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A NEW METHODOLOGY FOR HARMONIZATION IN THE DISSEMINATION OF THE TORQUE QUANTITY IN BRAZIL

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Abstract: The purpose of this paper is to show the needs and to propose a new methodology for a better dissemination of torque quantity in Brazil. Starting traceability from the Force, Torque and Hardness Laboratory (LAFOR) in the National Institute of Metrology, Standardization and Industrial Quality (INMETRO), an improvement to the Primary Torque Standard was necessary. In the same way, the acquisition of new transfer and reference standards, together with the development and adoption of new methods for torque calibration systems characterization, are important for a better acting of Inmetro's Accreditation and Laboratorial Proficiency Testing Division (DICLA) [1]. In the methodology for that dissemination and harmonization, this proceeding lists what are important points to be on focus.

Keywords: Proficiency testing, torque standardization, torque traceability.

1. INTRODUCTION

It's a duty and aim of Inmetro to be such a national reference in metrology, guarding and providing the dissemination of reference and transference standards in Brazil.

The increasing level of industrialisation in Brazil demands an improvement in the National Torque Standard of Inmetro regarding the reduction of uncertainty and a better traceability. In order to reach an immediate implementation and to be in line with the budget, the decision was made to acquire a hand operated dead-weight-TSM with the possibility of a subsequent automation. The target relative uncertainty was fixed to $1 \cdot 10^{-4}$ ($k=2$) [2].

Together with a higher confiability in realizing torque in Inmetro, comes the necessity of an adaptation for the methods used for characterization of calibration systems and also for national torque calibration guides and standards, which have now some huge technical base for new revisions. It means that, together with new equipments, come not only new technologies, but also new knowledge and better understanding for the torque unit and systems applications.

Many spots in the industry, like mechanical, naval, autos, and health, are getting their specific way to use and develop torque instruments and applications. Just as an example of that, diagram in figure 1 can show, in terms of metrology, how torque was understood till nowadays and also, what directions the calibration methodologies adopt during time, just as a reaction for that quantity development in practical utilities.

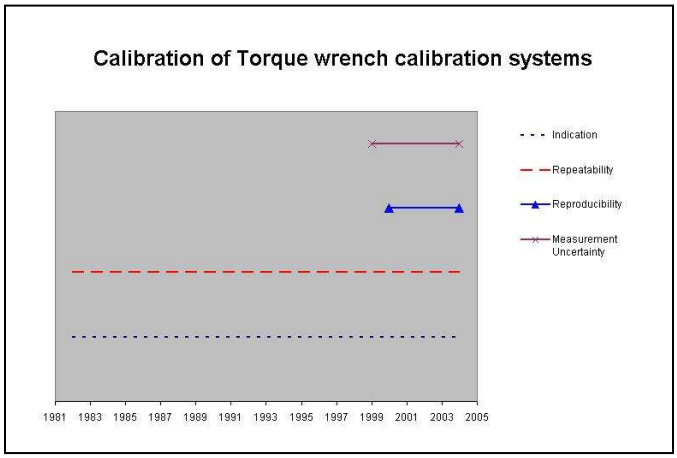

Fig. 1. Main parameters used in calibration of torque wrench calibrators in Brazil

This paper presents, in a general view, what should be considered, and also named, a *new methodology for harmonization in the dissemination of the torque quantity in Brazil* with purpose to give a validation of torque dissemination in Brazil and the different laboratories capabilities evaluation. It also brings to torque accredited laboratories sector a new point of view in accomplishing and reproducing the quantity, making systems to be better understood and services to be done in a more expansive way, what will attend to a growing demand in this area.

2. METHODS

As a first step, a bibliography research is done with the purpose of getting acquirements of what are the latest technologies applied in torque measuring and standardization systems used in other NMI's and metrology laboratories, in Brazil and in other countries, including ranges and best measurement capabilities for each system found.

Turning the focus to the national field, Inmetro's Accreditation and Laboratorial Proficiency Testing Division (DICLA) provided information about the accredited and in accreditation procedure laboratories, (total of 16 laboratories) in what refers to the kind of service, which instruments are calibrated, in what ranges and best measurement capabilities values. Also some review of how many calibrations these laboratories have done since accredited (figure 2). Those information are very important to project the increasing of the quantity in the country and also trace what should be the best position to be taken by Inmetro to attend the demand for service and also provide necessary technical information.

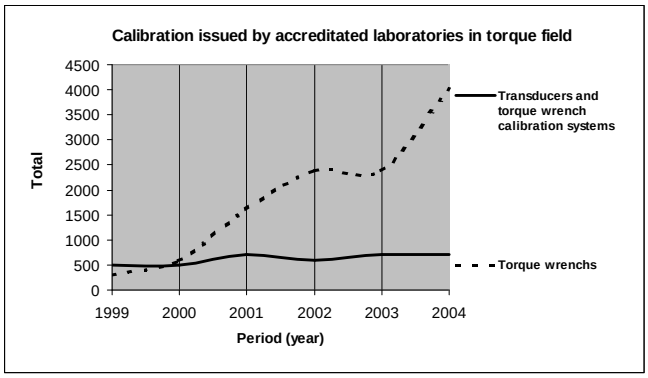

Fig. 2. Calibration certificates issued by accredited laboratories in torque field (DICLA)

With an analysis of these information and getting in contact with the laboratories, there are found some specific and different ways to work with torque quantity. These suitable differences come mainly from the interpretation and application of guides and standards, but also from the proceedings for the best measurement capabilities calculation.

After this first research made, together with the practice of Lafor`s crew during the torque laboratory implementation, characterization of the new primary standard machine and participation at the first CIPM Key Comparison in the field of torque (CCM.T-K1), Inmetro will meet those laboratories and propose a new methodology for harmonization in the dissemination of torque quantity. Although it is not presented in details here, that mainly includes:

- Meetings with the accredited laboratories to arrange details for new actions;
- Discussion about the necessity of new guides and revision of the national standards currently used in torque calibration. For example, ISO 6789 is international and will need a final portuguese version;
- Definition of basic concepts and better calculation methods of the best measurement capabilities (BMC) for the various systems;
- Proposal for a national intercomparison (ILC) program in torque calibration (torque wrench and transducer);

From those points, we can highlight the discussion for labs BMC evaluation methods and the realization of the ILC.

Relating to BMC evaluation, it is necessary not only calibrations using good and stable reference transducers to minimize its influence in the system, but also a sequence of tests that can put in detail all behavior of the calibration system during operation. If that is not done in its complete form, the BMC values can bring some doubts about its validation if in a very low value. For that, technicians of LAFOR can develop tests procedure and calculation templates to be inserted, and also accomplish those tests together with the labs' crew if necessary. At this point, all participants must be aware about the importance of these studies for the whole comprehension of these concepts around the unit, what will be done in the first meetings with presentation and discussion around technical publications and experiments made. As an example, figure 3 shows some ranges of BMC's declared by accredited laboratories.

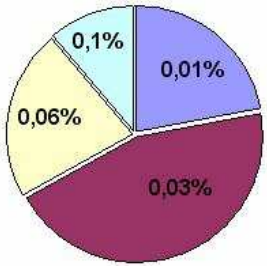

Fig. 3. BMC's declared by accredited labs for calibration of torque transducers

Another point of study for these BMC's evaluation is the type of system used, where there are manual machines using masses and a lever supported (normal bearing), lever multiplication or secondary systems [1]. So, the ILC can only happen if those values for BMC's are well declared, presented and validate for DICLA analysis.

After that, a particular proceeding for the comparison must be done according to ranges, types of services and reference standards machines, used by the participant labs. In torque wrench calibration for example, instruments used for the comparison will need different ranges, types and classes (acc. to ISO 6789), so all different situations on calibrations can be observed. The same is necessary in torque transducer comparison (acc. to NBR 12240) where Inmetro's reference and transfer torque transducers should be used.

3. CONCLUSION

The analysis and researches made will propitiate a better quality in the implementation of new proceedings used in accredited laboratories and a better understanding with the technical-scientific community which works with torque metrology. A harmonization of the national field with the international torque methodologies and tendencies is also expected as an improvement in Scientific Metrology in Brazil.

It is important to emphasize that an ILC never took place in Brazil before, and that can bring knowledge and improvement to all institutions involved.

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