INFORMATION

NONDESTRUCTIVE METHODS OF THE QUALITY CONTROL OF MATERIALS AND PRODUCTS IN THE NATIONAL STANDARDS OF DIFFERENT COUNTRIES

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Russia can become technologically independent only to the extent that Russian standards in machinery-manufacturing technology reflect the requirements of international standards. Standards on nondestructive methods of quality control are the normative basis for product certification in metallurgy, the chemicals, machine-building, and power industries, and other industrial sectors.

At the beginning of this year, the Russian Scientific-Technical Welding Association (RSTWA), with the participation of the International Scientific-Educational Center of the "Spektr" Scientific-Industrial Association, the "NIIkhimmash" company, and the VNIIOFI of Russian Gosstandart, held a scientific-technical seminar that involved a comparative analysis of the methods currently used in Russia, the U.S., Germany, England, and France to regulate the quality control of metallurgical products and products used in machine construction.

Presentations were given by leading experts on the development of scientific principles and practical methods of nondestructive inspection (NI) -- experts who have had a direct hand in developing NI standards and implementing them in various sectors of industry within the former USSR and the former members of the CMEA (Council for Mutual Economic Aid).

V. V. Chernykh, chairman of the organizing committee for the seminar and Director of the RSTWA, made it clear in his opening remarks that the goal of the association is to create the most favorable conditions for the activities of plants, organizations, and individual specialists in the field of welding in Russia to develop products and technologies that are scientifically sound and are commercially attractive both here and abroad.

V. Ya. Kershenbaum, general director of the "Science and Technology" Center, noted that the realm of quality standards is a relatively conservative domain and that despite the real achievements of domestic experts in elaborating physical principles and devising instruments, methods, and standards for NI, these findings have not been widely disseminated outside of Russia. Helping to amend this situation will be the publication of a special three-volume set reporting on this research. The books will also be the first step in the creation of a technical "esperanto." The present lack of a common technical language in the given field might in fact be another factor slowing the integration of domestic machine-building into the world market. From this viewpoint, the seminar was another step toward having Russian research in nondestructive testing objectively reflected in the system of international standards.

I. Sivert (NIST, U.S.) reported that the Fifth Commission of the International Institute of Welding (IIW) is working on the development of new internal standards and the revision of existing standards by generalizing results obtained in different countries after determining the main directions of research. One such direction is the radiographic inspection of welds (this entails the classification of systems of x-ray films, radioscopic inspection systems, and instruments), ultrasonic inspection of welds (which pertains especially to the methodology and instrumentation for the ultrasonic inspection of austenite welds), electrical, magnetic, and optical methods of weld inspection, welding defects and their relative importance, inspection of welded structures on the open sea, and elaboration of the overall concept of the quality control of welds in order to clearly determine the relationship between existing ISO standards and proposed new standards.
N. V. Khimchenko (of the All-Union Scientific Research and Design Institute for Chemical Engineering) gave a presentation on the requirements of GOST 14782 and the ASME codes in the U.S. (Articles 4 and 5 of Part V) on the ultrasonic inspection of welds. Khimchenko noted that despite the differences in these standards, they are founded on the same premises. Khimchenko also compared Russian, U.S., English, and German standards on the ultrasonic inspection of flat-rolled products and pointed out the advantages of the Russian standards: wider range of application in terms of the regulated thicknesses and methods of inspection used; a classification of methods of ultrasonic inspection and their characteristics that is based on physical principles; the existence of quantitative and qualitative criteria for the methods used to assign and adjust sensitivity for the entire range of manual and automatic ultrasonic methods presently employed to inspect rolled products; the existence of substantiated and exhaustive requirements on the control specimens. Khimchenko also noted that foreign standards also have several advantages, noting that the latter are of a more specific nature.

E. F. Kretov gave a comparative analysis of Russian and German requirements for the ultrasonic inspection of welds and hard-facings on process vessels and pipes. The inherent advantages of both sets of standards were mentioned. Kretov also analyzed standard E-797 (U.S.) and the standard Russian method, PNAN G-7-031, for ultrasonic thickness measurement. It was shown that, on the whole, the Russian methodology is more logical and more detailed in its construction and that the titles of the standard’s different subdivisions are an accurate reflection of their contents. The same cannot always be said of the U.S. standard. At the same time, the U.S. standard has important advantages. For example, the methods are applicable within a broader range of temperatures. Also, recommendations are given on the measurement of thickness at elevated temperatures.

As regards the requirements of Russian, U.S., and German standards on the ultrasonic inspection of metal products, it was noted that the ASME norms for flat-rolled products use the diameter of a circumscribed circle to characterize the parameters of the tolerable discontinuities in the product, while GOST 22727 uses area for the same purpose. The former is more convenient. However, the U.S. standards for forgings are fundamentally flawed, since they specify values of sensitivity and ranges of application that vary through the thickness of the specimen and are related to the parameters of the piezoelectric transducer. Foreign standards allow the presence of discontinuities of a certain length, while no discontinuities are generally permitted in domestic norms. As regards welds and anti-corrosion hard-facings, Kretov noted that the Russian standards on such hard-facings have an advantage due to their prohibition of long discontinuities.

I. N. Ermolov compared the requirements for the ultrasonic inspection of castings and forgings in the standards of Russia (GOST 24507), the U.S. (ASTM A-388-80), Germany (No. 1921, promulgated in 1980), and France (CSFF No. 5-76). With respect to the volume of inspection done under these standards, the Russian and U.S. standards are the most complete. At the same time, the approach used in the American and French standards causes sensitivity to be highly nonuniform through the thickness of the forging. As shown by an analysis of the requirements on the ultrasonic inspection of pipes in the standards of Russia (GOST 17410), the U.S. (SE-213, the analog ASTM E-213-83 and SB-51 and the analog ASTM B-513-77), and France (No. 1918), only the GOST provides for the nondestructive testing of pipes with a wall thickness of 10 mm or more to find laminations.

The comparison showed that domestic standards are closer to the European system. The main difference between the American and Russian systems is the use of lamellar artificial internal defects to evaluate levels of radiographic sensitivity. One feature of the standards of the U.S., Germany, France, and other countries is the possibility of replacing the radiographic method by any other (x-ray imaging, radiometric) nondestructive radiation-based method that is at least as equal to radiography in terms of sensitivity and reliability.

F. R. Sosnin analyzed the U.S. standards (ASTM E 1000-92 and E 1255-92) in comparison to the Russian GOST 20426 and GOST 27401 and the system of industry standards in Russia. The American standards just referred to are highly developed and very systematic but are not well understood by Russian specialists.

In the report by V. A. Bobrov, presenting a comparative analysis of the requirements for the magnetic particle method of inspection in the standards GOST 21105, DIN 54130 and DIN 54131 (Germany), MUS-1201 (Japan), and the ASME (U.S.), it was shown that there are no significant differences between these norms. However, there are some distinctions to be made. For example, the classification of magnetization methods by GOST 21105 is more systematic and convenient for the user than the ASME standard; the ASME standard details the inspection process and methodology, essentially reducing the role of the operator to a level that makes the test nearly automatic; the ASME code recommends that the test be done by the method of continuous magnetization (to achieve greater sensitivity) and that the moist method of identification be used (in this case, the magnetization should be done with a certain overlap in time between the delivery of the current and application of the suspension); the format of the record of the test results recommended by the ASME is more convenient in practice from