

**The minutes
of COOMET technical committee session
TC 1.10 “Thermometry and Thermal Physics”**

**BelGIM
Minsk, Belarus, on September 24, 2008**

1. The session opening, the program adoption, the session participants presentation

The session was opened by Vice President of COOMET, Director of BelGIM, Dr. Nikolay Adamovich Zhagora, which had a greeting speech for all participants of the meeting and informed all TC members with the activity of BelGIM.

After it the speech was continued by Chairman of Technical Committee of COOMET “Thermometry and Thermal Physics” (TC 1.10), by Deputy Director FGUP “VNIIM named after D.I. Mendeleev”, by Professor Pokhodun Anatoliy Ivanovich, Russia.

A.I. Pokhodun greeted TC members, which participated in the meeting. The representatives of 4 countries took part in the meeting: Belarus (BelGIM), Russia (VNIIM), Azerbaijan (Azstandart), Moldova (NISM).

AZERBAIJAN

Mr. Garalov Mavlud Nasreddin ogly, Chief of sector of State verification of thermal and technical, thermal and physical measuring instruments.

BELARUS

Mr. Zhagora Nikolay Adamovich, doctor of technical sciences, Director of BelGIM, Vice President of COOMET

Mrs. Kolomiets Tatyana Andreevna, Deputy Director of BelGIM.

Mr. Martynov Nikolay Evgenyevich, Chief of production and research department of measurements of thermal and technical quantities of BelGIM.

Mrs. Dikun Tamara Iosifowna, Deputy Chief of production and research and research department of measurements of thermal and technical quantities of BelGIM.

Mr. Kozlov Pavel Vladimirovich, engineer of the 1st category of production and research department of measurements of thermal and technical quantities of BelGIM.

Mrs. Lyahova Nadezhda Dmitrievna, Head of sector of scientific and research department of legal and theoretical metrology of BelGIM, Secretariat of Belarus in COOMET.

MOLDOVA

Mr. Bordiyan Konstantin, Chief of laboratory of measurements of thermal quantities of National institute of standardization and metrology.

RUSSIA

Mr. Pokhodun Anatoliy Ivanovich, Doctor of technical sciences, prof., Deputy Director, Chief of department of thermodynamics of All-Russian scientific and research institute of metrology named after D.I. Mendeleev.

2. Report of Chairman of TC 1.10

Chairman of TC 1.10 “Thermometry and thermal physics” prof. A.I. Pokhodun presented to the participants of the meeting the report about activity of Technical Committee (Annex 1). The following aspects are described in the report:

- General characteristic of cooperation in the field of thermometry and thermal physics on projects № 285/RU-a/07, № 228/UA-a/01, № 376/RU-a/06, № 417/UA-a/08;
- The results of the meeting of TC 1.10 2007;
- Review of finished projects;
- Interaction between international and regional organizations;
- Works on participation in realization of international agreements.

Resolution:

To take into account the report of Chairman of TC 1.10.

3. Information about activity of Consultative Committee on thermometry in the field of new determination of temperature unit and improvement of international temperature scale

Chairman of TC 1.10 “Thermometry and thermal physics” Prof. A.I. Pokhodun presented to the participants of the meeting information about activity of Consultative Committee on thermometry (CCT). The following questions were discussed:

Perspectives of development of temperature scale:

- new determination of temperature unit;
- improvement of international temperature scale and methods of its practical realization;
- using primary thermometer for direct measurements of thermo dynamical temperatures;

New determination of Kelvin

Many years International committee on measures and weighs had a long-term task of determining all basic units through fundamental physical constants to exclude the dependence of properties of any artifacts or materials and to provide a long-term stability of units.

In Recommendation № 1 from 2005, BIPM approved the preparation of the steps in the direction of new determination of Kilogram, Ampere, and Kelvin and Moth through fundamental physical constants.

The unit of temperature K, Kelvin, can be determined through unit of energy of SI system, joule, fixing the quantity of Boltzmann constant k , which is constant of proportionality between temperature and thermal energy.

In 2005 Working group TG-SI was formed in CCT, its aim is evaluation of consequence of introduction of new Kelvin determination.

Working group TG-SI has already presented its results to International committee on thermometry and Consultative committee on units for their discussing.

Working group TG-SI summarizing all results of research, which are connected with the possible new determination of Kelvin, recommends redetermination of this unit through the fixed mean of Boltzmann.

Arguments for new determination of Kelvin:

Change summarizes the determination, making it independent from material substance, technical realization, and also temperature or temperature range. It means, new determination will improve temperature measurements in the range, which differs very much from triple point of water.

The advantage is not only in metrology, but also in science, what is connected with precise mean of Boltzmann constant k , where error of measurement of thermo dynamical temperature will not be reasonable.

New determination of Kelvin through Boltzmann constant doesn't demand change of ITS - 90 by more modern temperature scale, but doesn't prevent such change. In long-term perspective it will give the opportunity to improve temperature scale regarding the decreasing the uncertainty and expanding temperature ranges without expensive costs and inconveniences, which occurred during changes of previous scales.

Proposals on possible formulations of new Kelvin determination:

Kelvin – change of thermo dynamical temperature, what occurs the change of thermal energy kT by $1,380\ 65 \times 10^{-23}$ joule.

Kelvin - change of thermo dynamical temperature, what occurs the change of thermal energy kT by $1,380\ 65 \times 10^{-23}$ joule, where k - Boltzmann constant.

Kelvin – thermo dynamical temperature, where average translational kinetic energy of atoms in ideal gas in balance is $(3/2) \times 1,380\ 65 \times 10^{-23}$ joule.

Kelvin – is a such unit of thermo dynamical temperature, where Boltzmann constant is equal to the mean $1,380\ 65 \times 10^{-23}$ joule/kelvin.

Status of ITS - 90

It is expected, that the change of Kelvin determination will not result in reasonable change of ITS-90 status. However, ITS-90 will not continue to be the one basis for temperature measurement.

The most useful consequence of change of Kelvin determination will have place in temperature ranges lower than 20K and more than 1300 K, where primary thermometers can provide lower thermo dynamical uncertainty, as it is available for ITS.

However, ITS-90 will be used in future as high-precise, well reproducible and convenient approximation to thermo dynamical temperature scale.

Long-term consequence of new determination is that new thermometers will be widely used and will replace ITS-90, because primary thermometers are improved and have lower error.

In future the most part of measurements, conducted in the needed range of temperatures from minus 200 up to 900C will be conducted with the help of standard platinum thermometers of resistance calibrated according to ITS-90.

MISE EN PRATIQUE

To help the users to make precise measurements of temperature, CIPM, through its Consultative Committee on thermometry and BIPM, will publish a document, which contains basic recommendations for temperature measurements. It will be the document very similar to the document “Additional information to International temperature scale 1990”, also published by BIPM.

This document will have the name *MISE EN PRATIQUE (MeP)* and will contain a description of agreed primary methods of measurement of thermo dynamical temperature or scale realization, and also agreed methods of approximation to thermo dynamical temperature scale, including ITS -90 WNTS and sources of uncertainty, typical for these measurements.

MeP will be regularly improved, because primary methods of temperature measurements will be developed.

Resolution:

To take into account the report about activity of CCT.

4. Information about developed international standards in the field of metrological assurance of temperature measurements

Project GOST 8.558 “State verification scheme for means of temperature measurements”

Chairman of TC 1.10 Prof A.I. Pokhodun presented the project of international standard GOST 8.558 “State verification scheme for means of temperature measurements”. During consideration of this standard the participants noticed, that it is developed for standard base of Russia.

Resolution:

To take into account information about development of standard project.

Project of international standard “Thermometers of resistance from platinum, copper and nickel. General technical demands and methods of testing”

Chairman of TC 1.10 Dr. A.I. Pokhodun informed the meeting participants about the process of development of standard project “Thermometers of resistance from platinum, copper and nickel. General technical demands and methods of testing”. There are no remarks or proposals concerning this project. Resolution about approval of this standard as international standard should be approved by International council on standardization, metrology and certification.

Resolution

To take into account information about development of standard project.

Project of international standard “Thermometers of resistance from platinum, copper and nickel. Methods of verification”

Chairman of TC 1.10 Prof. A.I. Pokhodun informed the participants of the meeting about the process of development of standard project “Thermometers of resistance from platinum, copper and nickel. Methods of verification” (instead of GOST 8.461-82). There are no remarks and proposals concerning this standard. Resolution about approval of this standard as international standard should be approved by International council on standardization, metrology and certification.

Specialists of BelGIM proposed to leave the standard GOST 8.461-82 “Thermoelements of resistance. Methods and means of verification” with the aim of further application during verification of thermometers of resistance, which were produced before according to GOST 6651 and which are exploited, and standard “Thermometers of resistance from platinum, copper and nickel. Methods of verification” to give new registration number and to apply it for newly developed thermometers of resistance.

Resolution:

To take into account information about development of project of the standard.

To recommend the chairman of TC 1.10 Prof. A.I. Pokhodun to send a letter to the address of NTKMetr with proposal about leaving as acting international standard GOST 8.461-82 “Thermometers of resistance. Methods and means of verification.”

5. Discussing the process of works on COOMET projects in the field “thermometry and thermal physics”

Project № 285/RU-a/03 “Regional comparisons of national standards of temperature unit in the range of temperatures from triple point of water till the freezing temperature of zinc”

Within the project № 285/ru-A/03 were completed regional comparisons of national standards of temperature unit in the range from 0C till the point of zinc freezing. According to the results report was prepared, which was agreed with participants of comparisons (VNIIM, Slovak metrological institute, BelGIM, NSC “Institute of metrology”). It was noticed, that NSC “Institute of metrology” couldn’t take part in the second part of comparisons. That is why it was made a decision about organization of analogue additional comparisons in 2008.

The agreed report on project 285/RU-a/03 was sent to the consultative committee on thermometry for expertise and approval of the results of comparisons. In May 2008 the 25th meeting of CCT took place, where report about conducting comparisons was presented. Report was considered and approved by two working groups of CCT-WG7 and WG8. On the base of their expertise the results of comparisons were published in the database of BIPM. As a result there was determined the degree of equivalence of national standards of temperature units of Belarus and Slovakia. On the base of evaluation of equivalence of national standard of temperature unit review of measurement capabilities of BelGIM can be started

Resolution:

To recommend the coordinator of the project Prof. A.I. Pokhodun to prepare the formulation of final report on project COOMET 285/RU-a/03 and to send it to COOMET Secretariat by December 1, 2008 for further distribution by Secretariat of information about completing the COOMET project to COOMET member-countries.

Project № 310/UA-a/04 “Conducting comparisons of standards of specific heat ”

Participants of the project № 310/UA-a/04 are NSC “Institute of metrology” (Ukraine) and Ural scientific and research institute of metrology FGUP “UNIIM” (Russia).

Within this project the works are completed in December, 2007 and report on the results of comparisons is prepared. Discussion of report was conducted by participants of comparisons and by Chairman of TC 1.10. Taking into account that fact, that in this kind of measurements there are no results of key comparisons, organized by Consultative Committee on thermometry, it is also decided to consider project 310/UA-a/04 as completed with change of its status from “Additional comparisons” to “Pilot comparisons”.

Resolution:

To ask COOMET Secretariat to change the status of project 310/UA-a/04 from “Additional comparisons” for “Pilot comparisons”.

To recommend coordinator of the project V.P. Slipushenko to prepare a form of final report on COOMET project 310/UA-a/04 and to send it to COOMET Secretariat by December 30, 2008 for further distribution by Secretariat of information about completing the COOMET project to COOMET member-countries.

To recommend the participants to publish the results.

Project № 228/UA-a/01 “Comparison of standards of combustion energy on the base of benzoic acid”

Since the moment of opening the project participants of the project were VNIIM (Russia) and NSC “Institute of metrology” (Ukraine).

In this kind of measurements key comparisons of Consultative Committee on thermometry weren’t conducted. In this connection it is better to change the status of project from “Additional comparisons” to “Pilot comparisons”.

Within project 228/UA-a/01 technical protocol was developed and measurements with the use of samples of benzoic acid, presented by VNIIM, at national standards of energy unit of combustion of Russia and Ukraine.

During the meeting of working group on thermal physics WG9 and CCT in May 2008 in Paris there was considered a proposal in Paris there was considered a proposal about participation of China as a third participant of comparisons. Samples of benzoic acid made in China for Ukraine and Russia are delivered to specialists of VNIIM. Now there are conducted the works on coordination of technical protocol of comparisons with three participants – Russia, Ukraine and China. In connection with the above mentioned in metrological institutes of Ukraine and Russia it is necessary to plan the works on research and conducting measurements with the use of samples of benzoic acid of China, Russia and Ukraine.

Resolution:

To ask COOMET Secretariat to change the status of project 228/UA-a/01 with “Additional comparisons” to “Pilot comparisons”.

Taking into account that fact, that in China modernization of primary standard of energy unit of combustion is completed, and in Russia analogue works are conducted today, to recommend NSC “Institute of metrology” to conduct modernization of State primary standard of energy unit of combustion with change izoperibolic calorimeter to the waterproof one.

Project № 387/UA-a/07 “Regional comparison of national standards of temperature in fixed points of silver, gold and copper freezing”

Within project 387/UA/07 “comparison of national standards of temperature in fixed points of silver, gold and copper freezing” it is supposed to conduct regional key comparisons of national standards of Ukraine, Slovakia and Russia with the aim of support by these comparisons of measurement capabilities of NSC “Institute of metrology” and Slovak metrological institute in the field of radiation thermometry. Project is coordinated and registered in BIPM. Protocol of comparisons is developed and discussed.

Resolution:

To recommend to continue the works on project COOMET 387/UA-a/07.

Project № 417/UA-a/08 “Additional regional comparisons of national standards of temperature unit in fixed points of melting-point of gallium, freezing of tin and zinc”

For support of measurement capabilities, declared by NSC “Institute of metrology”, in 2008 new topic 417/UA-a/08 was begun “Additional comparisons of national standards of temperature unit in the range from 0C to freezing point of zinc”. Project is coordinated and registered in BIPM. Works on project are already in progress. Specialists of NSC “Institute of metrology” have got standard thermometer, graduated in VNIIM named after D.I.Mendeleev.

Resolution:

To recommend to continue the works on COOMET project № 417/UA-a/08.

Project № 395/BY-a/07 “Regional comparisons of national standards of temperature unit in triple of water”

In 2007 activities on COOMET project 395/BY-a/07 “Regional comparisons of ampoules of triple point of water of national standards of temperature unit” are begun. Coordinator of works is BelGIM. Participants of comparisons – Belarus, Russia, Ukraine, Slovakia, Kazakhstan, Moldova.

Today this project is coordinated with all participants and is registered in BIPM. Protocol of comparisons is coordinated.

Participants of the meeting discussed perspectives of project realization.

Resolution:

To recommend to continue the works on COOMET project 395/BY-a/08/

6. About preparation of the next conference on temperature measurements “Temperature 2010”

Chairman of TC 1.10 Prof. A.I. Pokhodun informed participants of the meeting about that fact, that conduction of the conference “Temperature 2010” is planned for autumn 2010, place of conducting – Saint-Petersburg, Russia.

Resolution:

To take into account information about conduction of the conference.

To invite interested specialists from member-countries to take part in the work of conference.

7. Further cooperation in the field of temperature measurements and thermalphysic quantities.

Participants of the meeting stated, that the first main tasks of the work of technical committee for 2009 is conduction of comparisons within COOMET projects 387/UA-a/07, 417/UA-a/08 and 395/BY-a/07, and also preparation of CMC-data of interested COOMET countries, intraregional and interregional expertise of CMC-data, including completing the procedure of interregional expertise of CMC-data of BelGIM.

8. Time and place of the next meeting of TC 1.10

Participants of the meeting discussed the possible place of conducting the next meeting of technical committee and had a wish to conduct it in Moldova or Kharkov.

Resolution:

To recommend NSC “Institute of metrology” (Ukraine) to consider the possibility of the next conducting the meeting of TC 1.10 “Thermometry and thermalphysics” in 2009 in Kharkov.