

4.0 Results of the NMIs Assessment

4.1 Tanzania Bureau of Standards (TBS).

Table 4.1 TBS-Measurement Capabilities to Pharmaceutical Sector

Instrument/Equipment at Pharma company.	Measurement	Offered calibration range (TBS)	Uncertainty Offered (TBS)	Accredited range and uncertainty (TBS)	Max. uncertainty to be provided by calibration laboratory (derived from tolerance)	Tolerance (as required by pharma industry)	Traceability
GC	Gas Flow	* n/a			0.1 %	1 %	n/a
Climatic Chambers Data Logger with Humidity Sensors Hygrometer	Humidity	No humidity Chamber and humidity Sensors/loggers	n/a	n/a	0.1 %	5 %	n/a
Stop Watch/ Frequency counters	capability doesn't exist -got electronic watches	n/a	n/a	n/a	0.1 Hz	1 Hz	n/a
Thermometer Temperature sensors Ovens Climate chambers Sterilizer Thermocycler	Temperature	SPRT(2pcs), PT100 thermocouples (types R,S,N,J,T,K), Temperature	± 0.1 °C	-40 °C to 200 °C (accredited); Can perform calibration	0.1 °C resistance, 0.5 °C thermocouple	2 °C	NMISA & SP Sweden

Instrument/Equipment at Pharma company.	Measurement	Offered calibration range (TBS)	Uncertainty Offered (TBS)	Accredited range and uncertainty (TBS)	Max. uncertainty to be provided by calibration laboratory (derived from tolerance)	Tolerance (as required by pharma industry)	Traceability
		data logger		from- 80 °C to 1000 °C			
Dissolution tester Stirrer Homogenizer, Centrifuge	Revolution	n/a	n/a		1 revolution in 10 min	1 rpm	n/a
Working standards for balance calibration	Mass	Up to 20 kg (Class F ₂); E2 from 1mg up 5kg	In line with OIML	Accreditation of masses from 1mg to 20kg; Weighing instruments from 0g to 250kg	1mg to 20g-0.03g 20 g to 1kg-0.0002% 1kg to 20kg-0.0005%	F1 - M1	NMISA/SP Sweden
Stop Watch	Time	5 s to 2400 s 2400 s to 48 h	70ms 1200 ms	0.05 s 1s	1 s	1 s	NMISA
Torque wrenches for Maintenance	Torque wrenches	No capacity	n/a	n/a	n/a	10 %	n/a
Vernier calliper Wobble meter	Length	0-500mm	0-300 mm 300-500 mm	± 11 µm ±25 µm	±25 µm (Vernier caliper) ±6 µm (Micrometer screw) ±0.2(Gauge	50 µm (Vernier caliper) 2µm (Micrometer screw)	NMISA
Micrometer screw gauge,	External 0-200 mm	0-300 mm 0-200 mm	0-300 mm 0-200 mm	±6 µm ± 0.2 µm	±0.2(Gauge		

Instrument/Equipment at Pharma company.	Measurement	Offered calibration range (TBS)	Uncertainty Offered (TBS)	Accredited range and uncertainty (TBS)	Max. uncertainty to be provided by calibration laboratory (derived from tolerance)	Tolerance (as required by pharma industry)	Traceability
Gauge block					blocks)		
Compression machine Calibration Punch	Load cell	3000kN 300kN& 2000kN(read out not working)	0.5% Of the scale	n/a	0.5 %	5 %	n/a
Flow Meter. Water supply to system	Water flow	n/a	n/a	n/a	0.5 %	5 %	n/a
Anemometer A/C system	Air velocity	n/a			0.5 %	5 % or 0.2 m/s whatever is higher	n/a
Photostability sensors	UV light intensity	n/a				5 %	n/a
	Visible light intensity	n/a	n/a	n/a	0.5 %	5 %	n/a
Particle Counter for environmental monitoring	Particle count	n/a			2 %	20 %	n/a
Digital manometer Filter integrity Tester	Pressure	Up to 500 bar digital(50 Mpa) Dial gauge max.1000 bar Magnehelic pressure	±0.06 bar n/a	n/a	0.002 mbar 10 mbar	0.02 mbar (Magnehelic) 0.1 bar (standard pressure gauge)	NMISA (industrial pressure range}

Instrument/Equipment at Pharma company.	Measurement	Offered calibration range (TBS)	Uncertainty Offered (TBS)	Accredited range and uncertainty (TBS)	Max. uncertainty to be provided by calibration laboratory (derived from tolerance)	Tolerance (as required by pharma industry)	Traceability
		No capability for Magnehelic pressure	n/a				
Spirit level, Dissolution testing, maintenance	Level (Spirit level)	n/a no capability		n/a	0.01°	0.5°	

4.2 Uganda Bureau of Standards (UNBS)

Table 4.2. UNBS-Measurement Capabilities to Pharmaceutical Sector

Instrument/Equipment at Pharma company.	Measurement	Offered calibration range (UNBS)	Uncertainty Offered (UNBS)	Accredited range and uncertainty (UNBS)	Max. uncertainty to be provided by calibration laboratory (derived from tolerance)	Tolerance (as required by pharma industry)	Traceability
GC	Gas Flow	n/a			0.1 %	1 %	n/a
Climatic Chambers Data Logger with Humidity Sensors Hygrometer	Humidity	n/a	n/a	n/a	0.1 %	5 %	n/a
Stop Watch	Electrical frequency	n/a	n/a	n/a	0.1 Hz	1 Hz	n/a
Thermometer Temperature sensors Ovens Climate chambers Sterilizer Thermocycler	Temperature	PT100 -40 °C to 500 °C	± 20mK(0.2 °C)	Not accredited	0.1 °C	2 °C	NMISA
Dissolution tester Stirrer Homogenizer, Centrifuge	Revolution	n/a	n/a	n/a	1 revolution in 10 min	1 rpm	n/a
Working standards for balance calibration	Mass	1mg to 20kg F1	In line with OIML	accredited	E2	F1 - M1	NMISA
Stop Watch	Time	n/a	n/a	n/a	0.1 s	1 s	n/a
Torque wrenches for Maintenance	Torque wrenches	6Nm-1200Nm	± 0.01Nm (±0.4%)	n/a	1 %	10 %	DakkS Accredited

Instrument/Equipment at Pharma company.	Measurement	Offered calibration range (UNBS)	Uncertainty Offered (UNBS)	Accredited range and uncertainty (UNBS)	Max. uncertainty to be provided by calibration laboratory (derived from tolerance)	Tolerance (as required by pharma industry)	Traceability
							laboratory
Vernier calliper Wobble meter	Length	Micrometers 0 - 150 mm 0-300 mm Vernier calipers 0-1000 mm Gauge block set grade 00 Spirit level	± 0.001 mm ± 0.01 mm ± 0.01 mm 0.0005 mm 0.02mm/1000 mm	n/a n/a	5 μ m (Vernier caliper) 0.2 μ m (Micrometer screw)	50 μ m (Vernier caliper) 2 μ m (Micrometer screw)	NMISA
Compression machine Calibration Punch load cell	Compression force	300-3000kN	± 0.03 %	n/a	0.5 %	5 %	DakkS accredited laboratory
Flow Meter. Water supply to system	Water flow	30l/m-1200l/m	± 0.5 %	n/a	0.5 %	5 %	n/a
Anemometer A/C system	Air velocity		n/a		0.5 %	5 % or 0.2 m/s whatever is higher	n/a
Photostability sensors	UV light intensity		n/a			5 %	n/a
	Visible light intensity	n/a	n/a	n/a	0.5 %	5 %	n/a
Particle Counter for environmental monitoring	Particle count		n/a		2 %	20 %	n/a
Digital manometer	Pressure	n/a	n/a	n/a	0.002 mbar	0.02 mbar	n/a

Instrument/Equipment at Pharma company.	Measurement	Offered calibration range (UNBS)	Uncertainty Offered (UNBS)	Accredited range and uncertainty (UNBS)	Max. uncertainty to be provided by calibration laboratory (derived from tolerance)	Tolerance (as required by pharma industry)	Traceability
Filter integrity Tester Magnehelic					10 mbar	(Magnehelic) 0.1 bar (standard pressure gauge)	
Spirit level Dissolution testing, maintenance	Level (Spirit level)	n/a	n/a	n/a	0.01°	0.5°	n/a

4.3 Burundi Bureau of Standards (BBN)

Table 4.3. BBN-Measurement Capabilities for pharmaceutical sector

Instrument/Equipment at Pharma company.	Measurement	Offered calibration range (BBN)	Uncertainty Offered (BBN)	Accredited range and uncertainty (BBN)	Max. uncertainty to be provided by calibration laboratory (derived from tolerance)	Tolerance (as required by pharma industry)	Traceability
GC	Gas Flow	n/a			0.1 %	1 %	n/a
Climatic Chambers Data Logger with Humidity Sensors Hygrometer	Humidity (one piece}	Up to 90 %RH	± 3 %	n/a	0.1 %	5 %	DakkS accredited laboratory
Stop Watch	Electrical frequency	No capability	n/a	n/a	0.1 Hz	1 Hz	n/a
Thermometer Temperature sensors Ovens Climate chambers Sterilizer Thermocycler	Temperature	PT 100 0 °C to 450 °C -30 °C to 40 °C 40 °C to 100 °C	± 80mK	n/a	0.1 °C	2 °C	DakkS Accredited laboratory.
Dissolution tester Stirrer Homogenizer, Centrifuge	Revolution	No capability	n/a		1 revolution in 10 min	1 rpm	n/a
Working standards for balance calibration	Mass	F1 1 mg to 20 kg (Class)	In line with OIML R 111	n/a	F1	F1 - M1	DakkS accredited laboratory

Instrument/Equipment at Pharma company.	Measurement	Offered calibration range (BBN)	Uncertainty Offered (BBN)	Accredited range and uncertainty (BBN)	Max. uncertainty to be provided by calibration laboratory (derived from tolerance)	Tolerance (as required by pharma industry)	Traceability
Stop Watch	Time	No capability	n/a	n/a	0.1 s	1 s	n/a
Torque wrenches for Maintenance	Torque wrenches	No capability	n/a	n/a	1 %	10 %	
Vernier calliper Wobble meter	Length	Vernier caliper 0 - 150 mm	± 0.01 mm	n/a	(Vernier caliper) 0.1mm	50 µm (Vernier caliper) 2µm (Micrometer screw)	n/a
Compression machine Calibration Punch load cell	Compression force	n/a	n/a	n/ad	0.5 %	5 %	n/a
Flow Meter. Water supply to system	Water flow	n/a	n/a	n/a	0.5 %	5 %	n/a
Anemometer A/C system	Air velocity	n/a			0.5 %	5 % or 0.2 m/s whatever is higher	n/a
Photostability sensors	UV light intensity	n/a			n/a	5 %	n/a
	Visible light intensity	n/a	n/a	n/a	0.5 %	5 %	n/a
Particle Counter for environmental monitoring	Particle count	n/a			2 %	20 %	n/a
Digital manometer	Pressure	n/a	n/a	n/a	0.002 mbar	0.02 mbar	

Instrument/Equipment at Pharma company.	Measurement	Offered calibration range (BBN)	Uncertainty Offered (BBN)	Accredited range and uncertainty (BBN)	Max. uncertainty to be provided by calibration laboratory (derived from tolerance)	Tolerance (as required by pharma industry)	Traceability
Filter integrity Tester					10 mbar	(Magnehelic) 0.1 bar (standard pressure gauge)	n/a
Spirit level Dissolution testing, maintenance	Level (Spirit level)	n/a		n/a	0.01°	0.5°	n/a

4.4 Rwanda Standards Board (RSB)

Table 4.4 RSB- Measurement Capabilities for pharmaceutical sector.

Instrument/Equipment at Pharma company.	Measurement	Offered calibration range (RSB)	Uncertainty Offered (RSB)	Accredited range and uncertainty (RSB)	Max. uncertainty to be provided by calibration laboratory (derived from tolerance)	Tolerance (as required by pharma industry)	Traceability
GC	Gas Flow	n/a			0.1 %	1 %	n/a
Climatic Chambers Data Logger with Humidity Sensors Hygrometer	Humidity	No climatical chamber but Humidity sensors fitted with data loggers are available	n/a	n/a	0.1 %	5 %	n/a
Stop Watch	Electrical frequency	10Hz-20GHz	0.010Hz	n/a	0.1 Hz	1 Hz	n/a
Thermometer Temperature sensors Ovens Climate chambers Sterilizer Thermocycler	Temperature	-40 to 1800 °C	Resistance ± 0.2 °C Thermocouples ± 0.8 °C	n/a	0.1 °C	2 °C	DakkS accredited laboratory

Instrument/Equipment at Pharma company.	Measurement	Offered calibration range (RSB)	Uncertainty Offered (RSB)	Accredited range and uncertainty (RSB)	Max. uncertainty to be provided by calibration laboratory (derived from tolerance)	Tolerance (as required by pharma industry)	Traceability
Dissolution tester Stirrer Homogenizer, Centrifuge	Revolution	n/a	n/a		1 revolution in 10 min	1 rpm	n/a
Working standards for balance calibration	Mass	Up to 20 kg (Class E ₂)	In line with OIML	n/a	E2	F1 – M2	DakkS accredited laboratory
Stop Watch	Time	n/a	n/a	n/a	0.1 s	1 s	n/a
Torque wrenches for Maintenance	Torque wrenches	n/a	n/a	n/a	1 %	10 %	n/a
Vernier calliper Micrometer screw gauge	Length	0 - 100 mm 0-100 mm	± 0.9µm 0.4 µm	n/a n/a	5 µm (Vernier caliper) 0.2 µm (Micrometer screw)	50 µm (Vernier caliper) 2µm (Micrometer screw)	DakkS Accredited laboratory
Compression machine Calibration punch load cell	Compression force	0-3MN	0-100kN 0.4%	n/a	0.5 %	5 %	DakkS accredited laboratory
Flow Meter. Water supply to system	Water flow	0.015-20 m ³ /h	0.04%	n/a	0.5 %	5 %	n/a
Anemometer A/C system	Air velocity		n/a		0.5 %	5 % or 0.2 m/s whatever is higher	n/a
Photostability sensors	UV light intensity		n/a		n/a	5 %	n/a
	Visible light	n/a	n/a	n/a	0.5 %	5 %	n/a

Instrument/Equipment at Pharma company.	Measurement	Offered calibration range (RSB)	Uncertainty Offered (RSB)	Accredited range and uncertainty (RSB)	Max. uncertainty to be provided by calibration laboratory (derived from tolerance)	Tolerance (as required by pharma industry)	Traceability
	intensity						
Particle Counter for environmental monitoring	Particle count		n/a		2 %	20 %	n/a
Digital manometer Filter integrity Tester	Pressure	Up to 100 Mpa	n/a	n/a	0.002 mbar 10 mbar	0.02 mbar (Magnehelic) 0.1 bar (standard pressure gauge)	n/a
Spirit level Dissolution testing, maintenance	Level (Spirit level)	n/a		n/a	0.01°	0.5°	n/a
Volume	Small volume Micro-pipette Tanks	10 µl-1000 µl 1 ml-1000 ml 1 l-200 l	0.5% 0.2% 0.05%				NMI mass laboratory

4.5 Kenya Bureau of Standards (KEBS)

Table 4.5. KEBS-Measurement Capabilities for Pharmaceutical Sector

Instrument/Equipment at Pharma company.	Measurement	Offered calibration range (KEBS)	Uncertainty Offered (KEBS)	Accredited range and uncertainty (KEBS)	Max. uncertainty to be provided by calibration laboratory (derived from tolerance)	Tolerance (as required by pharma industry)	Traceability
GC	Gas Flow		n/a		0.1 %	1 %	n/a
Climatic Chambers Data Logger with Humidity Sensors Hygrometer	Humidity	Up to 90 %RH	± 3 %	n/a	0.1 %	5 %	
Stop Watch	Electrical frequency	1 MHz - 10 MHz	± 4.1E-13Hz/Hz	n/a	0.1 Hz	1 Hz	BIPM
	Temperature	Up to 1300 °C	± 0.1 °C	-40 to 420 °C, uncertainties of 0.2 °C to 0.5 °C	0.1 °C	2 °C	NIST
Dissolution tester Stirrer Homogenizer, Centrifuge	Revolution	Up to 2000 rpm	50 - 500 rpm ± 0.2 1000 rpm ± 0.4 2000 rpm ± 1		1 revolution in 10 min	1 rpm	NMISA
Working standards for balance calibration	Mass	Up to 20 kg (Class E ₂)	In line with OIML	Up to 1 kg (Class E ₂)	E2	F1 - M1	UME-TUBATAK
Stop Watch	Time	1 s to 1h	± 0.6 s	n/a	0.1 s	1 s	
Torque wrenches for	Torque	1-2000 Nm	± 1 %	n/a	1 %	10 %	UME-

Instrument/Equipment at Pharma company.	Measurement	Offered calibration range (KEBS)	Uncertainty Offered (KEBS)	Accredited range and uncertainty (KEBS)	Max. uncertainty to be provided by calibration laboratory (derived from tolerance)	Tolerance (as required by pharma industry)	Traceability
Maintenance	wrenches						TUBATAK
Vernier calliper Wobble meter	Length	0.5 - 100 mm	$\pm 0.8 \mu\text{m}$	n/a	5 μm (Vernier caliper) 0.2 μm (Micrometer screw)	50 μm (Vernier caliper) 2 μm (Micrometer screw)	UME-TUBATAK
Compression machine Calibration Punch load cell	Compression force	2-50 kN (relevant range for pharm. Industry)	2-10 kN: $\pm 0.2 \%$ 2-50 kN: $\pm 0.1 \%$	Accredited	0.5 %	5 %	UME-TUBATAK
Flow Meter. Water supply to system	Water flow	5 l/h - 600000 l/h	$\pm 0.12 \%$	Accredited	0.5 %	5 %	KEBS-MASS, KEBS-T&F
Anemometer A/C system	Air velocity	n/a			0.5 %	5 % or 0.2 m/s whatever is higher	n/a
Photostability sensors	UV light intensity	n/a				5 %	n/a
	Visible light intensity	319 cd to 701 cd	$\pm 2 \%$	n/a	0.5 %	5 %	NMISA
Particle Counter for environmental monitoring	Particle count	n/a			2 %	20 %	n/a
Digital manometer Filter integrity Tester	Pressure	Up to 100 Mpa	$\pm 4.4 \text{ mbar}$	n/a	0.002 mbar 10 mbar	0.02 mbar (Magnehelic) 0.1 bar (standard pressure)	NIMSA

Instrument/Equipment at Pharma company.	Measurement	Offered calibration range (KEBS)	Uncertainty Offered (KEBS)	Accredited range and uncertainty (KEBS)	Max. uncertainty to be provided by calibration laboratory (derived from tolerance)	Tolerance (as required by pharma industry)	Traceability
						gauge)	
Spirit level Dissolution testing, maintenance	Level (Spirit level)	0.05° & 0.005°		n/a	0.01°	0.5°	KEBS length laboratory

NOTE: The KEBS industrial (length) laboratory has spirit levels used for level measurements which are internally calibrated by using laser interferometer for flatness. The flatness laser interferometer has traceability to UME TUBITAK (NMI-Turkey).