

DEVELOPMENT AND MANUFACTURE OF CHARPY STANDARDS TEST SPECIMENS FOR XVIII IMEKO WORLD CONGRESS

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Abstract: The main purpose of this presentation is to show the development of standard test specimens to be used in indirect calibration of Pendulum-Type Impact Testing Machines, performed by the Mechanical Metrology Laboratory–LMM-IPT and the Force Laboratory – LAFOR-INMETRO. LMM-IPT is an accredited laboratory, in force, by RBC, the Brazilian Accreditation Net. INMETRO is the reference metrological institute in Brazil.

Keywords: standard test specimen, impact testing machine, Charpy.

1 INTRODUCTION

In the last revision of the ISO 148:1998-2 standard, the indirect calibration of impact testing machines was included, in order to measure the total energy absorbed in fracturing test specimens[1]. To perform that, certified standard testing specimens are needed. So, IPT and INMETRO in partnership, took the initiative to take the job for developing, manufacturing and certificate these specimens, in order to capacitate our country for more one certified reference material.

2 PURPOSE

The main purpose of this project is to establish the methodology for certify standard test specimens to be used in indirect calibration of Pendulum-Type Impact Testing Machines. The methodology is fundamentally the same used by the four institutions in the world[2] which have the standards specimens available. Research of raw material, thermal treatment, characteristics as uniformity and hardness, selection, manufacture of determined number of specimens from a same batch, testing of another determined number of them in two impact testing machines specified as in the international standard, statistical analysis of the results and, if proper, extend the mean value to the rest of the batch, followed by the uncertainty of the results.

3 METHOD

Two machines of different manufacturers were bought and installed one in INMETRO and other in IPT. The machine installed in INMETRO was manufactured by Tinius Olsen, nominal range 406J and IPT's machine was manufactured by Instron, nominal range 350J. Both have digital display.

Ipt's machine was installed on a steel badge which dimensions are nearly (1300x1000x130)mm and 1380 kg weight, in order to eliminate eventual external vibrations, see fig. 1



Fig. 1. Instron Impact testing machine DI-300

INMETRO's machine was installed on two steel badges with 2230kg total weight. After the installation, the machines once well leveled, were calibrated in accordance to ISO 148.

The indirect calibration were performed using two sets of reference specimens, one certified by NIST and other certified by IRMM, in three energy levels. Meanwhile, an interlaboratory comparison for dimensional measurements in testing specimens was been done, as well as the manufacture of the specimens, which were machined by milling, broaching and grinding. In every part of the project we have a partnership of the Laboratory of Mechanical Testing of USIMINAS, a big brazilian siderurgy. This laboratory is also accredited by RBC in force, and has a large experience in metallic materials. The next step is to prepare a pilot batch of 300 specimens from which 50 will be tested, 25 in the machine installed in INMETRO and 25 in the machine installed in IPT. It is foreseen repeating this last step, many times as necessary, in order to obtain very consistent results.

4 RESULTS

As dimensional measurements interlaboratorial comparison is concerned, the critical parameters on the V-notch were emphasized, that is: the angle of notch, the radius curvature at base of notch and the height below the notch. The measurements were performed in different types of measuring machines. At a first moment, some divergences in angle measurement happened, but an adjustment made in IPT's profile measuring machine left out the problem. Also a procedure to establish which part of the radius curvature has to be taken into account to figure out the radius value had been developed. In the first process machining of test specimens, some problems occur, as a mill was assembled in a machine center causing an axial run out error on the mill. Further other kinds of machining like broaching and grinding were tested in order to achieve the best way to obtain test specimens with lower dimensional errors and better surface finish. The heating caused by machining is a very important aspect and must be avoided. Related to the materials used in the two batches, two steel laminated plates, one of ASTM A36 and other of ATIX65 were used. The plates were deliverable by Usiminas. The expected absorbed energy is about 93J and 167J, respectively. As the project is still going on, we have not at now expressive numerical results to show but surely until next September we will have it.

5 DISCUSSION

In Brazil, the request for calibration of Pendulum-Type Impact Testing Machines, is nearly 50 per year. The ISO standard establishes the verification of, at least two energy levels in the indirect calibration, for each machine's range. By our observation, 90% of the machines in Brazil have only one range. Once five standards test specimens of the same value should be used for each energy level, one can estimate, therefore, the need of nearly 600 standards test specimens per year.

6 CONCLUSION

This is a very important project once it creates a competence in Brazil to produce and certificate standards test specimens. Besides this work is still beginning we know we have a very hard job to do in order to implement the method with confidence. It will allow us to participate in the next International Comparison of Impact Verification Program[3]. In addition, this project will allow to put in the capability to INMETRO certificate standards test specimens in C Appendix of mutual recognition of BIPM. Another important fact reinforces and fill up our goal: a new project recently approved but already going on, will permit more effectiveness the research of metallic material to be use in manufacturing of standard test specimens. In this next step more one weighty partner joint us, Pontificia Universidade Católica do Rio de Janeiro - PUC, over Usiminas which now in this new project, is a very important formal partner.

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