DEPARTMENT OF TRADE AND INDUSTRY

NO. 814 **08 JULY 2016**

NOTICE IN TERMS OF THE MEASUREMENT UNITS AND MEASUREMENT STANDARDS ACT OF 2006

(ACT NO. 18 OF 2006)

1. By virtue of the powers vested in me in terms of section 7 of the Measurement Units and Measurement Standards Act, 2006 (Act No. 18 of 2006), I, Dr Rob Davies, Minister of Trade and Industry, hereby –

(a) amend Government Notice No. 36486 of 31 May 2013 with the schedule of National Measurement Standards (NMS) as set out in the attached schedule, **with effect from the date of publication.**

Dr. Rob Davies, MP

Minister of Trade and Industry

Date: 9/5/16

SCHEDULE

NATIONAL MEASUREMENT STANDARDS

1 DIMENSIONAL

a) Length

Realised through the stabilisation on hyper-fine absorption lines of iodine, using a Helium-neon laser, No. 1008.

b) Angle

Realised through error separation using a Moore index table, No 8-1440-43, a polygon and a flatness interferometer, No. 6500-0593-01.

c) Form: Flatness

Realised by using a flatness interferometer, No. 6500-0593-01 and three optical flats to fulfil the definition of using a perfect flat geometrical element, for which the deviation away from the "perfect" geometric element is measured, traceable to the National Measurement Standard for length or angle.

d) Form: Roundness

Realised by using a high accurate roundness machine, No. K510/21 E-568 and a glass hemisphere to fulfil the definition of using a perfect round geometrical element, for which the deviation away from the "perfect" geometric element is measured, traceable to the National Measurement Standard for length or angle.

2 MASS

a) A cylinder of platinum-iridium, known as the national prototype, copy No. 56 of the International Prototype of the Kilogram.

3 TIME

a) South African Standard Time (SAST) is defined as Coordinated Universal Time plus two (2) hours (or UTC+02:00). A local prediction of UTC, known as UTC(ZA), is realised from one of the clocks mentioned in (b) below.

b) Frequency is realised from a group of atomic clocks:

i. Hewlett-Packard 5071A, No. 3608A01034;

ii. Agilent 5071A, No. US39301821;

iii. Symmetricom 5071A, No. US45382232;

iv. Symmetricom 5071A, No. US45382233; and

v. T4Science iMaser 3000, No. 101.

c) Electric phase angle is realised with a Clarke-Hess model 5500 phase standard, No. 217.

d) Pulse rise and fall time is realised with a Picosecond Pulse Labs pulse head, No. 171.

4 ELECTRICITY

a) Electric potential: A 10 V Josephson Voltage Standard, No. ME-106/5.

b) Electric resistance: A series of eight Leeds and Northrup Type 4210 1 Ω resistors, Nos. 681732, 681734, 681735, 755517, 1132427, 1146606, 1593469 and 1593473.

c) Electric capacitance: A series of capacitors:

i. Four Andeen Hagerling Type AH1100 capacitors with nominal values from 1 pF to 100 pF, Nos. 01284, 01285, 01286 and 01287;

ii. Four General Radio Type 1409 capacitors with nominal values from 1 nF to 1 μF, Nos. 18604, 27220, 27256 and 26977; and

iii. Two sets of Agilent Type 16380 capacitors each set containing four capacitors, with nominal values from 1 pF to 10 μF, Nos.1840J01793 and 2519J00893.

d) Electric inductance : A series of six type 1482 inductors with nominal values from 100 μH to 10 H, Nos.19399, 19604, 19515, 19723, 10916 and 19349.

e) Electric AC voltage: A series of PTB/IPHT AC to DC thermal converters and a Holt low voltage thermal converter:

i. MJTC 315, No. 9/2011;

ii. MJTC 228, No. 11-99-15;

iii. MJTC 310 with 400 Ω range resistor, Nos. 346-10 and 346-2;

iv. MJTC 312 with 900 Ω range resistor, No. 346-12;

v. MJTC 304 with 1,9 kΩ range resistor, No. 346-4;

vi. MJTC 305 with 2,9 kΩ range resistor, No. 346-5;

vii. MJTC 306 with 4,9 kΩ range resistor, No. 346-6;

viii. MJTC 308 with 10 kΩ range resistor, No. 346-8;

ix. MJTC 311 with 110 kΩ range resistor, No. 346-11; and

x. Holt 12 low voltage thermal converter, No. 0943500001458.

f) Electric AC current: A series of Fluke A40B current shunts with PTB/IPHT AC to DC thermal converters:

i. MJTC 313, No. 346-13;

ii. A40B-20mA and MJTC 314, Nos. 297269275 and 346-14;

iii. A40B-50mA and MJTC 307, Nos. 297269276 and 346-7;

iv. A40B-100mA and MJTC 313, Nos. 297269277 and 346-13;

v. A40B-200mA and MJTC 314, Nos. 297269278 and 346-14;

vi. A40B-500mA and MJTC 307, Nos. 297269279 and 346-7;

vii. A40B-1A and MJTC 313, Nos. 297269280 and 346-13;

viii. A40B-2A and MJTC 314, Nos. 297269281 and 346-14;

ix. A40B-5A and MJTC 307, Nos. 297269282 and 346-7;

x. A40B-10A and MJTC 313, Nos. 297269283 and 346-13; and

xi. A40B-20A and MJTC 314, Nos. 297269284 and 346-14.

g) Electric AC power: A Zera COM 3000 AC power comparator, No. 01-0018-04.

h) Radio-frequency power: A frequency and power range established by:

i. 50 Ω measuring head, No. 50/01;

ii. 50 Ω, 0 dBm power sensor HP 8485A, No. 2942A11856;

iii. 50 Ω, -30 dBm power sensor HP 8485D, No. 3318A02445;

iv. 75 Ω measuring head, No. 75/01;

v. 75 Ω power sensor, HP 8483A, No. 3318A07099;

vi. 50 Ω, 0 dBm power sensor R & S NRV-Z55, No. 839728/002;

vii. 50 Ω, 0 dBm power sensor Agilent 8487A, No. 3318A04344; and

viii. 50 Ω, -30 dBm power sensor Agilent 8487D, No. MY41090317.

i) Radio-frequency attenuation: Attenuator model WBCO 310, No. 103.

j) Radio-frequency impedance: A group of 50 Ω coaxial air-dielectric transmission lines:

i. Connector-type PC-7 mm, Nos. 00628 and 00639;

ii. Connector-type PC-3,5 mm, Nos. 00235 and 00551;

iii. Connector-type N-7 mm, Nos. 00696 and 00744;

iv. Connector-type K-2,92 mm, No. K–50 Ω; and

v. Connector-type PC-2,4 mm, Nos. 00968 and 00885.

5 TEMPERATURE

Reproducing the International Temperature Scale of 1990 (ITS-90) by utilising suitable interpolation and extrapolation instruments in conjunction with a measuring array consisting of:

a) Contact thermometry (–200 °C to 1085 °C):

i. Triple point cells of argon, No. TS-009;

ii. Triple point cells of mercury, No. TS-008;

iii. Triple point cells of water, No. TS-007;

iv. Melting point cells of gallium, Nos. TS-010 and TS-029;

v. Freezing point cells of tin, Nos. TS-006 and TS-018;

vi. Freezing point cells of zinc, Nos. TS-005 and TS-017;

vii. Freezing point cells of silver, Nos. TS-003 and TS-015; and

viii. Freezing point cells of gold and copper, Nos. TS-002 and TS-001.

b) Radiation thermometry (0 °C to 1600 °C):

ix. Model WB10 oil bath blackbody, No. TS-019, in conjunction with a suitable contact thermometer traceable to the contact thermometry measurement standards;

x. Model P550P blackbody furnace, No. TS-020, in conjunction with a suitable contact thermometer traceable to the contact thermometry measurement standards;

xi. Freezing point cell of silver, No. TS-013;

xii. Freezing point cell of copper, No. TS-115; and

xiii. Narrow band radiation thermometer, No. TS-160.

6 PRESSURE

a) Absolute Pressure:

i. A DHI Piston Cylinder Unit, Model PG7607, No. 359 and DHI Weight Stack, Model MS-7001-35, No. 2080; and

ii. A MKS Capacitance Diaphragm Gauge comprising: MKS Signal Conditioner, Model 270-5, No. 000206117 and MKS Measuring Head, Model 690A13TRA, No. 95263482A

b) Gauge Pressure:

i. A DHI Piston Cylinder Unit, Model PG7607, No. 359 and DHI Weight Stack, Model MS-7001-35, No. 2080.

7 SOUND PRESSURE IN AIR (ACOUSTICS)

a) Primary calibration of LS1P and LS2P microphones utilising the method as per IEC 61094-2 with microphones:

i. LS1P: Brüel & Kjær 4160, Nos. 1292308, 1389478, 2740789, 2036145 and 2036167; and

ii. LS2P: Brüel & Kjær 4180, Nos. 2049570, 1893477, 1886365, 2661008 and 2787487

8 RADIATION DOSIMETRY

a) Air kerma/ air kerma rate in radiation therapy:

i. X-rays (50 to 300) kV range: Ionisation chamber together with a suitable electrometer, Nos. RD-04; RD-05; RD-06 and RD-08; and

ii. Co-60: Ionisation chamber together with a suitable electrometer, Nos. RD-04 and RD-05.

b) Air kerma/ air kerma rate in Diagnostic radiology:

i. X-rays (25 to 50) kV range: Ionisation chamber together with a suitable electrometer, No. RD-11; and

ii. X-rays (40 to 150) kV range: Ionisation chamber together with a suitable electrometer, No. RD-12.

c) Air kerma/ air kerma rate in radiation protection:

i. Co-60, Cs-137 and Am-241: Ionisation chamber together with a suitable electrometer, Nos. RD-06 and RD-08; and

ii. X-rays (40 to 300) kV range: Ionisation chamber together with a suitable electrometer, Nos. RD-06 and RD-08.

d) Absorbed dose to water or absorbed dose rate to water, high-energy photons: Ionisation chamber together with a suitable electrometer, Nos. RD-04 and RD-05.

e) Absorbed dose to tissue or absorbed dose rate to tissue in Beta rays: set of beta sources, No. RD-03.

f) Particle emission rate: Set of extended area sources (100 x 150) mm, No. RD-02.

g) Reference air kerma rate: Re-entrant well-type ionisation chamber together with a suitable electrometer, No. RD-10.

9 FORCE AND TORQUE

a) A set of force transducers:

i. Above 5 kN up to 50 kN, No. 90596

ii. Above 20 kN up to 200 kN, No.113930115

iii. Above 30 kN up to 300 kN, No. 00281Q15

iv. Above 100 kN up to 1 MN, No. 82809; and

v. Above 500 kN up to 5 MN, No. 103430028

b) Mass Stack: Dead Weight Machine 50 kN, No. 40588.

c) Torque Rigs and weights:

i. 10 N m torque beam and Torque Rig and Weights, No. CRN TQ-0001;

ii. 1000 N m Torque Beam and Torque Rig and Weights, No. CRN TQ-0002; and

iii. Torque Angle Rig, No. CRN TQ-0007.

10 OPTICAL RADIATION

Radiation in the ultraviolet, visible and infrared regions:

a) Luminous intensity (cd): Absolute radiometer system, No. ORP-001.RA.

b) Luminous flux (lm): Goniophotometer system, No. ORP-004.GO.

c) Radiant power (W): Absolute radiometer systems, Nos. ORP-000.RA and ORP-002.RA.

d) Irradiance (W/m^2): Absolute radiometer systems, Nos. ORP-000.RA and ORP-002.RA.

e) Spectral response (A/W or V/W or W/W): Absolute radiometer systems, Nos. ORP-000.RA and ORP-002.RA.

f) Spectral irradiance ($(W.m^{-2})/nm$): Tungsten-bromide lamps, No. ORS-303.SR.

g) Reflectance (%):

i. Glossy ceramic tiles, No. ORP-014.SP; and

ii. Mat ceramic tiles, No. ORP-015.SP

h) Transmittance (%): Neutral density filters, No. ORP-016.SP.

11 HUMIDITY

a) Dew point (-75 °Cdp to +20 °Cdp):

i. Model S4000RS dew point hygrometer, No. HMS-100; and

ii. Model 373LX dew point hygrometer, No. HMS-110.

b) Relative humidity – suitable interpolation instruments in conjunction with:

i. Salt solution ampoules (5 %rh), No. HGS-505;

ii. Salt solution ampoules (10 %rh), No. HGS-510;

iii. Salt solution ampoules (11 %rh), No. HGS-511;

iv. Salt solution ampoules (20 %rh), No. HGS-520;

v. Salt solution ampoules (35 %rh), No. HGS-535;

vi. Salt solution ampoules (50 %rh), No. HGS-550;

vii. Salt solution ampoules (65 %rh), No. HGS-565;

viii. Salt solution ampoules (75 %rh), No. HGS-575;

ix. Salt solution ampoules (80 %rh), No. HGS-580; and

x. Salt solution ampoules (95 %rh), No. HGS-595.

12 FLOW

a) Volume Gas Flow Rate: A BIOS MET LAB Primary Flow Standard, Model ML-800 comprising:

i. Ultra-Low Flow Cell, Model ML-800-3, No. 128014; with Base Model ML-800-B, No. 1287894.

ii. Low Flow Cell, Model ML-800-10, No. 135209; with Base Model ML-800-B, No.1355134

iii. Medium Flow Cell, Model ML-800-24, No. 127325; with Base Model ML-800-B, No. 128789; and

iv. High Flow Cell, Model ML-800-44, No. 128098; with Base Model ML-800-B, No. 1355134.

13 AMOUNT OF SUBSTANCE

a) Gravimetrically prepared primary certified reference materials including primary gas reference mixtures and aqueous ethanol reference solutions as listed in the 'NMISA Chemistry and Materials Science Reference Materials and Reference Measurements Register'.

b) Referee analyses through methods of measurement having the highest metrological qualities, as listed in the 'NMISA Chemistry and Materials Science Reference Materials and Reference Measurements Register'.

c) Calibration services as listed in the 'NMISA Chemistry and Materials Science Reference Materials and Reference Measurements Register'.

14 RADIOACTIVITY STANDARDS

a) Radionuclide specific calibration factors used in a Vinten Instruments Radionuclide Assay Calibrator No. 88175, comprising a model 671 ionisation chamber (pressurised, re-entrant well type) attached to a Vinten ISOCAL 284 electrometer/display module. The reproducibility of the calibrator over time is checked against a certified radium standard.

b) For gamma-emitting radionuclides: A detection system to apply the absolute $4\pi\beta$-γ coincidence counting method using coincidence unit No. RS-019.

c) For pure-beta and pure-electron-capture radionuclides: A detection system to apply both the Triple-to-Double Coincidence Ratio (TDCR) and CIEMAT/NIST methods, using coincidence unit No. RS-029.

d) For iodine-125: A double sodium iodide (NaI) detection system.

15 VIBRATION

a) Acceleration: A homodyne laser-interferometer system with quadrature optical outputs based on a Melles Griot laser, type 05-STP-901, No. 21249, in compliance with ISO 16063-11 methods 1 and 3.

b) Acceleration: A heterodyne laser interferometer system with quadrature optical outputs based on a POLYTEC laser vibrometer head type OFV-505, No. 0100339, in compliance with ISO 16063 part 11, method 3.

c) Velocity and displacement: These are units derived from acceleration traceable to the national measurement standard for acceleration.

16 VISCOSITY

a) Kinematic Viscosity: A system consisting of a group of three Ubbelohde Capillary Viscometers (Nominal Viscometer Constant c = 0,002 mm^2s^{-2}); Nos. 37290, 37291 and 37292.