PROTOCOL FOR THE RMO SUPPLEMENTARY COMPARISON OF MASS STANDARDS COOMET.M.M-S6 (764/UA/18)
piloted by NSC IM, Ukraine (co-pilot VNIIM, Russia)

1. OUTLINE

This inter-laboratory comparison is based on the decision of the 23th Meeting of COOMET 1.6. This is a comparison for 20 kg stainless steel mass standard. During the comparison participants should determine the true mass of the weight and its uncertainty. NSC IM is a pilot laboratory. VNIIM is co-pilot. One stainless steel weight of 20 kg was provided by VNIIM to be used as a travelling standard in this comparison.

2. PURPOSE OF THIS DOCUMENT

The purpose of this document is:

- to define the organization of the comparison;
- to provide instructions for the participants for the transport and handling of the transfer standard;
- to explain the way of reporting results.

3. PARTICIPANTS

Four National Metrology Institutes will take part in this supplementary comparison. Among the participants three are COOMET members, and five are EURAMET members.The participating laboratories are listed in table 1.

Table 1. Participant laboratories of the comparison

National Institute of Metrology	**Acronym**	**Technical Contact**
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Georgian National Agency for Standards and Metrology N67 Chargali str. Tbilisi 0178 Georgia Tel/Fax: (+995 32) 2 61 35 00 Website: http://www.geostm.ge/ E-mail: geostm@economy.ge	GeoSTM	Irma Rurua-Mchedlidze **Email:** irmarurua@yahoo.com **Address:** WTO/TBT National Enquiry Point of Georgia N67 Chargali str. Tbilisi 0178 Georgia **phone**: +995599424888

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Service Metrologie – Metrologische dienst Koning Albert II laan, 16 1000 Brussel, Belgium tel: +3280012033	SMD	Mieke Coenegrachts (FOD Economie - SPF Economie) **Email:**Mieke.Coenegrachts@economie.fgov.be **Address: Koning Albert II laan 16** 1000 Brussel, Belgium **phone**:+3222779156
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4. TRAVELLING STANDARDS

The travelling standard for this comparison is a 20 kg weight, which is made in one piece of stainless steel, OIML-form. The travelling standard and transportation boxes are presented in the figure 1 - 3.

Fig.1

Fig.2

Fig.3

4.1 Characterization of the travelling standard

Values of volume, density and magnetic properties of the weight were measured at VNIIM before the starting of the comparison. The data of the travelling standard are listed in table 2.

Table 2. Data of the travelling standard

Identification	VNIIM
Nominal Value	20 kg
Density at 20	**7904.639 kg/m^3**
Standard uncertainty	**0.165 kg/m^3**
Volume at 20 .C	**2530.166 cm^3**
Standard uncertainty	**0.053 cm^3**
Magnetic susceptibility	**0.01536**
Magnetization	**0.39μT**
Surface roughness *Rz*	**0.75μm**
Surface roughness *Ra*	**0.085μm**
Height	**217 mm**
Diameter (head/bottom)	**113/127 mm**

At the beginning and at the end of the circulation, the mass of weight will be measured

at the pilot and co-pilot laboratories.

5. TRANSPORTATION OF THE TRAVELLING STANDARDS

For this comparison one weight will be circulated between participants. The circulation will bedone according to the schedule is presented in table 3.NSC IM will measure the mass of the standard at the beginning and at the end of the circulation in order to evaluate instability of the travelling standard.

Table 3. A timetable for the circulation of the travelling standard

NMI	Month of Arrival	Month of departure	Year
VNIIM		August	2021
NSC IM	September	October	
BelGIM	November	December	
IPQ	January	February	2022
GeoSTM	March	April	
NSC IM	May	June	
NIM	July	August	
BIM	1st part September	1st part of October	
ILNAS	2nd part of October	November	
SMU	1st part of December	January	2023
SMD	January	February	
DMDM	March	April	
VNIIM	May		

6. RECEIPT OF THE TRAVELLING STANDARD

Each laboratory is responsible for the organisation of the transportation to the next participant according to the circulation timetable, and for making proper arrangements for local customs formalities. The circulation of the traveling standard should be done by a Courier Company.Each participant will take care of the transportation of the travelling standard to the next participating laboratory according to the schedule is presented in table 3.

Each participating laboratory is responsible for its own costs for the transportation to the next participating laboratory and any custom charges within its own country.

Each participating laboratory shall have insurance for any damage or loss within its own country or during the travel to the next laboratory.

Each participantmust seal the transport box with a physical seal or an expandable sticker. Place for a physical seal is shown in the fig. 3 by red circle.

Before dispatching the package, the participating laboratory shall inform the pilot, giving transportation details. Each laboratory shall be informed of the incoming package at least one week in advance.

Any circumstances to which the standard is subjected during transit, which might affect the results of the comparison, shall be reported to the pilot laboratory at the earliest opportunity. The travelling standard shall be examined on receipt, and any scratches or other marks shallbe recorded in the “travelling standard visual inspection form” given in AnnexA. This formshould be sent by e-mail to the pilot laboratory within 24 hours after the inspection.

7. CLEANING

Cleaning of traveling mass standard should be only done by brushes or lint free tissue. If a participant finds that the seal is damage and/orthe surface of the weight has fingerprint or any other impurity traces, a participant should contact pilot and co-pilot laboratories during 24 hours after discovering of trace of intervention.

8. MEASUREMENTS

The standard should be manipulated with pincers or other appropriate tools. The mass standard should never be touched with bare hands. When not in the balance, the standards

should be stored at such a place where they are protected from dust, aerosols and vapor, for example on a plate covered with a clean bell jar.

Measurements should be done after an appropriate acclimatization time and according to ownweighing procedure and results should be reported on the forms annexed (Annex B).Before mass determination, dust particles should be removed from the surface of the standard by a soft brush.

The participating laboratories shall determine the mass of the travelling standard. For the buoyancy correction, the air density should be determined using the CIPM 2007 formula.

9. REPORTING RESULTS

The forms of Annex B (calibration results, Environmental data during calibration, characteristics of the balance and instruments used for the calibration, traceability and uncertainty budget) should be copied, filled in and returned to the pilot laboratory within two weeks after completing the measurements.

10. DISPATCH OF THE TRAVELLING STANDARD

After completion of the measurements the participant laboratory should pack the travelling standard and send it to the next laboratory according to timetable of table 3.
Within 24 hours after dispatch, the dispatching laboratory should inform the pilot laboratory by e-mail.

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11. ANNEXES

Annex A. Travelling standard visual inspection form

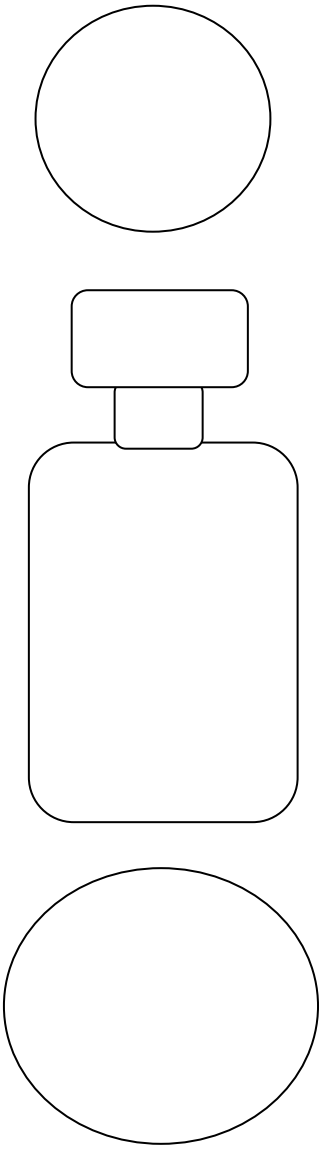
Annex B. Calibration results, Environmental data during calibration, characteristics of the balance and instruments used for the calibration, traceability and uncertainty budget

ANNEX A. TRAVELLING STANDARD VISUAL INSPECTION FORM

Laboratory		Date:	
Filled by:			

Record on the diagrams any mark on the travelling standards (scratches, contamination etc …), record pacing and travelling boxes conditions and send it the pilot laboratory.

TOP



BOTTOM

ANNEX B. CALIBRATION RESULTS, ENVIRONMENTAL DATA DURING CALIBRATION, CHARACTERISTICS OF THE BALANCE AND INSTRUMENTS USED FOR THE CALIBRATION, TRACEABILITY AND UNCERTAINTY BUDGET

Laboratory		Date:	
Filled by:			

Date of arrival of the travelling standard	
Date of departure of the travelling standard	

Date started of measurement	
Date finished of measurement	

Unusual environmental conditions experienced during transit or weighing :

(if appropriate)

CALIBRATION RESULTS

Measured mass

Nominal value	Mass	Standard-uncertainty	number of measurement	number of degrees of freedom
20 kg	20 kg + mg	mg		

Laboratory		Date:	
Filled by:			

CALIBRATION MEANS

Details of participant's mass standards used for the measurement including additional weights

Name of reference mass standard	Mass		Volume/density		Date of calibration Source of tracebility
	Value*	Standard uncertainty	Value	Standard uncertainty	

***** Please present in the form nominal mass (mg) + correction (mg)

Mass comparator used

Manufacturer	Type	Resolution	Standard deviation of repeatability/reproducibility of the result of one comparison process*	degrees of freedom

* Please indicate the weighing procedure and number of measurements

Enter details of the weighing scheme used (i.e. or)

Direct comparison ☐ Subdivision ☐

Please enter nominal value of reference weights here

Please enter a weighing scheme here

Laboratory		Date:	
Filled by:			

Ambient conditions during the measurements[1]

Parameter	Average value during measurements
air density (kg/m3)	
Temperature (°C)	
Pressure (kPa)	
H (%)	
CO_2 ($x10^{-6}$)	

Characteristics of the instruments formeasurement the environmental conditions

	Unit	Manufacturer	Type	Range	Resolution	Standard uncertainty *u*
Temperature*t*	ºC					
Barometric pressure*p*	Pa					
Relativehumidity *hr*,	%					
Mole fraction of CO2 (if appropriate)						

[1]Enter the average value for each parameter measured during the calibration process

Laboratory		Date:	
Filled by:			

UNCERTAINTY BUDGET

The uncertainty should be evaluated and combined following the GUM

Parameter	Standard uncertainty of component *u* / mg
Mass (correction) of the standard	
Stability of mass standard	
Compensation weight	
Stability of compensation weight	
Weighing reproducibility	
Position effect (automatic loading comparator)	
Comparator resolution	
Air density	
Travelling standard density	
Mass standard density	
Other….	
Combined standard uncertainty	
Degrees of freedom ν_{eff}	
Expanded uncertainty U (k =)	

Add lines as necessary.