

THE MINUTES

Of the 14th meeting of COOMET Technical Committee TC 1.10 “Thermometry and Thermal Physics”

**Institute of Metrology of Bosnia and Herzegovina (IMBIH)
8-9 November 2017, Sarajevo, Bosnia and Herzegovina**

1. Opening the meeting, welcoming, introduction of the participants, adoption of the agenda

The meeting was opened by the representative of the Institute of Metrology of Bosnia and Herzegovina Mr. Semir Cohodarevic, who welcomed the participants of the meeting and wished them a successful work.

Further word was handed on to the Chairperson of COOMET Technical Committee «Thermometry and Thermal Physics» (TC 1.10), Pokhodun Anatoliy Ivanovich.

A.I. Pokhodun welcomed TC members present at the meeting, the representatives of 10 countries: Bosnia and Herzegovina, Azerbaijan, Belarus, Georgia, Kazakhstan, Kyrgyzstan, Moldova, Russian Federation, Slovakia and Ukraine.

BOSNIA AND HERZEGOVINA

Mr. Cohodarevic S., IMBIH

Mrs. Hodzic N., IMBIH

Mr. Jandric N., IMBIH

AZERBAIJAN

Mr. Hasanov R.G., the State Metrology Service under the State Committee for Standardization, Metrology and Patent

BELARUS

Mr. Krivonos P.V., BelGIM

Mrs. Filitistovich E., BelGIM

Mr. Givoyno V.S., POINT Ltd.

GEORGIA

Mr. Chelidze Yu.V., Georgian National Agency for Standards and Metrology

Mrs. Kvichidze L., Georgian National Agency for Standards and Metrology

KAZAKHSTAN

Mrs. Duysebayeva K.K., KazInMetr, Almaty branch

Mrs. Nasibulina A. KazInMetr, Karaganda branch

KYRGYZSTAN

Mrs. Savina T.V., CSM under the KR ME

MOLDOVA

Mr. Bordianu K.I., NIM

RUSSIAN FEDERATION

Mr. Pokhodun A.I., VNIIM

Mr. Fuksov V.M., VNIIM

Mr. Razhba Ya.E, VNIIFTRI

Mr. Osadchiy S.M., VNIIFTRI

Mr. Petukhov A., VNIIFTRI

Mr. Vinge M.A., Eastern-Siberian Subsidiary of VNIIFTRI

SLOVAKIA

Mr. Duris S., Slovak Institute of Metrology

Mrs. Durisova S., Slovak Institute of Metrology

UKRAINE

Mrs. Sergiyenko R.P., NSC “Institute of Metrology”

The participants of the meeting approved the following agenda.

Agenda

- 1 State of works on redefinition of temperature unit on the base of Boltzmann constant
- 2 Presentation of the Project EURATHERMAL EMPIR 14RPT05
- 3 The activity of CCT in the organization of comparisons of national measurement standards for units of thermal physical quantities and the expansion of the measurement capabilities of NMIs in this field
- 4 About CCT activity in the field of the temperature measurements of environment
- 5 Discussion of the progress of works on COOMET Projects in the field of thermometry and thermal physics
 - 544/RU/11 “Regional comparison humidity standards of gases. Dew/frost point temperature -50 °C to +20 °C”
 - 593/RU/13 “Regional key comparisons of national measurement standards of temperature in the range from 0.01 °C to 660.323 °C”
 - 704/RU/16 „Comparisons of temperature national standards at the triple point of mercury”
 - 633/KG/14 Development of COOMET recommendations “Calibration of resistance thermometers by comparison method”
 - 642/MD/14 “Comparisons for measurements in the calibration of industrial platinum resistance thermometers”
- 6 New proposed Projects
- 7 Progress in the field of measurement of thermal physical quantities
- 8 State of the problem of increasing the measurement capabilities of metrology institutes of COOMET member countries
- 9 Miscellaneous
- 10 About the time and venue of the next COOMET TC 1.10 meeting

1. State of works on redefinition of temperature unit on the base of Boltzmann constant.

Reporters: Pokhodun A.I. (VNIIM), Osadchiy S.M. (VNIIFTRI).

Chairperson of TC 1.10 Pokhodun A.I. noted, that works on preparation for the transition to a new definition of the temperature unit in CCT have been generally completed. The leading NMIs carried out a large amount of research work to define the value of the Boltzmann constant using the methods of primary thermometry. For the redefinition of the temperature unit in terms of Boltzmann constant, the latter should be determined by two independent methods with the uncertainty of its assessment of better than 1 ppm. The best results of determining the Boltzmann constant were obtained by the acoustic thermometer and the thermometer that works on the basis of measurement of dielectric constant. It is

supposed that the use of primary thermometry methods will be more effective in the ranges below 20 K and above the point of solidification of silver. As for the rest of the range, a platinum resistance thermometer at present has no alternative with regard to ease of reproduction and accuracy achieved at this.

A new definition of a unit of temperature will stimulate the further development of primary methods and in prospect a unit of temperature throughout the temperature range will be reproduced by primary methods. The reporter noted that the CCT was preparing a document "100 words on the new definition of the Kelvin."

With the introduction of ITS-90, the methods for implementing, approximating and transmitting the temperature scale were set out in three documents, which are: Regulation on ITS-90, Supplementary information for ITS-90, Approximation methods for ITS-90 (Techniques for approximating the international temperature scale of 1990). In connection with the forthcoming redefinition of the temperature unit, a new document "Mise en Pratique" has been prepared in CCT, which has a broader focus, covering the provisions of the previous documents mentioned above, as well as information on the methods of primary thermometry. Within the development of "Mise en Pratique", extensive work has been carried out to revise the document "Supplementary information for ITS-90", a new version of which is available on the BIPM website. The reporter also announced that a revision of ITS-90 is planned.

The reporter summarized the principles of direct and indirect methods of reproducing a unit of temperature above the point of solidification of silver. The direct method is based on the use of an absolute cryogenic radiometer, an indirect method is based on the use of a metal-carbon eutectic as reference points. It was noted that an extensive research has been carried out on the reproducibility and definition of temperatures of the metal-carbon eutectic phase transitions, including those in the framework of international comparisons in this field. The results of this work are certain values of the melting temperatures of the eutectic and the established uncertainties for these temperatures.

Head of Laboratory VNIIFTRI Osadchiy S.M. presented a detailed report "Measurement of the universal gas constant R and the Boltzmann constant k_B on the apparatus of an acoustic gas thermometer by the sound velocity in helium." The report presented the results of the development and research of a facility for measuring the Boltzmann constant and the absolute measurement of thermodynamic temperature, as well as the results of measurements of the Boltzmann constant itself. The reporter also highlighted the results of VNIIFTRI's participation in the Ink2 Project in terms of determining the values $(T - T_{90})$, where T is the thermodynamic temperature measured by a gas acoustic thermometer.

Pokhodun A.I. presented the presentation "Redefinition of the Kelvin and the prospects for improving the National Primary measurement standards of the unit of temperature above $0\text{ }^{\circ}\text{C}$ ", dedicated to the work being carried out in the VNIIM to improve the metrological characteristics of the National primary measurement standard of the unit in the range from $0\text{ }^{\circ}\text{C}$ to $3200\text{ }^{\circ}\text{C}$ and the development of methods for reproducing the unit of temperature in the expected redefinition of this unit. Within the improvement of the National primary measurement standard 34-2007, the VNIIM is working to introduce both direct and indirect methods of reproducing the temperature unit.

Decision

To take note of information on the state of works on the redefinition of the temperature unit based on the Boltzmann constant.

2. Presentation of the project EURATHERMAL EMPIR 14RPT05

Reporter: Mr. Cohodarevic S., IMBIH

Mr. Semir Cohodarevic presented the presentation of the Project EMPIR 14RPT05 "Developing traceable capabilities in thermal metrology (EURATHERMAL)". The project coordinator is Jean-Remy Filtz (LNE, France). This Project provides support for NMIs in sharing scientific knowledge and experience in the development and use of innovative equipment and methods in the field of thermometry and thermophysics. The Project participants are NMIs of Hungary, the Czech Republic, Serbia, Croatia, Bosnia and Herzegovina, France, Slovenia, Ireland and Turkey. The Project has several directions, including, in particular, "Improving measurement capabilities for high temperature contact thermometry", "Improving and development references for radiation thermometry", "Improving traceability and capabilities for the measurement of thermal properties".

3. The activity of CCT in the organization of comparisons of national measurement standards for units of thermal physical quantities and the expansion of the measurement capabilities of NMIs in this field

Reporter: Pokhodun A.I. (VNIIM).

Head of CCT Task Group for Thermophysical Quantities (CCT-TG-ThQ) is currently Jean-Remy Filtz (LNE, France). As noted by the reporter, CCT has activated the work on organizing and performing comparisons in the field of thermophysical quantities, in particular, comparisons of measurement standards in the field of measurements of thermal expansion are outlined. There is also a preparatory work and a preliminary discussion of the possibilities of NMI participation in comparisons of measurement standards in the field of reproduction of the unit of calorific value.

4. About CCT activity in the field of the temperature measurements of environment

Reporter: Fuksov V.M. (VNIIM).

Fuksov V.M. highlighted the history of creation of the working group of CCT in the field of temperature measurement of environment (CCT Working Group for Environment, CCT-WG-Env). The activity of the working group is based on cooperation with the World Meteorological Organization (WMO). One of the first Projects in this cooperation was the EURAMET Project "MeteoMet - Metrology for Meteorology". The main components of CCT-WG-Env's activities are: identification of research directions and needs within the framework of thermometry for the environment (ground thermometry, upper atmosphere thermometry, marine thermometry, air and soil humidity, monitoring of permafrost and glaciers); ensuring interrelation with different organizations working in the field of ecology and environmental sciences; participation in the work of calibration laboratories, in particular, on the Everest and North Pole; information and dissemination of knowledge on thermometry for the environment through the organization of conferences and workshops. As the reporter noted, research related to long-term climate predictions is highly demanded, what, in turn, determines an increase in the accuracy of temperature measurements of both air and sea water.

5. Discussion of the progress of works on COOMET Projects in the field of thermometry and thermal physics

Reporter: Pokhodun A.I. (VNIIM).

Prior to the discussion of the progress of works on COOMET Projects in the field of thermometry and thermophysics, the Chairperson of TC 1.10 of COOMET presented a report on the activities of TC 1.10 for the period from 2014 to 2017. It was noted that the main activities of the Technical Committee for Thermometry and Thermophysics are: the organization of regional key comparisons, the presentation of CMC data of NMIs of

COOMET for the recognition of calibration and measurement capabilities, the development of recommendations in the field of temperature measurements, and peer review of CMCs. Peer review of CMCs to date has been mainly carried out by VNIIM specialists, in connection with which the reporter emphasized the need for active participation of other NMIs of COOMET in performing the works on peer review of CMCs in the field of thermometry and thermophysics.

704/RU/16 „Comparisons of temperature national standards at the triple point of mercury”

The participants of the comparisons are NMIs of Russia, Kazakhstan, Moldova, Georgia, Belarus, Slovakia. At the moment, the Technical Protocol has been prepared, the draft of which is presented by the pilot NMI to the participants of the meeting. Comparisons involve transportation of standard platinum resistance thermometers of the participant of the comparisons to coordinator. The scheme of comparisons includes sequential graduation of these thermometers at the triple point of mercury of the participant of comparison, at the triple point of mercury of coordinating laboratory at the triple point of mercury of the participant.

It is supposed that the final report should be prepared by December 1, 2018. Participants of the meeting discussed in detail the scheme and methodology for performing comparisons.

Decision

- 1. To take note of information on the state of works on Project 704/RU/16.***
- 2. The participants of the comparisons consider the draft of the Technical Protocol, send their comments and proposals to the coordinator by 28.02.2018.***

593/RU/13 “Regional key comparisons of national measurement standards of temperature in the range from 0.01 °C to 660.323 °C”

Reporter: Pokhodun A.I. (VNIIM).

Participants of the Project are NMIs of Russia (coordinator), Belarus, Kazakhstan, Ukraine and Georgia. The Project is registered on BIPM website as key comparisons COOMET.T-K3.3. The experimental part of the works is almost completed. The latest measurements are performed in NMIs in Georgia, which will be completed by the end of 2017. It is planned that the final report on the Project will be ready in the second half of 2018.

Decision

To take note of information on the state of works on Project 593/RU/13.

642/MD/14 “Comparisons for measurements in the calibration of industrial platinum resistance thermometers”

Reporter: Bordianu K.I., (NIM, Moldova, Pilot).

Participants of the comparisons are NMIs of Moldova, Kazakhstan, Kyrgyzstan, Azerbaijan, Georgia, Bosnia and Herzegovina, Turkey. The experimental part of the work as a whole is completed. The latest measurements are carried out in NMI of Kazakhstan. It is supposed that the report "A" will be formed by the end of 2017.

Decision

To take note of information on the state of works on Project 642/MD/14.

633/KG/14 Development of COOMET recommendations “Calibration of resistance thermometers by comparison method”

Reporter: Savina T.V. (CSM under the KR ME, Kyrgyzstan).

Coordinator of the project is NMI of Kyrgyzstan. COOMET Recommendations were developed in order to provide the uniformity of calibration of resistance thermometers by method of comparison in the thermostat. The Draft Recommendations were distributed by NMIs of COOMET in September 2017 for final approval. The Draft Recommendations were also discussed with specialists from Germany.

After discussing the state of works by the participants of the meeting, it was decided to adopt and approve the latest edition of the "Recommendations ..." with a view to their further submission to the COOMET Secretariat for the registration procedure in accordance with the Document "D4/2014. COOMET publications. Classification, the order of development, approval and registration. Basic provisions. "

Decision

To accept and approve "COOMET Recommendations" Calibration of resistance thermometers by direct comparison "with a view to their further submission to the COOMET Secretariat for the registration procedure as a COOMET document.

544/RU/11 “Regional comparison humidity standards of gases. Dew/frost point temperature -50 °C to +20 °C”

Reporter: Vinge M.A., (FSUE VNIIFTRI, Eastern-Siberian Subsidiary, coordinator of comparisons, Pilot).

At the moment the Project is not registered in the KCDB database. It is supposed that the Project participants will be NMIs of Ukraine, Belarus, Kazakhstan, Slovakia and Moldova. The role of the co-pilot laboratory was proposed by NMI of Kazakhstan. It is planned that the final version of the Technical Comparison Protocol will be distributed between the comparison participants at the end of 2017. The experimental part of the works will begin in early 2018 on the basis of a co-pilot laboratory. The reporter highlighted problems in choosing comparators to perform comparisons, as well as problems with equipment that arose in the co-pilot laboratory. In this regard, it was proposed to change the measurement range from minus 40 °C to +20 °C. This proposal was supported by the participants of the meeting.

Decision

1. To take note of information on the state of works on the Project 544/RU-a/11.

2. To recommend to the Project coordinator to take into account the suggestions of the comparison participants regarding the range change and to activate the works on forming the Technical Protocol.

6. Proposed new projects

Bordiyanu K.I. (Moldova) initiated the question of the prospects for performing comparisons in the field of contact thermometry in the range up to the point of solidification of silver.

Participants of the meeting were invited to continue the works on development of COOMET normative documents in the field of calibration of measuring instruments.

Representative of BelGIM Krivonos P.V. suggested to consider the possibility of organizing comparisons in the field of pyrometry.

Winge M.A. noted the applicability of performing regional comparisons in the field of measurements of relative humidity.

Decision

Interested NMIs during 2018 consider the possibility of participating in new Projects and send relevant information to the interested parties.

7. Progress in the field of measurement of thermophysical quantities

Reporter: Pokhodun A.I. (VNIIM).

This question has already been briefly discussed in item 3 of the agenda. As the reporter noted, most of the comparisons in TC 1.10 in the field of energy of combustion and thermal conductivity measurements were carried out at the level of the pilot, as under the guidance of CCT there were no similar key comparisons. The positive results obtained by NMI COOMET in pilot comparisons demonstrate the applicability of the organization of inter-regional key or supplementary comparisons within COOMET, the results of which would allow to confirm the equivalence of standards and/or to confirm the CMC entries claimed in this field.

Regarding the pilot inter-regional comparisons conducted in the field of thermal conductivity measurements, there was reached an agreement with the head of working group WG9 CCT about re-issuance of the materials of comparisons in the status of "supplementary" comparisons in order to support CMC entries of the participants of comparisons.

These additional comparisons are registered in the KCDB database. The results of the comparisons are published in the form of an article. At this time, the approval of the report "B" is in process.

The reporter noted the increased activity of the CCT in initiating comparisons in the field of thermophysical quantities. Regional and interregional comparisons are carried out in the field of measurements of thermal conductivity and emissivity. It is planned to carry out such comparisons as a comparison of measurement standards in the field of reproduction of units of thermal expansion and energy of combustion.

Decision

To take into account information on the state of works in the field of measurements of thermophysical quantities.

8. State of the problem of increasing the measurement capabilities of metrology institutes of COOMET member countries

Reporter: Pokhodun A.I.

At the moment, 18 CMCs lines of Ukraine have been published, 6 of which - on contactless thermometry, 6 lines of the Russian Federation in the field of humidity measurements and 4 CMCs of Kazakhstan in the field of contact thermometry.

As the reporter noted, after closing the COOMET Project 593/RU/13, the participants of comparisons will be able to increase their measurement capabilities in the temperature range up to the point of aluminum.

With regard to increasing the measurement capabilities in the field of thermophysical quantities, it is advisable to organize regional additional comparisons in this field with the involvement of NMIs from other regional organizations. In order to draw up CMCs data in the field of heat conductivity measurements, it is necessary to activate the works on the approval of the report "B", as noted in item 7 of the agenda.

The participants of the meeting were invited to analyze the status and prospects for the development of a standard measurement base in their NMIs in the field of measurements of thermophysical quantities so that this information could be sent to the Chairperson of TC 1.10 to summarize and plan further works on the organization of comparisons.

Decision

1. To take note of information about the state of measurement capabilities of metrological institutes of COOMET member countries.

2. To recommend the participants of the meeting to send information on the status and prospects for the development of the measurement standard base in their NMIs in the field of thermophysical measurements to the Chairperson of TC1.10 with a view to generalizing and planning the work.

9. Miscellaneous

Osadchiy S.M. initiated the issue of the implementation of open access to information on scientific and research and applied Projects, in particular EMPIR or similar, that are carried out under the guidance of EURAMET or other metrological organizations and in which the NMIs of COOMET could participate. In this regard, it was suggested to consider the possibility of placing such information materials on electronic resources of VNIIFTRI.

The participants of the meeting expressed their opinion on the prospects and feasibility of introducing the thermodynamic temperature scale into the daily metrological practice of implementing the primary methods. It was noted that, on the one hand, the transition to new definitions for a number of physical quantities leads to the consistency of the system of units of physical SI values and to uniformity of measurements. On the other hand, the reproduction of the scale by primary thermometers is extremely expensive, time-consuming and practically unprofitable. More expedient is the determination of the temperatures of the reference points by primary thermometers and the simplification of the methods for transferring the temperature scale.

For the participants of the meeting, an excursion was conducted on the measurement standard base of the Institute of Metrology of Bosnia and Herzegovina.

Decision

1. To take note of the presented information.

2. To recommend to consider the possibility of posting information materials about EMPIR projects or similar ones on electronic resources of VNIIFTRI.

10. About the time and venue of the next COOMET TC 1.10 meeting

The next meeting is planned to be held on the basis of NMIs of Georgia in the third quarter of 2018

Decision

To take note of information on time and venue of the next meeting of TC 1.10.