PROTOCOL

15th meeting of Technical Committee COOMET
TC 1.10 "Thermometry and Thermophysics"

National Agency for Standards and Metrology of Georgia (GEOSTM)
11 - 12 September 2018 , Tbilisi , Georgia

1. Opening of the meeting, greeting, introduction of the meeting participants, approval of the agenda

The meeting opened General Director of GEOSTM Davit Tkemaladze and Director of the Institute of Metrology, GEOSTM Nino Mikanadze, who addressed the meeting with a welcoming speech, and also presented the achieved results of the Institute of Metrology of Georgia.

Then the word was transferred to the Chairperson of the COOMET Technical Committee "Thermometry and Thermophysics" (TC 1.10) to Pokhodun Anatoly Ivanovich.

A.I. Pokhodun welcomed the TC members present at the meeting. The meeting was attended by representatives of 8 COOMET countries: Belarus, Georgia, Kazakhstan, Moldova, the Russian Federation, Slovakia , Uzbekistan and Ukraine , as well as invited experts from Turkmenistan.

BELARUS
Mr Kryvonos P .V. BelGIM
Mr Givojno V.S., Ltd. „POINT"

GEORGIA
Mr. Yu T- Chelidze, the National Agency for Standards and Metrology
Mr. L. Kvichidze, National Agency for Standards and Metrology
Mr. Tkemaladze D., National Agency for Standards and Metrology
Ms. N. Mikanadze, National Agency for Standards and Metrology

KAZAKHSTAN
Ms. Duysebaeva K.K. , KazInMetr , Almaty branch

MOLDOVA A
Mr. Bordianu K.I., NIM
Mr. Buzuk G., NIM

RUSSIAN FEDERATION
Mr. Pokhodun A .I ., VNIIM
Mr. Fuksov V.M., VNIIM
Mr. Konstantinov K.V., VNIIFTRI
Mr. Razhba I .E , VNIIFTRI
Mr. Osadchiy S.M., VNIIFTRI
Mr. Petukhov A., VNIIFTRI

SLOVAKIA
Mr. Djuris S., Slovak Institute of Metrology
Mrs. Dyurisova S., Slovak Institute of Metrology

UZBEKISTAN

Mr. Kudaykulov S., UzNIM

Mr. Zakhirov D. , UzNIM

UKRAINE

Mrs. Fil S.V. , NSC “Institute of Metrology”

The following agenda was adopted by the meeting participants .

Agenda

1 The state of work on redefining the temperature unit based on Boltzmann constant.
2 On the participation of the COOMET Chairman TC 1.10 in the work of the Technical Committee of EURAMET TKT.
3 Discussion of the progress of work on COOMET projects in the field of "Thermometry and Thermophysics" on the topic: 704 / RU / 16 "Regional key comparisons of national standards of the temperature unit at the triple point of mercury"
4 Discussion of the progress of work on the topic: 593 / RU / 13 “Regional key comparisons of national standards of a unit of temperature in the range from 0.01 ° C to 660.323 ° C”.
5 Discussion of progress on the topic: 642 / MD / 14 “Comparison of measurement results in the field of calibration of industrial platinum resistance thermometers”.
6 Discussion of the progress of work on the topic: 633 / KG / 14 “Development of COOMET Recommendations“ Calibration of resistance thermometers by direct comparison method ”
7 Discussion of the progress of work on the topic: 544 / RU-a / 11 “Regional comparisons of gas humidity standards. Dew/frost point temperature from minus 50 ° C to + 20 ° C. "
8 Discussion of the progress of work on the topic: 744 / RU / 18 “Comparisons in the field of measuring the heat of combustion of coal with different values of sulfur”.
9 On the development of a new verification scheme for temperature measuring instruments.
10 Improvement of the structure and expansion of the activities of the COOMET Technical Committee TC 1.10.
11 About new means of ensuring the uniformity of measurements of temperature and other thermophysical quantities produced by enterprises of COOMET member countries.
12 Miscellanea.
13 About the place and time of the next meeting of the COOMET Technical Committee TC 1.10.
14 Closing meeting

1. The state of work on redefining the temperature unit based on the Boltzmann constant.

Speaker: A. Pokhodun (VNIIM)

Chairman of the Technical Committee of TC 1.10 A. Pokhodun provided information on the EURAMET InK2 project. InK2 project aims to ensure that the new Kelvin was effectively implemented worldwide. The Chairman of the COOMET Technical Committee

TC 1.10 Pokhodun A.I. informed the participants of the COOMET rally TK1.10 that the Consultative Committee on Thermometry had completed preparations for the transition to a new definition of Kelvin. In particular, the following works have been completed:

- the new value of the Boltzmann constant was determined;
- Mise en Pratique document (MeP-K) was developed.

Mise en Pratique (MeP-K) contains all the necessary information for reproducing a temperature unit using acoustic thermometry methods and in the low temperature region and methods and apparatus for reproducing Kelvin by the direct method using an absolute radiometer, and also relative radiometry method in a high temperature.

It is expected that the new definition of Kelvin will be adopted at the General Conference on Weights and Measures, which will be held in November 2018.

It is assumed that one of the main areas of further activity of the Advisory Committee on Thermometry will be the creation of a new temperature scale, the so-called ITS-202X, which will be built on the basis of the improved ITS-90 and PLTS2000 scales. Work on the creation of a new scale is scheduled for completion in 2025.

Chairman of the Technical Committee of TC 1.10 A. Pokhodun drew the attention of the participants to a rally to the great attention of the organization EURAMET to the introduction of a new definition of Kelvin in the territory of the European Union. In the framework of EURAMET, a program, InK2, has been developed to address this issue.

In particular, project InK2 involves the following tasks:

- determine $T-T_{90}$ in the range from ~430 K to ~1358 K with an uncertainty of 5 mK based on the methods of gas acoustic thermometry and primary radiometry;
- determine $T-T_{90}$ in the range from ~5 K to ~200 K with an uncertainty of 0.5 mK using gas thermometry based on dielectric constant, refractive index thermometry and acoustic gas thermometry;
- establish new approaches to redefining T and $T-T_{90}$ and minimize the systematic components of uncertainty;
- carry out studies in the field of ultralow temperatures (0.9 mK - 1 mK) to determine the cause of the discrepancy of the PLTS2000 background data by measuring the difference $T-T_{2000}$ in the lowest part of the range and subsequently obtain an uncertainty of about 1%;
- implement project results in MeP-K-19.

The InK2 project is expected to contribute to obtaining reliable $T - T_{90}$ $T - T_{2000}$ values with low uncertainty. With the help of MeP-K-19, the redefined Kelvin will be actively introduced into national scientific institutes, accredited calibration laboratories, and further into a wider field: in the areas of trade, health, environmental research and science. Thus, any user who needs a reliable measurement of temperature or related quantities, such as humidity, or other thermophysical quantities, as well as any scientific research that requires a stable temperature, such as research in meteorology and climate change, will benefit from research.

Decision

Take note of the status and work on redefining the temperature unit based on the Boltzmann constant.

2. On the participation of the COOMET Chairman TC 1.10 in the work of the Technical Committee of EURAMET TKT.

Speaker: A. Pokhodun (VNIIM)

Chairman of the Technical Committee of TC 1.10 A. Pokhodun reported on the signing on April 12, 2018 of the Memorandum of Understanding between EURAMET and

COOMET. Such cooperation may involve the exchange of information, scientific research in metrology, joint publications, traceability of measurement results to SI units. In particular:

- a large number of national metrological institutes of the highest scientific level, which determine the current state of ensuring the uniformity of measurements in the world;
- the creation of long-term research programs aimed at solving fundamental and applied problems in the field of metrology;
- financing of EURAMET programs by the European Union; lack of problems of border and customs control.

From the above it can be concluded that the signing of the memorandum provides more opportunities for the organization of COOMET.

Chairman of the Technical Committee of TC 1.10 A. Pokhodun presented to the meeting the most topical issues that were presented at the last EURAMET TKT meeting, and also pointed out that at the last meeting of the EURAMET TKT working group, much attention was paid to measurements of thermal conductivity, emissivity of the melting temperature and heat flux up to 3000 °C.

3. Discussion of the progress of work on COOMET projects in the field of "Thermometry and Thermophysics"

1) Discussion of the progress of work on COOMET theme 704/ RU/16 “Regional key comparisons of national standards of the temperature unit at the triple point of mercury”.

Speaker: Osadchiy S. (VNIIFTRI).

Theme coordinator - VNIIFTRI, Russian Federation. The participants of the comparisons are: Belarus, Moldova, Kazakhstan, Georgia, Germany, Bosnia and Herzegovina, and Russia. Due to the fact that for many participants the standards are represented by the purchased equipment from Fluke Company, reference standards are considered to be the standards of own production of VNIIFTRI and PTB. At this stage, the comparison protocol is being agreed. In connection with the foregoing, the dates for comparisons were changed.

2) Discussion of the progress of work on COOMET theme 593/RU/13 “Regional key comparisons of national standards for temperature in the range from 0.01 ° C to 660.323 ° C”.

Speaker: A. Pokhodun (VNIIM)

Measurements are completed, I protocol has passed. At this stage, the final wording of the report has been sent to the working group on comparisons of the Consultative Committee on Thermometry. By the end of 2018 is expected to report a negotiation.

3) Discussion of progress on the topic. COOMET 642/MD/14 “Comparison of measurement results in the field of calibration of industrial platinum resistance thermometers”.

Speaker: Bordiyanu K. (NIM)

The topic of comparisons was changed and agreed to: “Calibration of industrial platinum resistance thermometers in thermostats”. The coordinator of comparisons is the National Institute of Moldova. 7 countries take part in comparisons: Moldova, Kyrgyzstan, Kazakhstan, Azerbaijan, Georgia, Bosnia and Herzegovina and Turkey. For comparisons,

standard platinum resistance thermometers of third rank were taken in range from minus 40 °C to 420 °C. The calculation was based on the recommendation of COOMET R/GM/19:2016. Measurements are performed. A final protocol has been drawn up which is being negotiated.

4) Discussion of the progress of work on COOMET theme 633/KG/14 "Development of COOMET Recommendations "Calibration of resistance thermometers using the direct comparison method "

Speaker: A. Pokhodun (VNIIM)

Works completed. The recommendations are published on the COOMET website in June 2018.

5) Discussion of the progress of work on COOMET theme 544/RU-a/11 "Regional comparisons of gas humidity standards. Dew/frost point temperature from -50 °C to +20 °C".

Speaker: Konstantinov K. (VNIIFTRI)

Theme coordinator is the East-Siberian branch of VNIIFTRI, Russia. Co-coordinator - Subsidiary "Ukrmetrteststandart", Ukraine. The purpose of comparisons is to determine the degree of equivalence between the participating national metrological institutes in the implementation of local scales of dew / frost temperature of a wet gas in the range from minus 50 °C to 20 °C. In the comparisons two comparators of different types are used.

The protocol is formed. Participation confirmed: Ukraine, Moldova, Belarus, Kazakhstan. Due to the fact that the equipment for comparisons has large dimensions, at the meeting of the working group of TC 1.10 a representative of the East-Siberian branch of VNIIFTRI Konstantinov Konstantin was asked to replace the "co-pilot" of comparisons with Kazakhstan, for the reason that Kazakhstan is in a better position geographical position, which is more convenient for the transport of goods.

The estimated date of commencement of measurements is determined - Quarter I, 2019.

6) Discussion of the progress of work on COOMET theme 744/RU/18 "Comparisons in the field of measuring the heat of combustion of coal with different values of sulfur".

Speaker: A. Pokhodun (VNIIM)

In the world, great attention was paid to the standards of thermal units, in particular, calorimetry. The initiator of the new comparisons was VNIIM. As a result of consultations with the group on thermal measurements, new comparisons were proposed in the field of measuring the heat of combustion of coal with different values of sulfur. The desire to participate was expressed by the institutions of the following countries: Germany, Turkey, Belarus, Romania.

At the moment, the topic of comparisons is registered with COOMET. In July 2018, consent was obtained for the participation of the Scientific Institute of China. VNIIM, as a pilot laboratory, carried out a selection of three coal samples with different sulfur values, among which a transit sample was selected, which has the most stable heat of combustion. A procedure for conducting comparisons has been developed and the preparation of a technical protocol has begun.

Decision

To consider the information on the status and works of COOMET topics.

4. On the development of a new verification scheme for temperature measuring instruments.

Speaker: A. Pokhodun (VNIIM)

Currently, it is planned to develop a new interstate standard, which will be a complete structural unit size straightedge transmission scheme from the standards to the working means of the measuring equipment. New scheme should consider the introduction of a new definition of Kelvin and the emergence of new means of measuring temperature and their calibration. Based on the new standard, each country will be able, based on its list of instruments and the state of the reference base, to create its own verification scheme, which ideologically will look the same, and the implementation will be different.

Decision

There was unanimous support for the feasibility of developing a verification scheme as an interstate standard

5. Improvement of the structure and expansion of the activities of the COOMET TC 1.10 technical committee.

There was a discussion about the possible directions of the COOMET TC 1.10 technical committee activities. The meeting participants worked out a joint decision on the creation within TC 1.10 of a working group in the field of humidity measurement, as well as a group on COOMET development strategy TK1.10.

Decision

To create within the framework of TC 1.10 a working group in the field of humidity measurement.

To create a working group on strategy for the development of COOMET TC 1.10 activities.

6. About new means of ensuring the uniformity of measurements of temperature and other thermophysical quantities produced by enterprises of the COOMET member countries.

Speakers: V. Givojno (Point), Osadchiy S. (VNIIFTRI).

The representative of POINT LLC (Belarus) reported on the established production of standard platinum thermometers of 1, 2 and 3 rank in the range from minus 180 °C to 660 °C.

The representative of VNIIFTRI reported on the development and production of low-temperature coal thermometers, which are calibrated from 4 K.

7. Miscellanea

Speakers: Osadchiy S. (VNIIFTRI), Fuksov V. (VNIIM)

Representative of VNIIFTRI Osadchiy S. presented the report on "Stabilization of the temperature of the resonator acoustic gas thermometry thermometer and expansion opportunities based on platinum resistance thermometer." The report discusses the temperature stabilization system of the resonator of an acoustic gas thermometer, in which a dual-circuit stabilization system is selected. In the VNIIFTRI, an AK-10 thermal controller was developed - a universal instrument for measuring the resistance of thermometers and the voltage of thermocouples, as well as for supplying electrical power to heaters. The result of work carried out in about VNIIFTRI is derived from the temperature of the transmission error of the resonator calibrated thermometers was 0.43 million^{-1}.

The representative of VNIIM Fuksov V. presented to the participants a report on the topic: “Works carried out within the framework of the direction “Photonics in Thermometry”. Fuksov V. reported that a working group on new technologies, CCT-TG-CTh-ET, was set up in the Consultative Committee on Thermometry. The report outlined the areas of technology in which CCT-TG- CTh-ET are developing. In particular:

- these are developments in optomechanical thermometry in the field of primary thermometry;
- Optical thermometry of the refractive index;
- thermometry based on nanoelectronics.

In thermometry with traceability to ITS-90:

- optical thermometry, resonators, photon thermometry.

Currently, the most developed areas are: work with ring resonators, with Bragg grating sensors, silicon hybrid and optomechanical methods. Separate attention is deserved by dew point sensors based on ring resonators, the sensitivity of which is 40 pm/K, the repeatability is 5 mK, and the total uncertainty of measuring the dew point is about 0.1 K.

8. About the place and time of the next meeting of the COOMET Technical Committee TC 1.10.

Representative from the East-Siberian branch of VNIIFTRI Konstantinov K. proposed to hold the next session in July-August 2019 in the city of Irkutsk (Russia) based on the East-Siberian branch of VNIIFTRI.

Decision

To support the proposal to hold the next meeting of the COOMET Technical Committee TC 1.10 in Irkutsk.

9. Closing session

Chairperson of TC 1.10 COOMET “Thermometry and Thermophysics” prof. A Pokhodun. thanked the participants of the meeting for their active work and the organizers for the high level of preparation and holding of the meeting.

Chairperson of TC 1.10 A.I. Pokhodun

Secretary TC 1.10 S.V. Fil