

NORMATIVE – METHODOLOGICAL MAINTENANCE OF QUALITY OF WELDED DESIGNS

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The report contains the basic lacks of the modern documentation regulating carrying out of nondestructive testing and technical diagnostics.

Welding, as well as any production, assumes some deviations from requirements technical norms. Requirements to various products can differ strongly enough. But generally quality of welded connection can be estimated on following indicators: durability, plasticity, structure of metal of a seam and weld-affected zone, discontinuity contamination and others. If deviations on these parameters fall outside the limits of established admissions - it is a defect which should be eliminated. Thus, welded connections are considered as qualitative if their properties meet the requirements shown to them according to service conditions of welded knot or a design. If defect elimination is impossible, the product cannot be accepted to use.

Quality management is important part of industrial process. The exact finding and identification of defects underlies safe and trouble-free operation of blocks of all units, including units maintained on hazardous industrial facilities. Metal designs are the most widespread object of nondestructive testing. Frequently welding serves as way of connection of their elements. Development of scientific and technical progress in the field of welding manufacture has allowed to raise operational properties of these knots considerably. At the same time it is widely known that welded connections are areas where cracks can arise and develop at operation of various equipment.

Various kinds of nondestructive testing are applied to receive qualitative welding designs. Use of nondestructive testing in the course of manufacturing, installation, repair and operation of technical devices allows to prevent stops and failures. It is especially important at hazardous industrial facilities. According to the governmental order of the Russian Federation from March, 28th, 2001 № 241 within the limits of System of examination of industrial safety works on development and introduction of system of nondestructive testing of technical devices and the constructions applied and maintained at hazardous industrial facilities are organized.

To an even greater the role of the periodic control increases because of necessity of maintenance of industrial safety in conditions of increasing quantity of the equipment which has developed the resource and absence of means for its replacement and reconstruction. For example, 90 % of tank field, maintained in petroleum industry, have exceeded standard term of operation. Ultrasonic, radiating, magnetic, and also visual both measuring kinds of the control and liquid penetrant control are often used. Relevant normative – methodological base should be foundation of use for all of them. It directly influences results of quality assurance of designs. There are a lot of regulatory and procedural documents regulating choice of equipment, preparation and carrying out of nondestructive testing, but thus there is a considerable blank in the field of rationing of an estimation of results of the control. And meanwhile, the new problem arises after detection of defect and an estimation of its sizes: it is necessary to determinate hazard rate and sometimes to determinate probability of imperfection enlargement. It is essential to make check calculation of designs on durability taking into account of the found out defect to predict it. Specialist on nondestructive testing usually has to use regulatory and procedural documents on the object being tested in that moment.

Besides, experts of nondestructive testing should use norms of an admissibility of defects in their work. Norms should provide the decision of two problems: to guarantee necessary mechanical properties of welded connections and to have disciplining influence with technology of welding.

There are technological and operational norms of admissibility of defects. The first are focused on possibilities of technological process and usually exceed requirements on durability. The second

are connected with predicted danger of defects at operation of designs. They are based on theoretical knowledge and experimental data of influence of defects on bearing ability of welded connections.

The majority of existing norms of deficiency are focused on possibilities of welding manufacture (technological norms). It is impossible to choose safety factor correctly basing on technology requirements only. Norms of an admissibility of the imperfection sizes scientifically-proved from positions of mechanics of destruction are applied rather seldom in wide practice.

So, for example, on the dismantled equipment which has served without refusals and failures not one tens of years, at times are lack of penetration on all perimeter for $1/3$ thickness. This fact confirms: "inadmissible" in the sizes defects are not always "dangerous" and may not lead to design destruction.

The given approach causes some problems: the over-expenditure of material means for correction of defects, difficulties in introduction of highly effective methods of nondestructive testing and others.

Problems of the internal defects control in angular, branch, t-joint welded connections, in connections of contact welding, in connections of a small thickness (to 6 mm) remain unresolved till now as well as definition язв corrosion on internal surfaces of pipelines. Imperfection of technical regulation system is one of serious obstacles on a way of reliability increase and durability of production at the given stage.

Introduction of the Federal law «On technical regulation» has considerably affected a legal field of activity of participants of the majority of industries. With its acceptance numerous standard documents, regulating branch activity, were moved from the category "obligatory" to the category "recommendatory". Actually they have lost legal, an evidential effect of indisputability of the technical decisions described in them.

Nowdays there are two national standards, describing welded connections defects: GOST 2601-84 «Welding of metals. Terms and definitions of the basic concepts» and GOST 30242-97 «Defects of connections at welding of metals by fusion. Classification, a designation and definitions».

According to the Order of the Ministry of the industry and trade of the Russian Federation from 04.08.2009 № 277 since July, 1st, 2010 GOST R ISO 857-1-2009 «Welding and related processes is installed. The dictionary. A part 1. Processes of welding of metals. Terms and definitions», identical to the international standard ISO 857-1:1998 "Welding and related processes. The dictionary. A part 1. Processes of welding of metals». From the same day other standard - GOST R ISO 17659-2009 «Welding is installed for voluntary use. Terms multilingual for welded connections», identical to the international standard ISO 17659:2002 «Welding. Multilingual terms for welded connections with drawings» is installed for voluntary use. These documents should replace the national standard GOST 2601-84 «Welding of metals. Terms and definitions of the basic concepts», operating now.

It is necessary to notice that standard documentation available at present describes possible defects enough superficially. For example, GOST 30242-97 «Defects of connections at welding of metals by fusion. Classification, designations and definitions» subdivides defects by the form, at the same time, without giving any classification by quality of a final product. The existing standard classification of methods of nondestructive testing worked out for area of crack detection, has formal character, dividing all variety of methods and means of nondestructive testing is faster on a way of allocation of used effect, than as physical fields.

The demanded degree of quality should be considered while rejecting the products. For this purpose it is possible to use EN 25817. The given norms establish three degrees of quality designated as D – low, C – average, B – high. However recommendations resulted in EN 25817 (ISO 5717) have essential lacks. Concepts of "short" (total length of one or several defects to 25 mm on each 100 mm of length of a welded seam or a minimum of 25 % of length of a seam at its size less than 100 mm) defects are entered. The given indicators do not depend on kinds of defects (inclusions, lacks of penetration, undercuts etc.) and practically are not connected with danger of defects as danger of the most significant plane defects (lacks of penetration, undercuts) is defined

first of all by their depth, instead of length. Almost not realized parameter of an estimation of an admissibility of porosity – the relative total area of a time in section of a welded seam in percentage is applied. Calculation of this parameter is extremely difficult.

It is necessary to estimate danger of welding defects to work out settlement norms of an admissibility of imperfections in welded connections. Influence of defects on working capacity of welded connections depends on a considerable quantity of various constructive, technological and operational factors. The main factors are: type and the sizes of welded connection; a kind, a configuration and a defect arrangement; character and size of operating loadings; level of residual pressure. Modern supervising documents on crack detection have no specification on factor of concentration of pressure, thou this defect is very important.

Besides, it is necessary to pay attention that danger is covered in "a predefective" condition of metal when at structure level irreversible changes have happened, and damage can suddenly occur because of weariness and, as a rule, in those zones where it is not expected. Level of sensitivity of traditional methods of nondestructive testing does not allow to reveal "a predefective" condition of metal. It substantially reduces efficiency of an resource estimation of the industrial equipment. So, transition from use of means and methods of nondestructive testing in present understanding to technical diagnostics with use of a bit different approaches looks actual. Here it is possible to carry, methods and the means, allowing to supervise the is intense-deformed condition of the equipment, in practice such, for example a method of acoustic emission. It is especially actual for early diagnostics of damages of the equipment and designs.

Standards and the rules operating nowadays in the field of technical diagnostics and the periodic control of a condition of objects of the industry, whether it be the equipment oil, gas or other branches of economy, extremely seldom mention the given kind of the control as the basic.

So, nondestructive testing needs to be considered as an element of complex process of an estimation of risk and a residual resource of object.

As above-stated acknowledgement, it is necessary to notice that fact that now at mechanical engineering factories as in Russia, and abroad, there is no production quality assurance on structural heterogeneity. It is known on the statistican that approximately to 20 % of new production comes to operation with inadmissible defects of metal. Therefore all process of regulation of quality of production requires perfection.

The legislation in sphere of scientific and technical and innovative activity is actively updated for the last years. It is necessary to pay attention to documents regulating nondestructive testing, including documents regulating the requirements to quality of welded designs.