REPORT

Workshop on Weights

Borås, Sweden (13–15 October 1999)

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The Swedish National Laboratory for Mass, under the Swedish National Testing and Research Institute (SP) and in cooperation with the NIST Secretariat of OIML TC 9/SC 3*, the TC 9 Nordic Task Group and the BIML, held a workshop to disseminate information on the 1st Committee Draft of R 111 *Weights of classes E_1, E_2, F_1, F_2, M_1, M_2 and M_3* to specialists from national standards laboratories. The objective was to ascertain the effectiveness, value and proper functioning of the *Test procedures and test report format* in this 1st CD of R 111, which involves the accuracy classification of weights.

The workshop took place at SP over three days, 13–15 October 1999, and included 35 participants from 19 different countries.

Lectures

On Wednesday morning, Håkan Nilsson (SP Project Leader of Metrology) welcomed participants to SP and made opening remarks.

Ian Dunmill (BIML Assistant Director) presented an overview of the OIML; he addressed what legal metrology is, its impact on society, governmental roles in legal metrology, the International Conference and Committee, Presidential Council, role of the BIML, TC's/SC's, Development Council and certification - including an update on the number of certificates issued to date.

Håkan Källgren (SP) provided a background to the Nordic Task Group, its developments and contributions to the revision of R 111, and explained how the workshop would be arranged. Debbie Ripley, on behalf of the Secretariat, gave a presentation on the Secretariat's plans for the revision of R 111, and a projected time schedule for finalizing the Recommendation.

Dr. Peter Lau (SP) spoke on density determination: his presentation centered on the methods conventionally used for measuring the density of artifacts. In addition, he described a newly developed method suitable for larger weights whereby a weight is inserted into a container of known volume, and the container is then filled with a well-defined amount of water.

An overview of mass calibration was presented by Dr. Lars Nielsen (Dansk Institut for Fundamental Metrologi, DFM, Denmark). He addressed the equilibrium equation of the balance, the calibration of a test weight by direct comparison with a reference weight, the difference between true mass and conventional mass, weighing schemes for the elimination of drift, and the use of check standards.

On Thursday, Dr. Michael Gläser (PTB) spoke about uncertainty calculations in mass calibrations including the terminology, the reporting of the results of a measurement and conventional mass as used in R 111.

Dr. Leslie Pendrill (SP) addressed magnetic measurements in mass calibrations. His presentation included topics on the sources of magnetic fields such as the mass comparator and the mass standard, the magnetic quantities and the magnetism requirements of R 111.

Mr. Ulf Jacobsson (SP) gave the final presentation on Friday: he addressed inverted subdivision, or the multiplication of the kilogram. This is a method used by SP, PTB and others where the weighing design consists of ten sets of a double substitution weighing using seven ABBA series in each set. One advantage of this method is that it offers greater confidence in the results due to increased redundancy of the procedure.

Exercises

The participants were divided into four groups, which visited four laboratories to determine calibration parameters and perform tests in magnetism, density and surface roughness on various sets of weights according

* *TC 9: "Instruments for measuring mass and density". TC 9/SC 3: "Weights"*

to the requirements of the 1st CD of R 111. Each laboratory exercise was conducted and guided by an assigned Leader from SP.

During the exercises, the groups listened to additional presentations. In the surface roughness exercise, Lars Sandin and Lisbeth Neugebauer (SP) and Debbie Ripley gave an overview of how to complete the application form and the checklists, and how to determine the surface roughness of a specimen using various tools available. Dr. Daniel Lindqvist gave a presentation on his work in surface roughness covering profiling techniques versus light scattering techniques. In addition, participants were able to observe a stylus profiling system used at SP.

In the magnetism section, Dr. Leslie Pendrill and Esten Koren (Norwegian Metrology and Accreditation Service) and Jan-Erik Thor (SP) gave an overview of how to determine the magnetic properties of a specimen, citing the advantages and disadvantages of the various methods, as well as the potential dangers of magnetizing a specimen.

The density exercise was led by Dr. Peter Lau, Jukka IsoPahkala and Dan Waltersson, all of SP. This exercise gave an overview of the methodologies and tools available, what the preferred methods were as well as which would give the most accurate results. The participants were able to break up into smaller groups to test out or observe each of the six different methods cited in the 1st CD of R 111.

Dr. Lars Nielsen and Karsten Simonsen (DFM) and Joel Vogler and Fredrik Langmead (SP) conducted the calibration exercises. Participants were given an overview of how to proceed with the calibration and verification of a specimen, perform the uncertainty calculations and complete the test forms.

On Thursday evening, all participants and SP staff visited Torpa Stenhus, a very old castle, for a guided tour and lecture on the history of Sweden during the middle ages. Then two invited speakers gave talks: Dr. Masaaki Ueki (NRLM, Japan) presented a method for determining the density of a weight using an acoustic volumeter, and Mr. Jan Björkman (LKAB, Sweden) spoke about problems encountered when weighing in heavy industry. These were followed by an OIML sponsored traditional Swedish dinner.

After completion of the laboratory sessions on Friday, there was a discussion on the workshop and the 1st CD of R 111. The respective Leaders presented the results of all the laboratory exercises, including comments from the participants on the test procedures, test forms, and any general comments on the exercises.

Conclusions

The workshop was an opportunity to test out the procedures and the test report format before publication of R 111 and comments and questions raised by the participants on how to verify the quality of weights were important contributions to the ongoing effort in revising this Recommendation.

Both the USA Secretariat and the Nordic Task Group received very useful comments and constructive criticism of the 1st CD of R 111. Many of the test procedures continue to need further clarification as well as the addition, deletion and clarification of certain text within the document.

All the participants agreed that the draft should be divided up into modules according to accuracy class requirements. Several of the countries represented at the workshop still use hexagonal weights; it was their opinion (and that of some other participants) that the hexagonal weight sections be removed from R 111 but retained as a separate OIML Recommendation.

Discussions also included the necessity for more or less theoretical text on uncertainty and magnetism sections and there was a suggestion that the theoretical portions could be published in an International Document. ■