

SCOPE OF ACCREDITATION

PCSIR Labs Complex, Peshawar (PLC)

Chemical Testing Laboratory

Annex-I

<i>Materials</i>	<i>Types of test/ properties measured</i>	<i>Range of Measurement</i>	<i>Minimum Detection Limit</i>	<i>Uncertainty of measurement (where applicable) (±)</i>	<i>Standard Specification/ Techniques/ Equipment Used</i>
Water	i. pH	0-14	0.01	0.0185	Standard Methods for the Examination of water and wastewater, APHA/ AWWA/ WEF 21 st Edition, 2005 Method No. Section 4-90-94 Method No. 3500-Na B Method No. 3500 – K B Method No. 2340 – C Method No. 3500 – Ca B Method No. 2320 - B
	ii. Sodium (Na)	0-40 ppm	0.1 ppm	0.1555 ppm	
	iii. Potassium (K)	0-20 ppm	0.1 ppm	0.120975 ppm	
	iv. Total Hardness as CaCO ₃	0-1000 ppm	4 ppm	0.000302 ppm	
	v. Calcium Hardness as CaCO ₃	0-1000 ppm	4 ppm	0.000302 ppm	
	vi. Total Alkalinity as CaCO ₃	0-1000 ppm	4 ppm	0.000248 ppm	
Fruits & Vegetables	i. Organochlorine Pesticide Residues	0.5 ppb – 40 ppm	≤ 10 ng/g.	---	Official Method of Analysis of AOAC International, 19 TH Edition; Vol. 1, 2012 Chapter 10, Page 17, Method No. 2007.01.

Microbiological Testing Laboratory
Annex-II

Materials	Types of test/ properties measured	Range of Measurement	Minimum Detection Limit	Uncertainty of measurement (where applicable) (±)	Standard Specification/ Techniques/ Equipment Used
Water	<i>i. Total plate Count (TPC)</i>	<i>25 – 250 CFU/plate</i>	<i>N.A.</i>	<i>---</i>	<i>Standard Methods for the Examination of water and Wastewater, APHA/ AWWA/WEF 21st Edition, 2005 Method No. 9215 A – B Method No.</i>
	<i>ii. Total Coliforms and Fecal Coliforms</i>	<i>---</i>	<i>< 1.1</i>	<i>---</i>	
Juices	<i>i. Total Plate Count (TPC)</i>	<i>25-250 CFU/plate</i>	<i>N.A.</i>	<i>---</i>	<i>Compendium of method for Microbiological examination of food 4th edition,2001 Edited by Frances Pouch Downes Keith TTO American Public Health Association Washington DC, USA</i>
	<i>ii. Total Coliforms and Fecal Coliforms</i>	<i>---</i>	<i>< 1.1</i>	<i>---</i>	
Milk	<i>i. Total Plate Count (TPC)</i>	<i>25-250 CFU/plate</i>	<i>N.A.</i>	<i>---</i>	<i>---do---</i>
	<i>ii. Total Coliforms and Fecal Coliforms</i>	<i>---</i>	<i>< 1.1</i>	<i>---</i>	

Calibration Laboratory
Annex-II

Materials	Types of test/ properties measured	Range of Measurement	Minimum Detection Limit	Uncertainty of measurement (where applicable) (±)	Standard Specification/ Techniques/ Equipment Used
Mass	<i>i. Calibration of weights</i>	<i>Class F₂ and lower classes</i>	<i>0.01 mg</i>	<i>0.01 mg</i>	<i>OTML RIII-I, 2004 (E)</i>
	<i>ii. Calibration of Balances</i>	<i>1 mg to 5 kg</i>	<i>0.01 mg</i>	<i>0.01 mg</i>	<i>OTML R76-I, 2006 (E)</i>
	<i>iii. Calibration of Laboratory Volumetric Apparatus</i>	<i>Upo 2 ltrs</i>	<i>0.01 ml</i>	<i>0.01 ml</i>	<i>E 542-01, ASTM 2002, Vol:14.01.</i>
Temperature	<i>i. Calibration of liquid in glass thermometers</i>	<i>-20°C – 250°C</i>	<i>0.1°C</i>	<i>0.1oC</i>	<i>E 77-07, ASTM 2002, Vol:14.03.</i>

PCSIR Leather Research Centre, Karachi (LRC)**Annex-III**

Materials	Types of test/ properties measured	Range of Measurement	Minimum Detection Limit	Uncertainty of measurement (where applicable) (±)	Standard Specification/ Techniques/ Equipment Used
Leather	<i>i. Volatile Matter</i>	<i>2.5% - 50%</i>	<i>2.5%</i>	<i>0.40%</i>	<i>SLC-3 Oven Analytical Balance</i>
	<i>ii. Fat Content</i>	<i>0.5% - 25%</i>	<i>0.5%</i>	<i>0.05%</i>	<i>SLC-4 Oven Analytical Balance Soxhlet Apparatus</i>
	<i>iii. Chromium Oxide</i>	<i>0.5% - 5.5%</i>	<i>0.5%</i>	<i>0.02%</i>	<i>SLC-8 Analytical Balance</i>
	<i>iv. pH Value</i>	<i>1 -13</i>	<i>0.1</i>	<i>0.07</i>	<i>SLC-13 EN ISO-4045 Shaker pH Meter Analytical Balance</i>
	<i>v. Formaldehyde Content</i>	<i>20mg/kg – 150 mg/ kg</i>	<i>1 mg/ kg</i>	<i>0.75 mg/kg</i>	<i>IUC 19 (SLC-23) Analytical Balance Spectrophotometer Shaking Water Bath</i>

	vi. <i>Tensile Strength</i>	0.1 N – 5000 N	0.1 N	0.22 N	ASTM D 2209-95/ IUP-6/ Universal Testing Machine
	vii. <i>Elongation at Break</i>	0.01% - 100%	0.01%	0.24%	ASTM D 2211-94/ IUP-9/ Universal Testing Machine
	viii. <i>Bursting Strength</i>	0.01kg – 500kg	0.01kg	0.82kg	IUP-6/ Universal Testing Machine
	ix. <i>Colour Fatness (Wet & Dry)</i>	1 to 99999 rev grading 5-1 (change in colour) grading 5-1 (Stain on Felt)	1 rev Grade 1	1.0	BS 1006 UK-LC SLF 5/ Colour Fatness Test
Leather Gloves	i. <i>Sizing & Dexterity of Glove</i>	150mm – 280mm 155mm – 220mm 5mm – 11mm	1mm 1mm 5mm	NA	EN-420/ Measuring Tape, Dexterity Bars
Leather/ Leather Gloves	i. <i>Tear Strength (Single Edge)</i>	0.01kg – 500kg	0.01kg	0.5kg	EN-388/ Universal Testing Machine
Water & Waste Water	i. <i>Total Hardness</i>	5ppm – 1000ppm	5ppm	2ppm	APHA 2340 C 20 th Editions/ Electronic Balance
	ii. <i>Sulphide</i>	5ppm – 1000ppm	5ppm	4ppm	APHA 4500 S ² 20 th Editions/ Electronic balance
	iii. <i>pH Value</i>	1 - 13	0.1	0.02	ASTM D-1293-99 Analytical Balance pH Meter

PCSIR Labs Complex, Lahore (LLC)

Applied Chemistry Research Centre

Annex-IV

<i>Materials/ Products tested</i>	<i>Types of test/ Properties measured</i>	<i>Range of measurement</i>	<i>Minimum Detection limit</i>	<i>Uncertainty of Measurement (where applicable)</i> <i>MU (±)</i>	<i>Standard specification/ Techniques/ Equipment Used</i>
Textile Testing Laboratory					
Textiles	Colour Fastness to Light: Xenon Arc Fading Lamp Test	1-5 Grey Scale Rating	1/2	0.5	ISO 105 B02: 1999 Instrumental Technique
	Colour Fastness to Domestic & Commercial Laundering	1-5 Grey Scale Rating	1/2	0.5	ISO 105 C06 / C2S: 1994 Instrumental Technique
	Colour Fastness to Dry Cleaning	1-5 Grey Scale Rating	1/2	0.5	ISO 105 D01: 1993 Instrumental Technique
	Colour Fastness to Water	1-5 Grey Scale Rating	1/2	0.5	ISO 105 E01: 1994 Instrumental Technique
	Colour Fastness to Sea-water	1-5 Grey Scale Rating	1/2	0.5	ISO 105 E02: 1994 Instrumental Technique
	Colour Fastness to Perspiration	1-5 Grey Scale Rating	1/2	0.5	ISO 105 E04: 1994 Instrumental Technique
	Colour Fastness to Rubbing	1-5 Grey Scale Rating	1/2	0.5	ISO 105 X12: 2002 Instrumental Technique
	Determination of the Pilling Resistance & other related Surface Changes of Textile Fabrics (Martindale Tester)	1 – 5 Grade	1/2	0.5	ISO 12945 2:2000 Instrumental Technique
	Determination of Abrasion Resistance of Fabrics (Martindale Tester)	1 - 99,999 Rubs	1	4.036	ISO 12947:1998
Water Repellency: Spray Test	0-100 Spray Rating	0	Not applicable	AATCC 22:2005 Instrumental Technique	

Wrinkle Recovery of Fabrics: Appearance Method	WR-1 – WR-5 Wrinkle Recovery Rating	1	0.5	AATCC 128:2004 Instrumental Technique
Gray Scale for Assessing change in Color	1-5 Grey Scale Rating	1/2	1/2	ISO 105 A02 :1994 Visual Assessment
Gray Scale for Assessing Staining	1-5 Grey Scale Rating	1/2	1/2	ISO 105 A03: 1994 Visual Assessment
Textiles-Standard Atmosphere for Conditioning and Testing	18-22°C 61-69%RH	0.1 °C, 0.1 % RH	0.2 1.6	ISO 139: 2005 Instrumental Technique
Dimensional Changes of Garments after Home Laundering	0-100%	0.5%	0.5	AATCC150-2003 Instrumental Technique
Dimensional Changes of Fabrics after Home Laundering	0-100%	0.5%	0.5	AATCC135-2003 Instrumental Technique
Determination of Linear Density of Yarn (Yarn Number) by the Skein Method	1-2500 Wraps	1 Wrap	0.002	ASTM D 1907-01Instrumental Technique
Standard Test Method for Warp End Count and Filling Pick Count of Woven Fabric	Not applicable	>1	Not applicable	ASTM D 3775-03a Physical Counting

Leather Testing Laboratory					
Leather	Cr-VI Content	1mg/kg-50 mg/kg	1.25 mg/kg	0.4mg/kg	SLC 22, (IUC 18) Spectrophotometric Technique
	Pentachlorophenol	0.005-10.000 ppm	0.005ppm	0.1mg/kg	CLRI & Freiburg Method Gas Chromatography
	Formaldehyde Content in Leather	9mg/kg-74 (mg/kg)	9.0 mg/kg	0.2mg/kg	IUC 19 (SLC 23) Spectrophotometric
	Tensile strength and percentage elongation	0.1N -2.5 KN	0.1N	Tensile= ± 1 N/mm ² Elongation= ± 1.4 %	IUP 6 (SLP 6) Tensile Strength
	Circular Rubbing	1-5 Gray Scale Rating	1 Grade 1	1/2	SLF 5 (BS 1006: UK-LC) Rubbing
	Tearing Load (Double Edge)	0.1N -2.5 KN	0.1N	2.16N	IUP 8 (SLP 7)/ BS EN ISO 3377-2:2002 Tear
	Tearing Load (Single Edge)	0.1N -2.5 KN	0.1N	0.1N	EN 388:2003 6.3. Tear
	pH Value of an Aqueous Extract	0.01-14	0.01s	0.82	SLC 13 (IUC 11; BS 1309:9)/ BS EN ISO 4045:1998 Electrometric
	Determination of Water Vapour Permeability	1.0 Sec-99Hrs	1.0 Sec	0.13mg/cm ² .h	BS EN 420:2003 6.3. Transmission
	Measurement of Abrasion Resistance	1.0 - 99,999 Rubs (I-4 Level)	1.0 (1 Level)	Not applicable	BS EN 388:2003 6.1 Abrasion Resistance

Drug Residue Testing Laboratory					
Meat	Chloramphenicol	0.05-50mg/Kg	0.02mg/Kg	±0.037	USP: 2012 / HPLC-UVD
Pesticide Residue Testing Laboratory					
Orange	Cypermethrin	0.1-2.0mg/Kg	0.1mg/Kg	±0.102	AOAC: 2012 /GC-ECD
	Deltamethrin				
	Permethrin				
	Bifenthrin				

Field of Measurement:			
<i>Measured Quantity</i>	<i>Range</i>	<i>Best Measurement Capability *</i>	<i>Brief Description of measurement and equipment used</i>
Calibration & Physical Testing Laboratory			Annex-VIII
Length:			
Line Length Standard	<i>Upto 100 cm</i>	$\pm 0.1 \text{ cm}$	Technique: Direct Comparison Line Length Standard # 251100 PTB, Germany
Measuring Tape	<i>Up to 500 cm</i>	$\pm 0.1 \text{ cm}$	Technique: Direct Comparison <i>Measuring tape</i> # 34-336, Stanley USA
Vernier Caliper	<i>Up to 300 mm</i>	$\pm 0.01 \text{ mm}$	Technique: Direct Comparison Gauge Block Set # 0403970, Mitutoyo, Japan
Micrometer	<i>Up to 25 mm</i>	$\pm 0.001 \text{ mm}$	Technique: Direct Comparison Gauge Block Set # 0403970, Mitutoyo, Japan
Gauge Blocks	0.5 mm to 100 mm	$\pm 0.2 \text{ }\mu\text{m}$	Technique: Direct Comparison Micrometer, Vernier Caliper CD-12" C, <i>Gauge Block Set</i> # 0408006 Mitutoyo, Japan, <i>Tesa Tronic Amplifier Type:</i> 04430008, Swiss-Made

Masses and Weighing Balances:

Masses	1 mg to 200mg 1g to 200g 1kg to 10 Kg	$\pm 0.1 \text{ mg}$ $\pm 0.1 \text{ mg}$ $\pm 0.1 \text{ g}$	<i>Technique: Direct Loading</i> <i>Set of Standard Masses</i> <i>Weighing Balance SARTORIUS ME235S</i> <i>Weighing Balance OHAUS, USA</i> <i>Weighing Balance GP-30K, AND, Japan,</i> <i>Weighing Balance, DIGI D-I 30N, Japan</i>
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Field of Measurement:			
Measured Quantity	Range	Best Measurement Capability *	Brief Description of measurement and equipment used
Weighing Balance	1 mg to 200mg 1g to 200g 5 g to 10 kg	± 0.1 mg ± 0.1 mg ± 0.1 g	Technique: Direct Loading Set of Standard Masses, <i>Cal Lab. M25, M26 China</i>
Temperature:			
Liquid in Glass Thermometer	-10°C to 375°C	± 1 °C	Technique: Direct comparison <i>Dry Well Calibrator 9100S, Precision Thermometer, WA57497</i>
Temperature Probe / Temperature Controller	-10°C 0°C to 800 °C	± 0.1 °C ± 1 °C	-do-
Pressure:			
Pressure Gauge	-10 to 100psi 100 to 3000 psi 1000 to 10000 psi	± 0.1 psi ± 1 psi ± 5 psi	Technique: Direct Comparison <ul style="list-style-type: none"> ● <i>Pressure Calibrator PPC-3300</i> ● <i>Hydraulic Pressure Calibrator, H540/193,</i>

Frequency:			
Frequency	1 Hz 10 Hz 100 Hz 1 kHz 10 kHz 100 kHz 1 MHz 10 MHz 50 rpm to 500rpm 1000 rpm to 30000 rpm	± 0.001 Hz ± 0.01 Hz ± 0.1 Hz ± 0.001 kHz ± 0.01 kHz ± 0.1 kHz ± 0.001 MHz ± 0.01 MHz ± 0.2 rpm ± 1 rpm	Technique: Direct Comparison <ul style="list-style-type: none"> ● Universal Frequency Counter (Agilent, Malaysia) MY40004247, Cal.Lab-f6 ● Frequency Counter Tektronix-Malaysia CMC-251TW54148, Cal.Lab-f2 ● Digital tachometer 5600, Kyoritsu Japan, Cal.Lab-f7
Time:			
Time	1s to 3600 s	± 0.038 s	<ul style="list-style-type: none"> ● Universal Frequency Counter (Agilent, Malaysia) MY40004247, Cal.Lab-f6 ● Frequency Counter Tektronix-Malaysia CMC-251TW54148, Cal.Lab-f2 ● Technique: Direct comparison Digital Timer # 57120 USA.

Electrical Parameters:			
a.c Voltage,	0.1 V to 1 V 10 V to 100 V 200 V 600 V	$\pm 0.008 V$ $\pm 0.06 V$ $\pm 0.1 V$ $\pm 1 V$	Technique: Direct comparison <i>Digital Multimeter 3155A</i> <i>Escort, Taiwan</i>
d.c. Voltage	1 mV to 100mV 1 V 10V 100 V to 200 V 200 V to 800 V	$\pm 0.01 mV$ $\pm 0.0002 V$ $\pm 0.001 V$ $\pm 0.01 V$ $\pm 0.1 V$	<ul style="list-style-type: none"> • <i>Digital Multimeter 3155A</i> <i>Escort, Taiwan</i> • <i>D.C. High Voltage Probe</i> • <i>Portable Calibrator 2422</i> <i>Yokogawa, Japan</i>
a.c Current	1mA 10 to 100mA 1A to 10A 10A to 100A 100A to 1000A	$\pm 0.001 mA$ $\pm 0.1 mA$ $\pm 0.001 A$ $\pm 1 A$ $\pm 1 A$	<ul style="list-style-type: none"> • <i>Digital Multimeter 3155A</i> <i>Escort, Taiwan</i> • <i>Digital Multimeter 45 Fluke</i> • <i>AC/DC Clamp-on Meter, Kyortisu, Japan</i> <i>Cal.Lab-E60</i>

Field of Measurement:			
d.c. Current	<i>1mA</i> <i>10 to 100mA</i> <i>1A to 10A</i> <i>10A to 100A</i> <i>100A to 1000A</i>	$\pm 0.01 \text{ mA}$ $\pm 0.1 \text{ mA}$ $\pm 0.001 \text{ A}$ $\pm 1 \text{ A}$ $\pm 1 \text{ A}$	-do-
Resistance	<i>1Ω to 100Ω</i> <i>1kΩ, 10kΩ</i> <i>100kΩ</i> <i>1MΩ, 10MΩ, 100MΩ</i> <i>100MΩ to 1GΩ</i>	$\pm 0.1\Omega$ $\pm 0.001k\Omega, \pm 0.01k\Omega$ $\pm 0.1K\Omega$ $\pm 0.001M\Omega, \pm 0.01M\Omega$ $\pm 0.1M\Omega$ $\pm 1M\Omega$	<ul style="list-style-type: none"> Standards Resistances Digital Insulation Tester, MIS-4D Japan LCR Meter PM6304, Fluke, USA
Spectrophotometer:			
Spectrophotometer	<i>0%T to 100%T</i> <i>0 to .999 ABS</i> <i>520 to 535nm</i>	$\pm 0.1 \%T$ $\pm 0.001 \text{ ABS}$ $\pm 1.2 \text{ nm}$	Spectronic Standards Model # 333150 Thermospectronics, USA

- Best Measurement Capability expressed as Uncertainty, with k=2, providing a
- Level of Confidence of approximately 95%

<i>Materials/ Products tested</i>	<i>Types of test/ Properties measured</i>	<i>Range of measurement</i>	<i>Minimum detection limit</i>	<i>Uncertainty of Measurement (where applicable)</i> <i>MU (±)</i>	<i>Standard specification/ Techniques/ equipment Used</i>
Environmental Testing Laboratory					
Water & Wastewater	BOD 5 at 25 °C	2.0 mg/l -1000mg/l	2.0 mg/l	0.2 mg/l	5210 B AWWA/APHA, 2005 Titrimetric Method
	COD	2.0 mg/l -2000 mg/l	2.0 mg/	0.1 mg	5220 B AWWA/APHA, 2005 Open reflex Method
	PH Value at 25 °C	0.1-14	0.1	.01	4500 – HB AWWA/APHA, 2005 pH Meter
	Chlorides	0.25 mg/l- 1000 mg/l	0.25 mg/l	0.05 mg/l	4500 – CIB AWWA/APHA, 2005 Titrimetric
	Total Dissolved Solids	2.5 mg/l - 200 mg/l	1.0 mg/l	6.0 mg/l	2540 – C AWWA/APHA, 2005Gravimetric Method

	Total Suspended Solids	2.0 mg/l - 2000 mg/l	1.0 mg/l	6.0 mg/l	2540 – D AWWA/APHA, 2005 Gravimetric Method
	Grease & Oil	1.0 mg/l - 500 mg/l	1.4mg/l	0.1 mg/l	5520 – B AWWA/APHA, 2005 Gravimetric Method
	Temperature	Ambient-100°C	0.5°C	0.1°C	2550 B-1 AWWA/APHA, 2005 Equipment: Thermometer (Mercury filled, Celsius)
	Phenolic Compounds (as Phenol)	0.05mg/l – 1 mg/l	0.05 mg/l	0.005mg/l	5530-D AWWA/APHA, 2005 Equipment: Spectrophotometer pH Meter

	Ammonia (NH ₃ -N)	> 5mg/l	5 mg/l	0.5 mg/l	4500 B & 4500 C AWWA/APHA, 2005 Equipment: pH Meter
Water & Wastewater	Sulfide	> 2 mg/l	2.0 mg/l	0.2 mg/l	4500-S ² -F AWWA/APHA, 2005 Technique: Titrimetric
	Sulfate	1mg/l- 40 mg/l	1.0 mg/L	0.1 mg/l	4500-E AWWA/APHA, 2005 Equipment: Spectrophotometer Nephelometer Technique: Turbidity method
Heavy Metal Testing Laboratory					
Rice	Cadmium	0.01-10 mg/Kg	0.01 mg/Kg	0.004	ICP-OES/ JAOAC:2005
	Lead	0.02-20 mg/Kg	0.02 mg/Kg	0.006	ICP-OES/ JAOAC:2005

Materials/ Products tested	Types of test/ Properties measured	Range of measurement	Minimum detection limit	Uncertainty of Measurement (where applicable) MU (+)	Standard specification/ Techniques/ equipment used
Microbiology Testing Laboratory					
Water, drinks and food items	Enumeration of total plate count in food	30 to 3.0 x 10 ⁷ CFU/g	<1.0	0.061	Manual of Food Quality Control 4. Rev.1 Microbiological Analysis. FAO Food and Nutrition Paper 14/4 Rev. 1. Chapter 2. FAO of the United Nations. 1992.
	Enumeration of Total Coliforms, Fecal coliforms and <i>E. coli</i> in Food	<3 to 1.1 x 10 ⁴ MPN/g	<3	Not applicable	Manual of Food Quality Control 4. Rev.1 Microbiological Analysis. FAO Food and Nutrition Paper 14/4 Rev.1. Chapter 3. FAO of the United Nations. 1992.
	Detection of <i>Salmonella</i> spp. in Food	Absence/ presence per 25gm	Qualitative	Not applicable	Manual of Food Quality Control 4, Rev.1 Microbiological Analysis, FAO Food & Nutrition Paper 14/4 Rev. 1 Chapter 4. FAO of the United Nations. 1992
	Enumeration of <i>Staphylococcus aureus</i> in Food	20 to 2.0x 10 ⁷ CFU/g	<1.0	0.056	Manual of Food Quality Control 4, Rev.1 Microbiological Analysis, FAO Food & Nutrition Paper 14/4 Rev. 1 Chapter 4. FAO of the United Nations. 1992

	Enumeration of Yeast and Mould in Food	10 to 1.5 × 10 ⁶ CFU/g	<1.0	0.014	Manual of Food Quality Control 4, Rev.1 Microbiological Analysis, FAO Food & Nutrition Paper 14/4 Rev. 1 Chapter 4. FAO of the United Nations. 1992
	Enumeration of total plate count in water (LLC/M;/TM/003)	30 to 3.0 × 10 ⁷ CFU/ml	<1.0	0.48	Standard methods for the examination of water and waste water. 21 st edition. (2005) Method no. 9215B. Published by American Public Health Association, Washington, DC
	Enumeration of Total Coliforms, Fecal Coliforms and <i>E.coli</i> in water	<1 TO 4.6 X 10 ³ MPN/100ml	< 1.0	Not applicable	Standard methods for the examination of water and wastewater. 21 st edition. (2005) Method no.(9221B E & F). Published by American Public Health Association, Washington, DC
	Enumeration of Pseudomonas spp		< 1.0	Not applicable	Standard methods for the examination of water and wastewater. 21 st edition. (2005) Method no.(9221B E & F). Published by American Public Health Association, Washington, DC

Nutrition Testing Laboratory					
Milk products, Cereals, Animal Feeds, Dry vegetable, Pulses, Dry Fruits and Baby Foods etc.	Determination of Moisture (% Age)	0.1%- 99.5%	0.1%	2.02 %	AOAC: 2012
	Determination of Ash (% Age)	0.1%- 99.5%	0.1%	3.12%	AOAC: 2012
	Determination of Total Fat (%age)	0.1%- 99.5%	0.1%	2.06%	AOAC: 2012
	Determination of Protein (%age)	0.1%- 99.5%	0.1%	2.84%	AOAC: 2012
Mycotoxin Testing Laboratory					
Food, Food Products, Feed and Feed Ingredients.	Determination of Aflatoxin B1	0.72-500	0.72	Not applicable	AOAC 972.26:2012
	Determination of Aflatoxin B2	0.20-500	0.20	Not applicable	AOAC 972.26:2012
	Determination of Aflatoxin G1	0.72-500	0.72	Not applicable	AOAC 972.26:2012
	Determination of Aflatoxin G2	0.20-500	0.20	Not applicable	AOAC 972.26:2012

Materials/ Products Tested	Types of test/ Properties measured	Range of Measurement	Minimum detection limit	Uncertainty of Measurement (where applicable) MU (+)	Standard specification/ Techniques/ equipment used
Glass & Ceramics Testing Laboratory					
Limestone	Loss on ignition, silica (SiO ₂), Alumina (Al ₂ O ₃), Iron oxide (Fe ₂ O ₃), Lime(CaO), Magnesia(MgO), Soda (Na ₂ O), Potashs(K ₂ O)	0.01% - 56.00%	0.01%	0.86%	ASTM C-25-06 2007

Materials/ Products Tested	Types of test/ Properties measured	Range of Measurement	Minimum detection limit	Uncertainty of Measurement (where applicable) MU (+)	Standard specification/ Techniques/ equipment used
Metallography Testing Laboratory					
Metallic Materials	Standard guide for preparation of metallographic Specimens	Metallic materials	Not Applicable	Not Applicable	ASTM E 3-01
	Standard practice for Microetching of Metals & Alloys	Metallic materials	Not Applicable	Not Applicable	ASTM E 407-07
	Standard practice for Macroetching of Metals & Alloys.	Metallic materials	Not Applicable	Not Applicable	ASTM E 340-00
	Standard Test Method for Determining Average grain size	ASTM Grain size No. 0-10	0.5	Not Applicable	ASTM E 112-96
	Standard Test Method for Measurement of metals & oxide coating thickness.	0.5 μ m – 1mm	0.5 μ m	Not Applicable	ASTM B 487-85
	Standard Test Method for Evaluating the microstructure of graphite.	All types of Graphite in iron	1	Not Applicable	ASTM A 247-06
	Optical Emission Vacuum Spectrometric analysis of carbon and low alloy steel	C 0.0 – 1.1 Mn 0.0 – 2.0 Si 0.0 – 1.15 S 0.0 – 0.055 P 0.0 – 0.085	0.001%	0.03%	ASTM E 415-08

Test Method for Optical Emission Vacuum Spectrometric analysis of Stainless Steel by Point to Plane Excitation Technique	C 0.005 – 0.25 Mn 0.01- 2.0 Si 0.01 – 0.9 S 0.003-0.065 P 0.003 – 0.15 Cr 17.0 – 23.0 Ni 7.5 – 13.00 Mo 0.01 – 3.0	0.001%	0.197%	ASTM E1086-94
Test Method for Analysis of Manganese Steel using Atomic Emission Spectrometer	C 0.3 – 1.4 Mn 8.0 – 16.2 Si 0.25 – 1.5 P 0.025-0.06 Cr 0.25 – 2.0 Ni 0.05 – 4.0	0.001%	0.412%	ASTM E 2209-02
Test Method for Optical Emission Spectrometric Analysis of Aluminum and Aluminum Alloys by the argon atmosphere Point to Plane, unipolar self- Initiating Capacitor Discharge	Si 0.001 -24.0 Cu 0.001- 20.0 Mg 0.001- 11.0 Zn 0.001- 10.0 Ni 0.001- 4.0 Sn 0.001- 7.5 Fe 0.001- 3.5 Mn 0.001- 2.0 Pb 0.002- 0.7	0.001%	0.872%	ASTM E 1251-07
Practice for Sampling of steel & iron for determination of Chemical composition	Diameter. (12mm -100 mm)	12mm	Not Applicable	ASTM E1806-09
Test Method for Analysis of Cast Iron using Optical Emission Spectrometer	C 1.9 – 3.8 Mn 0.0 – 1.8 Si 0.0 – 2.5 S 0.0 – 0.08 P 0.0 – 0.04	0.001%	0.872%	ASTM E1999-99

Mechanical Testing Laboratory					
Metallic Materials (Deformed Steel Bars)	Standard Test Method for Tension Testing Of Deformed Steel Bars (Tensile Strength, Yield Strength, Elongation)	4-1000 KN	4 KN & Least Count 0.01 KN	---	Instrumental ASTM E 8M-04,A 370-03a,615/A 615 BS EN 10002-1:2001, BS4449 UTM, Jinan TE China
Metallic Materials (Hardened &Tempered Alloy Steel, Brass & Bronze)	Hardness HRB HRC	(0.1-129.9) HRB (0.1-99.9) HRC	0.1	2.085 HRB 2.011 HRC	Instrumental ASTM E -18 Rockwell Hardness Tester, INDENTEC, UK
Optical Emission spectrometer Laboratory					
Metallic Materials	Test Method for Optical Emission Spectrometric Analysis of Aluminum and Aluminum Alloys by the argon atmosphere Point to Plane, unipolar self- Initiating Capacitor Discharge	Si 0.001 -24.0 Cu 0.001- 20.0 Mg 0.001- 11.0 Zn 0.001- 10.0 Ni 0.001- 4.0 Sn 0.001- 7.5 Fe 0.001- 3.5 Mn 0.001- 2.0 Pb 0.002- 0.7	0.001%	0.872%	ASTM E 1251-07
	Practice for Sampling of steel & iron for determination of Chemical composition	Diameter. (12mm -100 mm)	12mm	Not Applicable	ASTM E1806-09
	Test Method for Analysis of Cast Iron using Optical Emission Spectrometer	C 1.9 – 3.8 Mn 0.0 – 1.8 Si 0.0 – 2.5 S 0.0 – 0.08 P 0.0 – 0.04	0.001%	0.872%	ASTM E1999-99

Materials/Products tested	Types of test/ Properties measured	Range of measurement	Minimum detection limit	Uncertainty of Measurement (where applicable) MU (\pm)	Standard specification/ Techniques/ equipment used
EMTL/SOA/01	Resistance of conductors	100 n Ω – 30 k Ω	100 n Ω	\pm 0.002 m Ω	IEC 60227-3, IEC 60227-4, IEC 60227-5, IEC 60227-2 Clause 2.1
EMTL/SOA/02	Voltage test on cores at 1500 V	0.01 – 15 KV	0.01 KV	\pm 0.02 KV	IEC 60227-5, IEC 60227-2 Clause 2.3
EMTL/SOA/03	Voltage test on cores at 2000 V	0.01 – 15 KV	0.01 KV	\pm 0.02 KV	IEC 60227-4, IEC 60227-2 Clause 2.3
EMTL/SOA/04	Voltage test on completed cable at 2000 V	0.01 – 15 KV	0.01 KV	\pm 0.02 KV	IEC 60227-5, IEC 60227-4, IEC 60227-2 Clause 2.2
EMTL/SOA/05	Voltage test at 2500 V	0.01 – 15 KV	0.01 KV	\pm 0.02 KV	IEC 60227-3, IEC 60227-2 Clause 2.2
EMTL/SOA/06	Insulation resistance at 70°C	1 – 5000 VDC 1 k Ω – 5.0 T Ω	1 VDC 1 k Ω	\pm 0.002 M Ω	IEC 60227-3, IEC 60227-4, IEC 60227-5, IEC 60227-2 Clause 2.4
EMTL/SOA/07	Checking of compliance with constructional provisions	Visual Inspection	Visual Inspection	N.A	IEC 60227-3, IEC 60227-4, IEC 60227-5, IEC 60227-1
EMTL/SOA/08	Measurement of insulation thickness	0.001 – 100 mm	0.001 mm	\pm 0.002 mm	IEC 60227-3, IEC 60227-4, IEC 60227-5, IEC 60227-2 Clause 1.9
EMTL/SOA/09	Measurement of sheath thickness	0.001 – 100 mm	0.001 mm	\pm 0.002 mm	IEC 60227-4, IEC 60227-5, IEC 60227-2 Clause 1.10
EMTL/SOA/10	Measurement of overall diameter	0.001 – 100 mm	0.001 mm	\pm 0.002 mm	IEC 60227-3, IEC 60227-4, IEC 60227-5, IEC 60227-2 Clause 1.11
EMTL/SOA/11	Ovality	0.001 – 100 mm	0.001 mm	\pm 0.002 mm	IEC 60227-4, IEC 60227-5, IEC 60227-2 Clause 1.11
EMTL/SOA/12	Tensile test of insulation before ageing	0.01 N – 5 KN	0.01 N/mm ²	\pm 0.03 N/mm ²	IEC 60227-3, IEC 60227-4, IEC 60227-5, IEC 60811-1-1 Clause 9.1

EMTL/SOA/13	Tensile test of insulation after ageing	0.01 N – 5 KN	0.01 N/mm ²	± 0.03 N/mm ²	IEC 60227-3, IEC 60227-4, IEC 60227-5, IEC 60811-1-2 Clause 8.1, 8.1.3 & 8.1.3.1
EMTL/SOA/14	Loss of mass test	0.1 mg – 30 Kg	0.1 mg	± 0.2 mg	IEC 60227-3, IEC 60227-4, IEC 60227-5, IEC 60811-3-2 Clause 8.1
EMTL/SOA/15	Tensile test of sheath before ageing	0.01 N – 5 KN	0.01 N/mm ²	± 0.03 N/mm ²	IEC 60227-4, IEC 60227-5, IEC 60811-1-1 Clause 9.2
EMTL/SOA/16	Tensile test of sheath after ageing	0.01 N – 5 KN	0.01 N/mm ²	± 0.03 N/mm ²	IEC 60227-4, IEC 60227-5, IEC 60811-1-2 Clause 8.1 & 8.1.3
EMTL/SOA/17	Loss of mass test	0.1 mg – 30 Kg	0.1 mg	± 0.2 mg	IEC 60227-4, IEC 60227-5, IEC 60811-3-2 Clause 8.2
EMTL/SOA/18	Pressure test of insulation at high temperature	0.001 – 100 mm	0.001 mm	± 0.002 mm	IEC 60227-3, IEC 60227-4, IEC 60227-5, IEC 60811-3-1 Clause 8.1
EMTL/SOA/19	Pressure test of sheath at high temperature	0.001 – 100 mm	0.001 mm	± 0.002 mm	IEC 60227-4, IEC 60227-5, IEC 60811-3-1 Clause 8.2
EMTL/SOA/20	Bending test of insulation at low temperature	Visual Inspection	Visual Inspection	N.A	IEC 60227-3, IEC 60227-4, IEC 60227-5, IEC 60811-1-4 Clause 8.1
EMTL/SOA/21	Bending test of sheath at low temperature	Visual Inspection	Visual Inspection	N.A	IEC 60227-4, IEC 60227-5, IEC 60811-1-4 Clause 8.2
EMTL/SOA/22	Elongation test of insulation at low temperature	0.01 – 100 %	0.01 %	± 0.05 %	IEC 60227-3, IEC 60811-1-4 Clause 8.3
EMTL/SOA/23	Elongation test of sheath at low temperature	0.01 – 100 %	0.01 %	± 0.05 %	IEC 60227-4, IEC 60811-1-4 Clause 8.4
EMTL/SOA/24	Impact test of insulation	Visual Inspection	Visual Inspection	N.A	IEC 60227-3, IEC 60811-1-4 Clause 8.5
EMTL/SOA/25	Impact test on completed cable	Visual Inspection	Visual Inspection	N.A	IEC 60227-4, IEC 60227-5, IEC 60811-1-4 Clause 8.5

EMTL/SOA/26	Heat shock test of insulation	Visual Inspection	Visual Inspection	N.A	IEC 60227-3, IEC 60227-4, IEC 60227-5, IEC 60811-3-1 Clause 9.1
EMTL/SOA/27	Heat shock test of sheath	Visual Inspection	Visual Inspection	N.A	IEC 60227-4, IEC 60227-5, IEC 60811-3-1 Clause 9.2
EMTL/SOA/28	Flexing test of completed cable	1 – 15000 cycle	1 cycle	N.A	IEC 60227-5, IEC 60227-2 Clause 3.1
EMTL/SOA/29	Test of flame retardance of completed cable	1 – 100 cm	1 mm	± 0.1 cm	IEC 60332-1-1, IEC 60332-1-2
EMTL/SOA/30	General Conditions for the Tests	N.A	N.A	N.A	IEC 60335-2-80 Clause 5
EMTL/SOA/31	Classification	N.A	N.A	N.A	IEC 60335-2-80 Clause 6
EMTL/SOA/32	Marking and instructions	N.A	N.A	N.A	IEC 60335-2-80 Clause 7
EMTL/SOA/33	Protection against access to live parts	N.A	N.A	N.A	IEC 60335-2-80 Clause 8
EMTL/SOA/34	Starting of motor-operated appliances	N.A	N.A	N.A	IEC 60335-2-80 Clause 9
EMTL/SOA/35	Power input and current	0.1 – 100 kW 0.1 – 100A	0.1 W 0.1 mA	± 0.15 W ± 0.003 mA	IEC 60335-2-80 Clause 10
EMTL/SOA/36	Heating	0.1 – 350 °C	0.1 °C	± 0.3 °C	IEC 60335-2-80 Clause 11
EMTL/SOA/37	Leakage current and electric strength at operating temperature	0.01µA –20 mA 0.01 – 15 KV	0.01 µA 0.01 KV	± 0.003 mA 0.02 KV ±	IEC 60335-2-80 Clause 13
EMTL/SOA/38	Transient over voltages	0.01 – 15 KV	0.01 KV	± 0.02 KV	IEC 60335-2-80 Clause 14
EMTL/SOA/39	Moisture resistance	0.01 – 100 °C 20 – 100 % rh	0.01 °C 0.1 % rh	± 1.2 °C ± 2 % rh	IEC 60335-2-80 Clause 15
EMTL/SOA/40	Leakage current and electric strength	0.01µ A–20 mA 0.01 – 15 KV	0.01 µA 0.01 KV	± 0.003 mA 0.15 KV ±	IEC 60335-2-80 Clause 16

EMTL/SOA/41	Overload protection of transformers and associated circuits	N.A	N.A	N.A	IEC 60335-2-80 Clause 17
EMTL/SOA/42	Endurance	N.A	N.A	N.A	IEC 60335-2-80 Clause 18
EMTL/SOA/43	Abnormal operation	0.1 – 350 °C	0.1 °C	± 0.3 °C	IEC 60335-2-80 Clause 19
EMTL/SOA/44	Stability and mechanical hazards	1° – 180°	1°	± 1°	IEC 60335-2-80 Clause 20
EMTL/SOA/45	Mechanical strength	0.20 – 1.0 J	0.2 J	± 0.01 J	IEC 60335-2-80 Clause 21
EMTL/SOA/46	Construction	1 – 100 N	1 N	± 1N	IEC 60335-2-80 Clause 22
EMTL/SOA/47	Internal wiring	0.01 – 15 KV	0.01 KV	± 0.02 KV	IEC 60335-2-80 Clause 23
EMTL/SOA/48	Components	N.A	N.A	N.A	IEC 60335-2-80 Clause 24
EMTL/SOA/49	Supply connection and external flexible cords	0.001 – 100 mm 0.1 – 50 cN - m	0.001 mm 0.1 cN - m	± 0.003 mm ± 0.9 cN - m	IEC 60335-2-80 Clause 25
EMTL/SOA/50	Terminals for external conductor	0.001 – 100 mm	0.001 mm	± 0.002 mm	IEC 60335-2-80 Clause 26
EMTL/SOA/51	Provision of earthing	0.001 – 1.8 Ω	0.001 Ω	± 0.002 Ω	IEC 60335-2-80 Clause 27
EMTL/SOA/52	Screws and connections	20–500 cN - m	20 cN - m	± 1.0 cN - m	IEC 60335-2-80 Clause 28
EMTL/SOA/53	Clearances, creepage distance and solid insulation	1.0mm–8.0mm	1.0 mm	± 0.001 mm	IEC 60335-2-80 Clause 29
EMTL/SOA/54	Resistance to heat and fire	0.001 – 100mm 1 – 1000 °C	0.001 mm 1 °C	± 0.002 mm ± 1.0 °C	IEC 60335-2-80 Clause 30
EMTL/SOA/55	Resistance to rusting	N.A	N.A	N.A	IEC 60335-2-80 Clause 31
EMTL/SOA/56	Radiation, toxicity and similar hazards	N.A	N.A	N.A	IEC 60335-2-80 Clause 32
EMTL/SOA/57	Marking	-	-	-	IEC 60968 Clause 4.1, 4.2, 4.3
EMTL/SOA/58	Interchangeability	-	-	-	IEC 60968 Clause 5.1, 5.2, 5.3
EMTL/SOA/59	Protection against Electric Shock	-	-	-	IEC 60968 Clause 6

EMTL/SOA/60	Insulation Resistance and Electric Strength after Humidity Treatment	1K Ω – 5.00T Ω 0.01 – 5 kV	1K Ω 0.01 kV	\pm 0.15M Ω \pm 0.05 kV	IEC 60968 Clause 7.1, 7.2
EMTL/SOA/61	Mechanical Strength	0.001 – 6 Nm	0.001 Nm	\pm 1.0 %	IEC 60968 Clause 8
EMTL/SOA/62	Cap Temperature Rise	0.1 – 200°C	0.1°C	\pm 2.0°C	IEC 60968 Clause 9
EMTL/SOA/63	Resistance to Heat	0.1 – 220 °C	0.1 °C	\pm 1.5 °C	IEC 60968 Clause 10
EMTL/SOA/64	Resistance to Flame and Ignition	0.1 – 960°C	0.1°C	\pm 2.0 °C	IEC 60968 Clause 11
EMTL/SOA/65	Fault Conditions	-	-	-	IEC 60968 Clause 12
EMTL/SOA/66	Dimensions	0.01 – 150 mm	0.01mm	\pm 0.05 mm	IEC 60969 Clause 3
EMTL/SOA/67	Test Conditions	-	-	-	IEC 60969 Clause 4
EMTL/SOA/68	Starting and Run-up	-	-	-	IEC 60969 Clause 5
EMTL/SOA/69	Lamp wattage	0.1 – 5 kW	0.1 W	\pm 1.0 W	IEC 60969 Clause 6
EMTL/SOA/70	Luminous flux	-	0.1 lm	\pm 2.0 %	IEC 60969 Clause 7
EMTL/SOA/71	Colour	2700 – 6500 K	-	\pm 12.0 K	IEC 60969 Clause 8
EMTL/SOA/72	Lumen maintenance	-	-	-	IEC 60969 Clause 9
EMTL/SOA/73	Life	-	-	-	IEC 60969 Clause 10
EMTL/SOA/74	Caps	0.01 – 150 mm	0.01 mm	\pm 0.05 mm	IEC 60081 Clause 1.5.2
EMTL/SOA/75	Dimensions	0.1 – 100 cm	0.1 cm	\pm 0.2 cm	IEC 60081 Clause 1.5.3
EMTL/SOA/76	Starting Characteristics	0.01 – 5 min	0.01 sec.	\pm 1.0 sec.	IEC 60081 Clause 1.5.4
EMTL/SOA/77	Electrical & Cathode Characteristics	0.1 – 5 kW	0.1W	\pm 1.0 W	IEC 60081 Clause 1.5.5
EMTL/SOA/78	Photometric Characteristics	-	0.1 lm	\pm 2.0 %	IEC 60081 Clause 1.5.6
EMTL/SOA/79	Lumen Maintenance	-	-	-	IEC 60081 Clause 1.5.7
EMTL/SOA/80	Marking	-	-	-	IEC 60081 Clause 1.5.8
EMTL/SOA/81	Marking	-	-	-	IEC 60921 Clause 5
EMTL/SOA/82	Voltage at Terminations of Lamp or Starter (If any)	0.1 – 500 V	0.1 V	\pm 1.0 V	IEC 60921 Clause 6

EMTL/SOA/83	Pre-Heating Conditions	0.001 – 15 A	0.001 mA	±1.0 %	IEC 60921 Clause 7
EMTL/SOA/84	Lamps Power and Current	0.1 – 5 kW 0.001 – 40 A	0.1 W 0.001 A	± 1.0 W ± 0.01 A	IEC 60921 Clause 8
EMTL/SOA/85	Circuit Power Factor	0.001 – 1.0	0.001	± 0.03	IEC 60921 Clause 9
EMTL/SOA/86	Supply Current	0.001 – 40 A	0.001 A	± 0.01 A	IEC 60921 Clause 10
EMTL/SOA/87	Maximum Current in any Lead to a Cathode	0.001 – 15 A	0.001 mA	± 1.0 %	IEC 60921 Clause 11
EMTL/SOA/88	Magnetic Screening	0.001 – 40 A	0.001 A	± 0.01 A	IEC 60921 Clause 13
EMTL/SOA/89	Marking	-	-	-	IEC 60879 / PS-1 Clause 8
EMTL/SOA/90	Test of Air Performance (Air Delivery Test)	0.01 – 20 m/s	0.01 m/s	± 0.05 m/s	IEC 60879 / PS-1 Clause 9.4
EMTL/SOA/91	Measurement of Speed of the Fan	0.1-10000 RPM	0.1 RPM	± 1.0 RPM	IEC 60879 / PS-1 Clause 9.5
EMTL/SOA/92	Measurement of Power Factor and Power Input	0.1 – 100 kW 0.001 – 1.00 Pf	0.1 W 0.001 Pf	± 0.15 W ± 0.002 Pf	IEC 60879 / PS-1 Clause 9.6
EMTL/SOA/93	Service Value	-	-	-	-

National Physical & Standard Laboratory (NPSL), Islamabad

Testing Laboratory

Annex-XI

Materials/ Products tested	Types of test/ Properties measured	Range of measurement	Minimum Detection limit	Uncertainty of Measurement (where applicable) MU (±)	Standard specification/ Techniques/ Equipment Used
Liquids Fluids	1) Kinematics Viscosity	0.2 – 30000 mm ² s ⁻¹	1 mm ² s ⁻¹	0.3 – 1.8 %	ASTM D 445-97 Calibrated Ubbelohde viscometers
pH of Water	2) Measurement of pH	0 to 14	0.001 pH	0.01 to 0.03 pH	ASTM D1293 (99-2005) Two point calibration (glass electrode method)
Water/ Wastewater and Industrial Effluents	3) Measurement of Conductivity	4 to 5000 µmhos/cm	4 µmhos/cm	20 µmhos/cm	AWWA/APHA 2510 –B Conductometry /Conductivity meter
	4) Total Dissolved Solid (TDS)	2.5 to 200 mg/L	2.5 mg/L	3.0 mg/L	Gravimetric method, 2540 B, AWWA/APHA
	5) Total Suspended Solid (TSS)	2.5 to 200 mg/L	2.5 mg/L	3.0 mg/L	Filtration & Drying of residues,2540D, AWWA/APHA
	6) Total Hardness	5 to 1000 mg/L	2.0 mg/L	3.0 mg/L	EDTA Titrimetric method, 2340 C AWWA/APHA
	7) Alkalinity	20 to 500 mg/L	2.0 mg/L	2.0 mg/L	Titration method 2320 B AWWA/APHA
	8) Chloride	1.5 to 100 mg/L	1.0 mg/L	1.0 mg/L	Argentometric Method, 4500 CIB, AWWA/APHA
	9) Calcium	0 to 100 mg/L	0.8 mg/L	2.0 mg/L	EDTA Titric method, 3500-CaB AWWA/APHA
	10) Chemical Demand (COD) Oxygen	0.5 to 900 mg/L	5.0 mg/L	8.0 mg/L	Open reflux method, 5220 B

11) Copper in water ASTM(D1688-02) wavelength: 324.8nm	0.05 to 5 mg/L	0.05 mg/L	0.5 mg/L	ASTM Standards/ Atomic Absorption Spectrometer, model A Analyst -100, Perkin Elmer-USA/ Direct method (Flame - AAS)
12) Iron in water ASTM(D1068-05) wavelength: 248.3nm	0.1 to 5 mg/L	0.06 mg/L	0.1mg/L	
13) Potassium in water ASTM(D4192-03) wavelength:766.5nm	0.2 to 4 mg/L	0.02 mg/L	0.8 mg/L	
14) Sodium in water ASTM(D4191-03) wavelength: 589.0nm	0.2 to 3 mg/L	0.02 mg/L	0.1 mg/L	
15) Nickel in water ASTM(D1886-03) wavelength: 232.0nm	0.1 to 10 mg/L	0.06 mg/L	0.6 mg/L	
16) Calcium & Magnesium in water ASTM(D511-03) wavelength: 285.2nm	Ca= 1.0 to 15 mg/L Mg=0.25 to 3.5 mg/L	0.09Ca Mg 0.008 mg/L	0.05 mg/L 0.15 mg/L	
17)Chromium in water ASTM (D1687-02) wavelength:357.9nm	0.1 to 10 mg/L	0.06 mg/L	0.24 mg/L	
18) Lead in water ASTM(D3559-03) wavelength:283.3nm	1 to 10 mg/L	0.28 mg/L	0.5 mg/L	
19) Cadmium in water ASTM (D3557-02) wavelength:228.8nm	0.05 to 2 mg/L	0.08 mg/L	0.12 mg/L	
20) Zinc in water ASTM(D1691-02) wavelength:213.9nm	0.05 to 2 mg/L	0.02 mg/L	0.2 mg/L	

<i>Field of measurement: (i) MASS MEASUREMENTS</i>			
Measured quantity	Range	Calibration & Measurement Capability (CMC) expressed as an uncertainty (+)	Brief description of measurement and equipment used
Mass	i) 1mg to 1000 g ii) 2000 g to 5000 g iii) 10,000 mg to 20,000 g	i) (0.001 to 0.22) mg ii) (0.37 to 0.98) mg iii) (1.8 to 5) mg	i) E ₂ , F ₁ and F ₂ class standard masses from 1mg to 20kg ii) Mass Comparator CCE6 having readability 0.1µg and capacity of 6.1g iii) Mass Comparator CC111 having readability 1µg and capacity of 111g iv) Mass Comparator AX1006 having readability 1µg and capacity of 1000g v) Mass Comparator CC10000U-L having readability 10µg and capacity of 10kg vi) Mass Comparator CC50001S-L having readability 1mg and capacity of 50kg
Balance/ Weighing machine (On-Site Calibration)	5g to 5000g	(0.01 to 1) mg	E ₂ class standard masses from 1mg to 5000g

<i>Field of measurement: (ii) VOLUME MEASUREMENTS</i>			
Measured quantity	Range	Calibration & Measurement Capability (CMC) expressed as an uncertainty (+)	Brief description of measurement and equipment used
Micropipette	10 µL to 1000 µL	0.2 µL to 5µL	Gravimetric Method is used for the calibration of volume measures ranging from 10µL to 20 L. Three precision electronic balances are used for the calibration measures i-e. M-27, M-28 and M-39.
Glassware	1 mL to 1000 mL	0.1mL to 3.5 mL	
Glassware	1 L to 10 L	0.004 L to 0.03 L	
Metallic	20 mL to 2000 m L	0.12 mL to 5.78 mL	
Metallic	2 L to 5 L	0.006 L to 0.017 L	
Metallic	5 L to 10 L	0.017 L to 0.029 L	
Metallic	10 L to 20 L	0.029 L to 0.050 L	
<i>Field of measurement: (iii-a) ELECTRICAL MEASUREMENTS</i>			
DC Voltage	i)1.0180 V ii)10 V	i) 0.2 µV ii) 0.4 µV	Model 732B is a dc voltage laboratory standard that produces reference voltages of 10V and 1.018V
	0 mV to 1100 V	0.00205 mV to 0.0069 V	Multifunction Calibrator (Fluke 5720A/ Wavetek 9100) is used to calibrate various instruments and devices; digital and analogue multimeters, frequency meters, ohm meters, AC/DC mill voltmeters, clamp meters, and much more.
AC Voltage	1 mV (10 Hz – 1 MHz) to 750 V(10 Hz – 100 kHz)	0.00424 mV to 0.431 V	- do -
DC Current	i) 220 µA to 20 A ii)1000 A(via current coil)	0.0148 µA to 0.00408 A	- do -

AC Current	220 μ A(10 Hz – 10 kHz) to 20 A (40 Hz – 40 kHz) 1000 A (via current coil)	0.071 μ A to 15.5 mA	- do -
Resistance	0 Ω to 100 M Ω	40 $\mu\Omega$ to 0.0001 Ω	- do -
	0.0001 Ω to 10 k Ω	60 $\mu\Omega$ to 0.008 Ω	High accuracy working Resistance standards.
Capacitance	0.1 μ F to 1 μ F	0.0005 μ F	Standard Capacitors
	500 pF to 400 mF	0.115 pF to 1.15 μ F	Multifunction Calibrator (Wavetek 9100) is used to calibrate various instruments and devices; digital and analogue multimeters, frequency meters, ohm meters, AC/DC millivoltmeters, clamp meters, and much more.
AC Power	1 mW/mVAR to 20 kW/kVAR (up to 1MW/MVAR (via current coil)	4.2806 μ W to 155.5 W	- do -
DC Power	1 mW to 20 Kw (up to 1MW via current coil)	4.2806 μ W to 155.5 W	- do -
Field of measurement: (iii-b) ELECTRICAL MEASUREMENTS			
DC Voltage	1 mV to 1000 V	0.0021 mV to 0.0055 V	The Reference Multimeters (3458A Agilent DMM, 8½ Digit/34401A Agilent DMM, 6½ Digit) are high performance DMMs, offer very high accuracy and high-speed digitizing for calibration laboratory precision measurements and fast test system throughput.
AC Voltage	0.01V (1 kHz – 300 kHz) to 750 V (1 kHz)	2.7 μ V to 0.035 V	- do -
DC Current	100 μ A to 20 A	0.0018 μ A to 0.0012 A	- do -

AC Current	10 μ A to 20 A (1 kHz - 50 Hz)	0.0053 μ A – 0.0052 A	- do -
Resistance	0.1 m Ω to 100 M Ω	0.0578 m Ω to 0.1366 M Ω	- do -
Capacitance	900 pF to 9 μ F (1 kHz)	5.6x10 ⁻⁶ μ F	The PM 6303A is a quality assurance tool used for calibration of Capacitors, Resistors and Inductors
Inductance	100 μ H to 1 H	0.00577 μ H to 0.006 μ H	- do –
Field of measurement: (iv) TEMPERATURE MEASUREMENTS			
Calibration of Liquid in Glass Thermometer	-38 °C to 200 °C	0.1 °C to 0.15 °C	Digital Readout, Ultra Low Bath/ Stirrer Oil Bath, Zero point Dry Well, Reference Thermometer
Calibration of Thermocouples	-40°C to 900°C	1.0 ° C to 1.5 °C	Dry block Temperature Calibrator, Muffle Furnace, Digital Readout, Low Temperature Bath, Reference Thermometer
Field of measurement: (vi) LENGTH AND DIMENSION MEASUREMENTS			
Length	(i) 1Meter	0.1 mm (point to point comparison) & 0.01 mm (end to end comparison)	Meter Scales, Measuring Tapes, steel rulers, One meter Gauge Blocks, Length Bars using Length Comparator & Double Image Comparator
	(ii) Up to 300 mm	(0.08 to 0.2) μ m	Gauge Blocks sets up to 100 mm range normally End Standards, Feeler Gauges, Snap Gauges, Dial Gauges Using Mechanical Measuring Machine & Universal Measuring Machine
	(iii) Up to 300mm	1.0 μ m	Vernier caliper, Dial calipers, External Micrometers, Thickness gauges and Mandrel Using Standard Gauge Blocks set.
Diameter External	Up to 300 mm	0.6 μ m	Master Plug Gauges, Pin Gauges and Cylinders using Mechanical Measuring Machine & Universal Measuring Machine
Diameter Internal	10 mm to 205 mm	0.6 μ m	Master Ring Gauges Using Mechanical Measuring Machine & Universal Measuring Machine

Field of measurement: vii) TIME AND FREQUENCY MEASUREMENTS

Measured quantity	Range	Calibration & Measurement Capability (CMC) expressed as an uncertainty (+)	Brief description of measurement and equipment used
Frequency (Source)	(0.1,1,5,10) MHz	(2.3×10^{-5} to 1.6×10^{-3}) Hz	Direct frequency measurement using calibrated frequency counters along with primary standard, GPS 10RBN. All kinds of Rubidium Frequency Standards and frequency converters are calibrated through this scheme of practice for all available outputs and time basis within T&FMD's range of calibration.
Frequency (Measure)	10 Hz to 18GHz	(8.0×10^{-3} to 1.4×10^{-1}) Hz	Direct frequency measurement using calibrated frequency source / Generator along with primary standard, GPS 10RBN is used. All kinds of General Frequency counter: Universal Counter, Microwave Counter etc. are calibrated through this scheme of practice within T&FMD's range of calibration and time bases (5MHz, 10 MHz etc.) if available.
Time Interval (Measure)	5 s to 28800 s	(9.0×10^{-3} to 1.0×10^{-2}) Hz	Using second ticks of Master clock of PST drawn from calibrated Rubidium Frequency standard. All kinds of stopwatches, timers, up / down counters etc. are calibrated through this scheme of practice within T&FMD's range of calibration

<i>Field of measurement: vii) TIME AND FREQUENCY MEASUREMENTS</i>			
Measured quantity	Range	Calibration & Measurement Capability (CMC) expressed as an uncertainty (\pm)	Brief description of measurement and equipment used
Pressure	i) (0.1 to 1100) bar	0.017 bar	<p>a. Pressure Gauge and dead weight testers are calibrated.</p> <p>b. Instruments used: Dead weight pressure tester and references gauges.</p> <p>c. Pressure gauge and dead weight pressure testers are calibrated.</p> <p>d. Instruments used: HDWT and references gauges,</p> <ul style="list-style-type: none"> • Pneumatic calibrator, pressure switches, pressure module and pneumatic pressure gauges. • Vacuums gauges, pressure gauges and pneumatic calibrators are calibrated. <p>Instruments used: Digital Calibrator.</p>
	ii) (10 to 18000) psi	0.02 psi	
	iii) (-1 to 20) bar	0.01 bar	
	iv) 0 to 20 bar	0.005 bar	
	v) (10 to 10000) psi	(0.005-0.01) psi	
<i>Field of measurement: (viii) VISCOSITY MEASUREMENTS</i>			
UBBELOHDE Viscometer Calibration	(0.03 to 500) mm ² s ⁻²	(0.3 – 1.8) %	ASTM D 445-97 Viscosity Standard oils

Field of measurement: (ix) CONDUCTIVITY MEASUREMENTS			
Measured quantity	Range	Calibration & Measurement Capability (CMC) expressed as an uncertainty (\pm)	Brief description of measurement and equipment used
Conductivity Meter Calibration	4-10 ⁶ μ s/cm	(1410-12800) μ s/cm	Calibration of conductivity meters by using KCl standard solution.
Field of measurement: (x) pH MEASUREMENTS			
Measured quantity	Range	Calibration & Measurement Capability (CMC) expressed as an uncertainty (\pm)	Brief description of measurement and equipment used
pH	0-14 pH	0.01 to 0.03	Standard Buffer solutions / Two point calibration method

PCSIR Labs Complex, Karachi (KLC)

Testing Laboratory

Annex-XIII

<i>Materials/ Products tested</i>	<i>Types of test/ Properties measured</i>	<i>Range of measurement</i>	<i>Minimum Detection limit</i>	<i>Uncertainty of Measurement (where applicable) MU (±)</i>	<i>Standard specification/ Techniques/ Equipment Used</i>
Food Chemistry					
Cereal Foods	Mosture	1 % - 99 %	0.5 %	0.28 %	Air Oven Method AOAC 18 th Edition (2005) AOAC Official Methods 32.1.03, 925.10
	Protein	1 % - 99 %	0.2 %	0.28 %	Kjeldahl Method AOAC 18 th Edition (2005) AOAC Official Methods 32.1.22, 920.87 Total Protein in flour
	Fat	1 % - 99 %	0.5 %	0.71 %	Soxhlet Method AOAC 18 th Edition (2005) Crude fat or Ether extract 32.2.01, F (4.5.01) 920.39C
	Ash	1 % - 99 %	0.1 %	0.35 %	Direct Method AOAC 18 th Edition (2005) Official Methods AOAC 32.1.05, 923.03
	Crude Fiber	0.5 % - 99 %	0.1 %	0.52 %	Weende Method AOAC 18 th Edition 2005, Fiber Tech M6 (1020/1021) FOSS AOAC Official Method 920.86, (32.1.15) AOAC Official Method 950.37, (32.3.16) AOAC Official Method 930.24, (32.4.02) AOAC Official Method 935.39, (32.5.06)

	Carbohydrate (by difference)/ Nitrogen free Extract	1 % - 99 %	0.2 %	0.5 %	By Calculation Modern Food Analysis by Hart & Fisher 1971 by difference/ Nitrogen Free Extract
	Calorific Value/ Energy Value	1 % - 99 %	0.2 %	0.5 %	(By Calculation) MacCance & Widdowson's. The composition of Food by Paul & Southgate 4 th Ed. 1988
	Fat	1 % - 99 %	0.2 %	0.11 %	Acid Hydrolysis Method AOAC Official Method 922.06, Chapter 32.1.14 official method of Analysis AOAC International 18 th Edition 2005
Raw/ Processed Foods	Vitamin C	3 mg/100g – 10 mg/100g	1 mg/ 100g	2 mg/ 100g	Titrimetric Method Association of Official Analytical Chemists (AOAC) 18 th Edition (2005) 45.1.14, Method: 967.21
	Vitamin A	90 IU/g – 150 IU/g	80 IU/g	50.7 µg/100 g	UV-Spectrophotometer Pearson's Composition & Analysis of Food 9 th Edition Page 641
	Vitamin –C	2 mg/100g – 10 mg/100g	1 mg/ 100g	2 mg/ 100g	Titrimetric method AOAC Official Method 985.33, Chapter 50.1.09, Official Methods of Analysis of AOAC Int., 18 th Ed. 2005

Red Chili, Rice, Food, Feed & Agriculture Commodities	Aflatoxins B1, B2, G1, G2 & Total Aflatoxin in Food & Feed	Not applicable	LOD 1 µg/kg	1.368 ppb 1.055 ppb 0.487 ppb 0.445 ppb 0.838 ppb	1. Thin-layer chromatographic method 2. Liquid-Liquid Partiti on chromatography 18 th Edition (2005) Chapter 49 AOAC Official Method (Adapted) 975.36 (49.2.08), 968.22 (49.2.08), 970.43 (49.1.01), 971.22 (49.2.03), 970.44 (49.2.07), 968.22 (49.2.02)
Milk & Milk Products	Aflatoxin M1 in Milk & Milk Products	Not Applicable	Aflatoxin M1/conc. in µg/kg (ppb)/ 1. LOD in fluid milk = 0.05 µg/L, 2. LOD Dried milk=0.1 µg/kg, 3. LOD in cheese =0.1 µg/kg	0.988 ppb	1. Thin-layer chromatographic method 2. Column Chromatography 18 th Edition (2005) chapter 49 AOAC Official Method (Adapted) 980.21 (49.3.02), 974.17 (49.3.01), 970.43 (49.1.01), 978.15 (49.2.21), 970.44 (49.2.07), 968,22 (49.2.08) Aflatoxin M1 in Milk and cheese
Red Resin, Wheat & Feed	Ochratoxin 'A'	Not Applicable	LOD 1 µg/kg	0.852 ppb	1. Thin-layer chromatographic method 2. Column Chromatography Adapted Method of IARC (1982) AOAC 18 th Edition (2005) Chapter 49 AOAC Official Method (Adapted)

Microbiology

Food	Aerobic Plate Count	250- 10 ⁸ cfu/g	10 cfu/g	0.64 cfu/g	Bacteriological Analytical Manual, Online USFDA, Chapter # 03 (Jan. 2001), (By Pour Plate Method)
	Total Coliforms	3 cfu/g – 1100 cfu/g	3 cfu/g	Not applicable	Bacteriological Analytical Manual, Online USFDA, Chapter # 04 (Sept. 2002), (By MPN Multiple Tube Method)
	Fecal Coliforms	3 cfu/g – 1100 cfu/g	3 cfu/g	Not applicable	Bacteriological Analytical Manual, Online USFDA, Chapter # 04 (Sept. 2002), (By MPN Multiple Tube Method)
	Mould & Yeast Count	10 cfu/g – 10 ⁵ cfu/g	10cfu/g	0.34 cfu/g	Bacteriological Analytical Manual, Online USFDA, Chapter # 18 (April 2003), (Spread plate/ pour plate method)
	Salmonella Detection	Absent/ present	Not applicable	Not applicable	Bacteriological Analytical Manual, Online USFDA, Chapter # 05 (Jan. 2001), (Selective enrichment method)
	Staphylococcus aureus Enumeration	35 cfu/g - 10 ⁵ cfu/g	35 cfu/g	Not applicable	Bacteriological Analytical Manual, Online USFDA, Chapter # 12 (Jan.2001), (Spread plate method)
	E.coli in Food	3 cfu/g – 1100 cfu/g	3 cfu/g	Not applicable	Bacteriological Analytical Manual, Online USFDA, Chapter # 04 (Sept. 2002), (MPN Multiple Tube Method)

Water	Heterotrophic Plate Count	30 cfu/ml - 10 ⁵ cfu/ml	01 cfu/ dL	0.37 cfu/ml	Standard Method for the examination of water & wastewater, 20 th Edition 1998, (Pour plate method)
	Total Coliforms Count	1 cru/ml - 10 ⁴ cfu/ml	01 cfu/dL	0.14 cfu/ml	ISO-9308 – 1 Part 1 Membrane filtration Method 2 nd Edition, 2000, (Membrane filtration/ MPN Multiple tube method) ISO- 9308 – 2 Part 2 Multiple tube Method 1 st Edition, 1990, Membrane filtration Method/ (MPN Multiple tube Method)
	Fecal Coliforms Count	1 cfu/dL – 10 ⁴ cfu/dL	01 cfu/dL	0.005 cfu/ml	ISO – 9308 – 1 Part 1 Membrane filtration Method 2 nd Edition, 2000, (Membrane filtration Method/ MPN Multiple tube method) ISO – 9308 – 2 Part 2 Multiple Tube Method 1 st Edition, 1990, (MPN Multiple tube method)
	E. Coli in Water	1 cfu/dL – 10 ⁴ cfu/dL	01 cfu/dL	0.005 cfu/ml	ISO – 9308 – 1 Part 1 Membrane filtration Method 2 nd Edition, 2000, (Membrane filtration method / MPN Multiple tube Method) ISO – 938.10– 2 Part 2 Multiple Tube Method 1 st Edition, 1990, (MPN Multiple Tube Method)

Chemical Pharmaceutical					
Edible Oil and Products Containing Edible Oil	Erucic Acid	0.5% - 5.0%	5.0%	0.02%	Validated self developed method KL/PRC/Erucic Acid/ 03 Gas Chromatograph
Food/ Pharmaceutical	Vitamin E	5 µg – 20mg	5 µg – 100g	0.013 µg/ 100g	HPLC
Pharmaceutical	Vitamin C	>2 mg	2mg	0.0081 mg	BP 2008 page # 186 – 187 Techniques used: Titrimetric Method
Spices & Food containing Spices	(Sudan I – IV) Absorbance	20 ppm – 100 ppm	10ppm	Not applicable	AOAC, 920.208B (2005) UV Visible Spectrophotometer TLC
Pickles	Water Activity Equilibrium Water	0.1 – 1	0.08	0.0016	AOAC 978.18 (2005)
Margarine/ Milk Powder, Pharmaceutical	Vitamin A	7 µg – 0.5mg	5 µg	0.011 µg	HPLC
Food/ Pharmaceutical	Vitamin D	0.5 µg/g -12 µg/g	0.5 µg	0.06 µg	AOAC, 2002.2.05 HPLC
Chilli	Para red	2 ppm – 100 ppm	1 ppm	± 0.18 ppm	Validated self developed method KL/PRC/Para red/08
Spices & Food Containing Spices	Sudan I,II, III, IV Absorbance	>0.2ppm	0.1ppm	Sudan: I ± 0.025 ppm II ± 0.08 ppm III ± 0.01 ppm IV ± 0.01 ppm	LC – MS/ MS

Environment					
Food (All Commodities)	Lead	≥ 0.100 ppm	3.000 ppb	0.155 ppb	AOAC 18 th Edition (2005) AOAC Official Method 999.10 (9.1.08)
	Cadmium	≥ 0.010 ppm	0.200 ppb	0.034 ppb	AOAC 18 th Ed (2005) AOAC Official Method 999.10 (9.1.08)
	Zinc	≥ 0.5 ppm	0.010 ppm	0.039 ppm	AOAC 18 th Ed (2005) AOAC Official Method 999.10 (9.1.08)
	Copper	≥ 0.500 ppm	0.010 ppm	0.016 ppm	AOAC 18 th Ed (2005) AOAC Official Method 999.10 (9.1.08)
	Iron	≥ 0.2 ppm	0.04 ppm	5.000 ppm	AOAC 18 th Ed (2005) AOAC Official Method 999.10 (9.1.08)
	Arsenic	≥ 0.100 ppm	1.000 ppb	0.025 ppm	AOAC 18 th Ed (2005) AOAC Official Method 986.15(Sec 9.1.01)
	Selenium	≥ 0.20 ppm	3.0 ppb	0.021 ppm	AOAC 18 th Ed (2005) AOAC Official Method 986.15(Sec 9.1.01)
	Mercury	≥ 0.100 ppm	0.2 ppb	6.23 ppm	AOAC 18 th Ed (2005) AOAC Official Method 971.21 (Sec 9.2.22)
	Pesticides	0.010 ppm – 005 ppm	0.001 ppm	0.002 ppm	AOAC 2005 GC
Water	Pesticides	0.010 ppm – 005 ppm	0.001 ppm	0.002 ppm	AOAC 2005 GC

Textile					
Fabric	Colour Fastness to Rubbing	Grey Scale (1 – 5)	1 (Grey Scale Rating)	Change in colour 1/2	AATCC – 08 (2005) (Change in Colour & Staining)
	Colour Fastness to Perspiration	Grey Scale (1 – 5)	1(Grey Scale Rating)	Change in colour Acid: 1/2 Alkaline: 1/2	ISO – 105 EO4 (1994) (Change in Colour & Staining)
	Colour Fastness to Water	Grey Scale (1-5)	1 (Grey Scale Rating)	Change in colour 1/2	ISO – 105 EO1 (1994) (Change in Colour & Staining)
	Colour Fastness to Sea Water	Grey Scale (1 – 5)	1 (Grey Scale Rating)	Change in colour 1/2	ISO – 105 EO2 (1994) (Change in Colour & Staining)
	Colour Fastness to Rubbing (Organic Solvent)	Grey Scale (1 – 5)	1 (Grey Scale Rating)	Change in Colour Warp: 1/2 Weft: 1/2 Staining Warp:1/2 Weft: 1/2	ISO – 105 DO2 (1993) (Change in Colour & Staining)
	Wrinkle Recovery of Woven Fabrics	20° – 180°	20° (Angle)	2°	AATCC – 66 (2003) Angle of Recovery
	Tensile Strength of Fabric (Strip Method)	1N – 5 KN	1N (Force)	Warp: 9.0 % of the observed value Weft: 14.9 % of the observed value	ISO – 13934 – 1 (1999) Force at Break
	Tear Strength	1N – 5KN	1N (Force)	Across Warp: 15.7 % of the observed value Across Weft: 13.40 % of the observed value	ISO – 13937 – 2 (2000) Force at Tear

	Fibre Composition/ Blend Ratio	% of Cotton % of Polyester	0.1 %	% of Cotton: 0.09 % % of Polyester: 0.09 %	ISO 1833, Section 10. (Mixture of Cellulose & Polyester) (1977) Fiber Solubility
	Ends and Picks	Numeric Values	1 Thread	Warp: 5.4 thread Warp: 3.9 thread	ISO – 7211 – 2 No. of threads/ Area
	Pilling (Martindale)	Numeric Value (1 – 5)	1 (Rating)	15 % of observed reading	ASTM D – 4970 (2002) Fabric Deformation
	Abrasion (Martindale)	Numeric Value (1 – 5)	1 (Rating)	33 % of observed reading	ISO – 12947 (1998) Fabric Deformation
	Spray Rating Tester	0 – 100	0 (AATCC Rating)	1.0	AATCC - 22 (2005) Water Penetration
	pH of water Extract	4 – 10	2	± 0.084	AATCC – 81 (2001) pH of fabric
Yarn	Count of Yarn	English (Ne)/ Denier/ Tex	Not Applicable	15 % of observed reading	ISO – 7211 – 5 (1984)

Measured quantity	Range	Calibration & Measurement Capability (CMC) expressed as an uncertainty (\pm)	Brief description of measurement and equipment used
Weighing	2.0 mg to 1.0 Kg	0.2 mg to 2.0 mg	R – 76 – 1 & 2 (OIML) Masses: ASTM Class – 1 (1 mg to 10 Kg) Working Class (10 mg to 10 Kg)
Mass/ Weights	10 mg to 20 Kg	0.01 mg to 0.5 g	Technique: Direct Comparison 1. Set of masses 2. Analytical Balance Mettler Toledo AX 205 3. Mass comparator Mettler Toledo XP 5003S 4. Mass Comparator Mettler Toledo KA 30 – 3/P 5. Top Loading Balance, AND GP – 40K
Volume	1 ml to 2 L	0.03 ml to 0.5 ml	ASTM E – 542 -01 Top Loading Balance (i) Ohaus Model AR 3130 and (ii) AND Model GX 6100 (iii) Analytical Balance ME 414 Capacity 410 g
Length	1 mm to 1000 mm	0.01 mm to 1 mm	Direct Comparison Use Use of gauge blocks Grade 0, Length comparator

Temperature	-20 °C to 1000 °C	0.03 °C to 0.8 °C	<p>ASTM E – 77/84 Low Temperature Hydra Liquid Bath, 7380 Fluke Dry Block Calibrator Jupiter Make ISO Tech Model 650B Dry Block Calibrator Tecal, 650S Dry Block Calibrator Pegas, ISO Tech Three Zone Furnace ISO Tech 465 Saturn Thermocouple Calibrator 27152 – 6 Huminator Germany Multi Function Process Calibrator Model 725 Make Fluke Thermocouples S, R T and K type</p>
DC Voltage	1 mV to 1000V	0.001 mV to 1.0 V	<p>Direct comparison Universal Calibration System, Keithley Model 2002 DMM Agilent 344401</p>
AC Voltage	1 mV to 700 V	0.0004 mV to 1.0 V	
Resistance	1 Ω to 300 MΩ	0.2 m Ω to 0.0003 M Ω	