>3</sup> to 2800 kg/m <sup>3</sup> ) Rel. U = 0.005 %	Service: Density artefacts Range: (20 g to 1000 g) Uncertainty (95%): Rel. unc.: 0.01 %
Density of Solid @ 20 °C	Density artefact (stainless steel mass standards)	(7900 kg/m <sup>3</sup> to 8400 kg/m <sup>3</sup> ) Rel. U = 0.01 % to 0.7 %	Service: Mass standards Range: Nominal mass of 1 g to 1000 g Uncertainty (95%): Rel. unc.: (0.01 % to 0.7 %)
Density of Liquid @ 20 °C	Density artefact (Schott glass sinker)	2525 kg/m <sup>3</sup> U = 1 kg/m <sup>3</sup>	Service: Liquids of viscosity ≤ 20 mPa·s Range: (680 kg/m <sup>3</sup> to 1200 kg/m <sup>3</sup> ) Uncertainty (95%): 0.6 kg/m <sup>3</sup>
Liquid Volume	Stainless steel overflow reference pipette	Nominal Value: 50 l U = 0.003 ml	Service: Proving tanks and volumetric vessels Range: (50 l to 1000 l) Uncertainty (95%): Rel. unc.: 0.03 %
Liquid Flow Rate (Volume)	Positive Displacement Flow Standard (Piston Prover)	(0.024 m <sup>3</sup> /h to 72 m <sup>3</sup> /h) Rel. U = 0.11 %	Service: Water flow meters (turbine, PD, e-mag, Coriolis etc.), size DN 10 to DN 60 Range: (0.024 to 72 m <sup>3</sup> /h) Uncertainty (95%): Rel. unc.: 0.12 %
Gas Flow Rate (Volume)	Positive Displacement Flow Standard (Piston Prover)	(0.3 l/h to 3000 l/h) Rel. U = 0.18 %	Service: Gas flow meters (Variable area, thermal mass, PD, etc.), size up to DN 10 Range: (0.3 l/h to 3000 l/h) Uncertainty (95%): 0.20 %
	Positive Displacement Flow Standard (Bell Prover)	(0.84 m <sup>3</sup> /h to 80 m <sup>3</sup> /h) Rel. U = 0.20 %	Service: Gas flow meters (turbine, PD, etc.), size DN 10 to DN 40 Range: (0.84 m <sup>3</sup> /h to 80 m <sup>3</sup> /h) Uncertainty (95%): 0.22 %



### FORCE, PRESSURE and TORQUE LABS

Measuring parameter	Measurement std. instrument	Range and Expanded Uncertainty of the Measurement Std.	CMC (service, Range, expanded uncertainty)
Force	Hydraulic Force Standard Machine with reference force transducers	(100 kN – 5 MN) Rel. U = $500 \times 10^{-6}$	Service: Force Proving Devices Range: 100 kN to 5000 kN Uncertainty (95%): 0.05 kN to 2.5 kN
Torque	Torque Standard Machine	(0.5 N·m -1 kN·m) Rel. U = $100-1000 \times 10^{-6}$	Service: Torque Transducers Range: 0.5 N·m to <1 N·m Uncertainty (95%): 0.0005 N·m to 0.001 N·m Service: Torque Transducers Range: 1 N·m to <10 N·m Uncertainty (95%): 0.0005 N·m to 0.005 N·m Service: Torque Transducers Range: 10 N·m to 1000 N·m Uncertainty (95%): 0.001 N·m to 0.1 N·m
Pressure	Vacuum Gauges	(10 $\mu$ Pa-4 kPa) Rel. U = 0.05%-10%	Service: Vacuum Gauge Range: 0.01 mPa to 1 mPa Uncertainty (95%): 0.001 mPa to 0.1 mPa Service: Vacuum Gauge Range: 1 mPa to 100 mPa Uncertainty (95%): 0.01 mPa to 1 mPa Service: Vacuum Gauge Range: 100 mPa to 4 kPa Uncertainty (95%): 0.05 mPa to 0.1 mPa to 0.002 kPa
	Differential Pressure balance	(0-200kPa diff.) Rel. U = $40 \times 10^{-6} + 9 \text{ Pa}$	Service: Differential Pressure Transmitters Range: 0 kPa to 200 kPa differential (static pressure up to 20 MPa) Uncertainty (95%): 9 Pa to 17 Pa
	Pressure balance	(0.009-7MPa gas) Rel. U = $17-25 \times 10^{-6}$	Service: Electromechanical and Mechanical Manometers Range: 9 kPa to 380 kPa Uncertainty (95%): 0.54 Pa to 6.86 Pa Service: Electromechanical and Mechanical Manometers Range: 18 kPa to 760 kPa Uncertainty (95%): 0.83 Pa to 14.18 Pa Service: Electromechanical and Mechanical Manometers Range: 35 kPa to 1.9 MPa Uncertainty (95%): 1.67 Pa to 37.10 Pa Service: Electromechanical and Mechanical Manometers Range: 70 kPa to 3.8 MPa Uncertainty (95%): 2.84 Pa to 47.60 Pa



			Service: Electromechanical and Mechanical Manometers Range: 140 kPa to 7.1 MPa Uncertainty (95%): 5.5 Pa to 177 Pa
	Pressure balance	(0.1-500MPa oil) Rel. U = 25-85 x 10 <sup>-6</sup>	Service: Electromechanical and Mechanical Manometers Range: 0.1 MPa to 10 MPa Uncertainty (95%): 22.5 Pa to 270 Pa Service: Electromechanical and Mechanical Manometers Range: 0.2 MPa to 20 MPa Uncertainty (95%): 25.4 Pa to 560 Pa Service: Electromechanical and Mechanical Manometers Range: 0.5 MPa to 50 MPa Uncertainty (95%): 35.5 Pa to 1.38 kPa Service: Electromechanical and Mechanical Manometers Range: 1 MPa to 100 MPa Uncertainty (95%): 57 Pa to 3.23 kPa Service: Electromechanical and Mechanical Manometers Range: 2 MPa to 200 MPa Uncertainty (95%): 131 Pa to 9.64 kPa Service: Electromechanical and Mechanical Manometers Range: 5 MPa to 500 MPa Uncertainty (95%): 525 Pa to 42.6 kPa



<b>ELECTRICAL, TIME AND FREQUENCY LAB</b>			
Measuring parameter	Measurement std. instrument	Range and Expanded Uncertainty of the Measurement Std.	CMC (service, Range, expanded uncertainty)
DC Voltage	Zener Voltage Standards and Reference Divider	(1 mV to 1200 V) Rel. U = $0.02 \times 10^{-6}$ - ( $3 \times 10^{-6} + 2 \mu\text{V}$ )	Service: Solid State DC Voltage Standards Range: 10 V Uncertainty (95%): 7.3 $\mu\text{V}$
			Service: Solid State DC Voltage Standards Range: 1.018 V Uncertainty (95%): 2.6 $\mu\text{V}$
			Service: DC voltage calibration of measuring instruments Range: 1 mV to 1 kV Uncertainty (95%): 3.4 $\mu\text{V/V}$ to 46 $\mu\text{V/V}$
			Service: DC voltage calibration of sources Range: 1 mV to 1.2 kV Uncertainty (95%): 3.4 $\mu\text{V/V}$ to 46 $\mu\text{V/V}$
			Service: DC voltage calibration of sources Range: 1 kV to 40 kV Uncertainty (95%): 2%
AC Voltage	AC/DC Thermal Transfer Standards	(2 mV to 1000V) (10 Hz to 1 MHz) Rel. U = $(10-5000) \times 10^{-6}$	Service: AC voltage calibration of measuring instruments Range: 10 mV to 1 kV - 10 Hz to 100 kHz Uncertainty (95%): 28 $\mu\text{V/V}$ to 2 mV/V
			Service: AC voltage calibration of sources Range: 10 mV to 1 kV - 10 Hz to 100 kHz Uncertainty (95%): 28 $\mu\text{V/V}$ to 2 mV/V
			Service: AC voltage calibration of sources Range: 1 kV to 25 kV - 40 Hz to 60 Hz Uncertainty (95%): 2%
Resistance	Resistance Bridge and Reference Resistors	(1 m $\Omega$ – 10 G $\Omega$ ) Rel. U = $(0.06-50) \times 10^{-6}$	Service: DC resistance standards Range: 100 $\mu\Omega$ - 10 m $\Omega$ Uncertainty (95%): 14 $\mu\Omega/\Omega$ to 6 $\mu\Omega/\Omega$
			Service: DC resistance standards Range: 100 m $\Omega$ - 10 k $\Omega$ Uncertainty (95%): 0.43 $\mu\Omega/\Omega$ to 0.57 $\mu\Omega/\Omega$
			Service: DC resistance standards Range: 100 k $\Omega$ - 10 G $\Omega$ Uncertainty (95%): 1.9 $\mu\Omega/\Omega$ to 60 $\mu\Omega/\Omega$



			<p>Service: DC resistance calibration of resistor decades Range: 1 mΩ/step to 100 MΩ/step Uncertainty (95%):0.05 mΩ to 20 mΩ/Ω</p> <p>Service: DC resistance calibration of measuring instruments Range: 0 Ω to 10 GΩ Uncertainty (95%):3.0 μΩ to 100 μΩ/Ω</p> <p>Service: DC resistance ratio Range: 0.1:1 to 1000:1 Uncertainty (95%):0.08 to 100 μΩ/Ω</p>
DC Current	Precision Current Shunts and DC Current Transformer	(10 μA to 150 A) Rel. U = (20 – 174) x10 <sup>-6</sup>	<p>Service: DC current calibration of measuring instruments Range: 10 μA to 20 A Uncertainty (95%): 35 μA/A to 100 μA/A</p>
			<p>Service: DC current calibration of sources Range: 10 μA to 150 A Uncertainty (95%): 3.0 nA to 20 μA/A</p>
AC Current	Precision Current Shunts	(1 mA to 100 A) ( DC to 100 kHz ) Rel. U = (20 – 174) x10 <sup>-6</sup>	<p>Service: AC current calibration of measuring instruments Range: 10 μA to 20 A - 10 Hz to 100 kHz Uncertainty (95%):140 μA/A to 1 mA/A</p>
			<p>Service: AC current calibration of measuring instruments Range: 20 A to 120 A - 45 Hz to 65 Hz Uncertainty (95%):10 μA/A to 100 μA/A</p>
			<p>Service: AC current calibration of sources Range: 10 μA to 20 A - 10 Hz to 100 kHz Uncertainty (95%):140 μA/A to 1 mA/A</p>
			<p>Service: AC current calibration of sources Range: 20 A to 120 A - 45 Hz to 65 Hz Uncertainty (95%):10 μA/A to 100 μA/A</p>
Capacitance	Reference Capacitors	(10 pF to 1000 pF) Rel. U =5 x10 <sup>-6</sup>	<p>Service: Standard capacitors Range: 10 pF to 1000 pF Uncertainty (95%): 20 μF/F</p>
			<p>Service: Capacitance calibration of measuring instruments Range: 100 pF to 40 mF Uncertainty (95%): 6.6 mF/F to 18 mF/F</p>
			<p>Service: Capacitance calibration of sources Range: 100 pF to 110 mF Uncertainty (95%): 250 μF/F to 18 mF/F</p>
Inductance	Reference Inductors	(100 μH to 1 H) Rel. U = 0.01%	<p>Service: Standard inductors Range: 100 μH to 1 H</p>



			Uncertainty (95%): 100 $\mu$ H/H
AC Power and Energy	Primary Power Meter	0 to 60 kW 40 Hz to 400 Hz Rel. U = 25 $\mu$ W/VA	Service: AC Power calibration of measuring instruments Range: 1 V to 500 V - 0.125 A to 120 A 40 Hz to 400 Hz Uncertainty (95%): Active Power 25 $\mu$ W/W Reactive Power 25 $\mu$ W/W
Frequency	<sup>133</sup> Caesium stds.	(1 MHz, 5MHz, 10MHz) Rel. U = 10 <sup>-13</sup>	Service: Local Frequency Standard Range: 1 MHz, 5 MHz, 10 MHz Uncertainty (95%): 2.1 x 10 <sup>-11</sup>
			Service: General Frequency Source Range: 1 MHz to 350 MHz Uncertainty (95%): 3 x 10 <sup>-11</sup>
			Service: Frequency Counter Range: 1 MHz, 5 MHz, 10 MHz Uncertainty (95%): 1.4 x 10 <sup>-12</sup>
			Service: Frequency Counter Range: 1 kHz to 350 MHz Uncertainty (95%): 3 x 10 <sup>-11</sup>
			Service: Time Interval – Stopwatches and Timers Range: 20 minutes to 100 hours Uncertainty (95%): 0.48 s
			Service: Time Interval – Local clock Range: 24 hours Uncertainty (95%): 1.3 s
			Service: Time scale difference – Local clock vs. UTC Range: $\pm$ 5 minutes Uncertainty (95%): 0.8 s
			Service: Non-contact tachometer Range: 30 rpm to 199 999 rpm Uncertainty (95%): 0.01 rpm to 1 rpm





TEMPERATURE AND HUMIDITY LAB			
Measuring parameter	Measurement std. instrument	Range and Expanded Uncertainty of the Measurement Std.	CMC (service, Range, expanded uncertainty)
Temperature	Triple point of Mercury	-38.83440 °C U = 0.2 mK	Service: Calibration of SPRT Range: -38.83440 °C Uncertainty (95%): 0.6 mK
	Triple point of Water	0.01 °C U = 0.1 mK	Service: Calibration of SPRT Range: 0.01 °C Uncertainty (95%): 0.5 mK
	Ga melting point	29.76460 °C U = 0.1 mK	Service: Calibration of SPRT Range: 29.76460 °C Uncertainty (95%): 0.5 mK
	In freezing point	156.5985 °C U = 0.7 mK	Service: Calibration of SPRT Range: 156.5985 °C Uncertainty (95%): 1.2 mK
	Sn freezing point	231.9280 °C U = 0.5 mK	Service: Calibration of SPRT Range: 231.9280 °C Uncertainty (95%): 1.2 mK
	Zn freezing point	419.5270 °C U = 0.7 mK	Service: Calibration of SPRT Range: 419.5270 °C Uncertainty (95%): 1.7 mK  Service: Calibration of Noble and Pure Metal Thermocouples Range: 419.5270 °C Uncertainty (95%): 0.3 °C
	Al freezing point	660.3230 °C U = 1.3 mK	Service: Calibration of SPRT Range: 660.3230 °C Uncertainty (95%): 7 mK  Service: Calibration of Noble and Pure Metal Thermocouples Range: 660.3230 °C Uncertainty (95%): 0.3 °C
	Ag freezing point	961.780 °C U = 7 mK	Service: Calibration of Noble and Pure Metal Thermocouples Range: 961.780 °C Uncertainty (95%): 0.3 °C
	Cu freezing point	1084.620 °C U = 15 mK	Service: Calibration of Noble and Pure Metal Thermocouples Range: 1084.620 °C Uncertainty (95%): 0.4 °C
	SPRTs (five instruments)	-80 to 660 °C 0.6 to 7 mK	Service: Comparison calibration of resistance thermometers Range: -80 to 250 °C Uncertainty (95%): 0.01 to 0.02 °C



	Type S thermocouples (two instruments)	0 to 1100 °C 0.3 to 0.4 °C	Service: Comparison Calibration of Thermocouples Range: 0 to 1100 °C Uncertainty (95%): 0.4 to 0.8 °C
Humidity	Two-pressure humidity generator	10 to 95 %rh 0.2 to 0.7 %rh	Service: Calibration of hygrometers Range: 10 to 95 %rh Uncertainty (95%): 0.3 to 1 %rh
	Optical dew-point hygrometer	-20 to 70 °C dew point 0.05 to 0.07 °C dew point	Service: Calibration of hygrometers Range: -20 to 70 °C dew point Uncertainty (95%): 0.1 °C dew point