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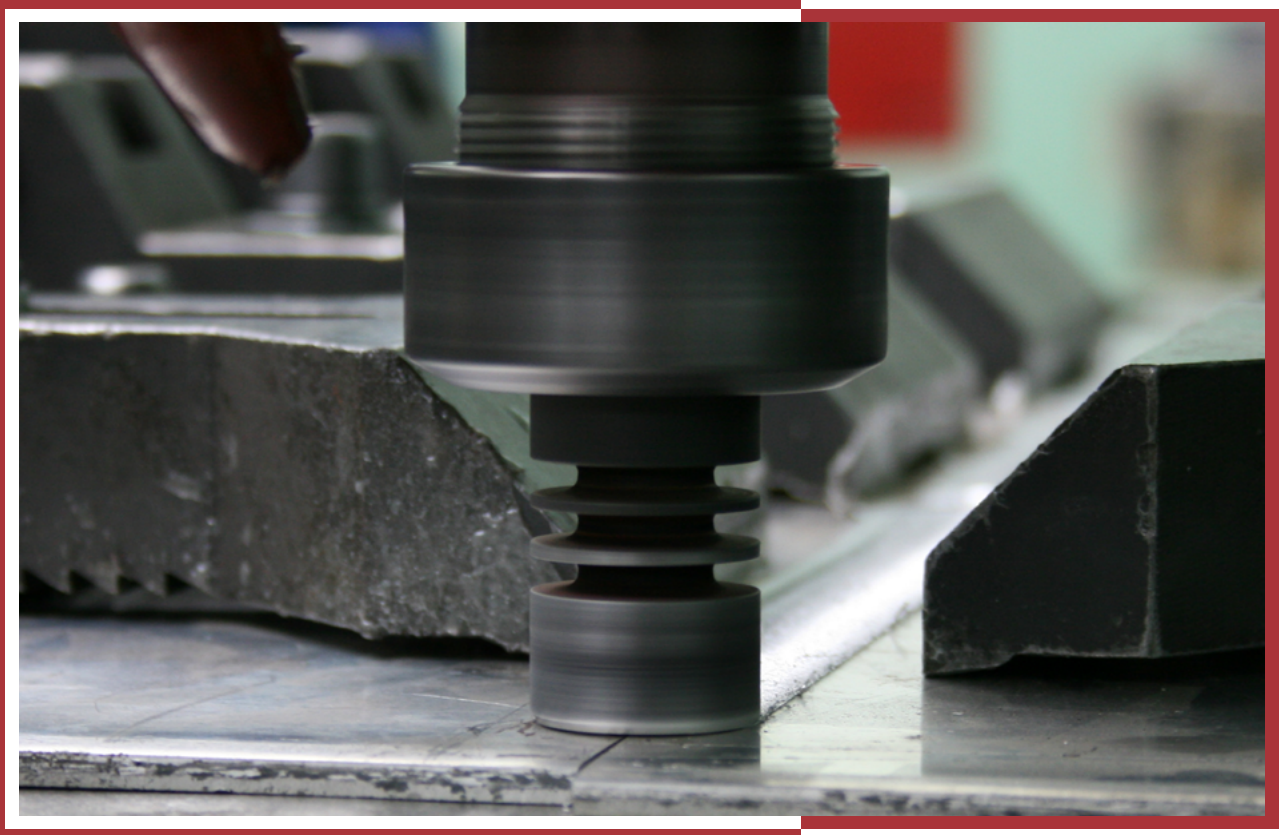

No. 2/2020

INSTITUTE OF WELDING BULLETIN

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No. 2 BIMONTHLY

CONTENTS

A. Kotarska, J. Górka, T. Walczak – The Effect of Post-Weld Heat Treatment Temperature on the Structure and Hardness of Joints Made in Steel 10CrMoVNb9-1

DOI: *10.17729/ebis.2020.2/1*

The article discusses the effect of annealing temperature applied during heat treatment as well as the suitability of preheating before the welding of butt joints in pipes (having a diameter of 33.7 mm and a wall thickness of 4.5 mm) made of steel X10CrMoVNb9-1 (P91). In the article, the structure and properties of a joint subjected to heat treatment performed in accordance with manufacturing standards concerning power unit elements are compared with those of a joint not subjected to heat treatment. The welding process discussed in the paper was based on the TIG method and involved the use of filler metal Thermanit MTS 3 (W Cr Mo 91). The material of steel X10CrMoVNb9-1 after welding and not subjected to heat treatment is both very hard and brittle. Because of the fact that the power engineering steel of the above-presented characteristics cannot be exposed to the effect of a high-pressure and high-temperature medium (due to possible crack formation), the welding of such steel should be followed by appropriate post-weld heat treatment.

E. Tasak, A. Ziewiec –Problems Accompanying Repairs of Chemical Equipment

DOI: *10.17729/ebis.2020.2/2*

The paper presents problems experienced during repairs of structures operated at high temperature for a long time. Research-related TOFD method-based ultrasonic tests revealed indications implying the presence of unacceptable imperfections in welded joints. Attempted repairs involving the use of welding methods proved ineffective as the welding and heat treatment processes resulted in the formation of cracks. The tests and analysis of the above-named issue revealed that the reason for repair-related problems lay in relaxation cracks triggered by excessively high stresses in the joints and improper parameters of heat treatment to which the steel of the boiler was subjected. The welding technology developed as a result of the study enabled the performance of the proper repair of related equipment and made it possible to re-start the production.

J. Lewandowski, D. Rozumek – The Effect of Technological Treatments and Loads on the Service Life of Fillet Welds

DOI: *10.17729/ebis.2020.2/3*

The paper presents test results concerning the service life of fillet welds made in steel S355. In addition, the article discusses the initiation and growth of fatigue cracks in specimens subjected to bending with torsion. The tests were performed in relation to constant stress ratio R = -1 and 0. The results presented in the article take into account the effect of the technological treatment on the service life of the specimens. The tests revealed longer service life of the specimens not subjected to the technological treatment, both when R = -1 and 0.

A. Rzeźnikiewicz, M. Żołnierek – The Effect of Heat Treatment on the Structure and Hardness of Welded Joints in Steel 7CrMoVTiB10-10

DOI: *10.17729/ebis.2020.2/4*

The article presents results of tests concerning the effect of heat treatment on the structure and hardness of submerged arc welded joints made in steel 7CrMoVTiB10-10 (T24). The tests revealed that the welds made of steel 7CrMoVTiB10-10 required post-weld heat treatment at a temperature 750°C. The heat

treatment was performed in order to protect welded structures from cracking during transport and operation as well as to prevent the development of secondary hardness.

A. Pocica, M. Pocica – Mechanisation and Automation at the Turn of 20th Century

DOI: *10.17729/ebis.2020.2/5*

The article presents the history of the mechanisation and automation of arc welding at the turn of the 20th century, including the first Benardos and Slavianov welding machines and the first related patents.

K. Głowacka, T. Łagoda –Nominal Stress-Based Estimation of Fatigue Life of Welded Joints

DOI: *10.17729/ebis.2020.2/6*

The paper presents methods for determining the fatigue life of welded joints with particular emphasis given to typical joints. In addition, the article presents various possible nominal stress-based ways enabling the calculation of stresses, including structural stresses and involving the most complex linear fracture mechanics. The paper also discusses recommendations by the International Institute of Welding related to the determination of the fatigue life of welded joints in flat elements exposed to tension-compression conditions. The work is focused on assessing the fatigue life of welded joints (selected types) in accordance with the guidelines specified in related recommendations issued by the International Institute of Welding and taking into consideration the analysis concerned with the safety of such structures.

J. Pospolita, D. Rozumek, J. Polak, S. Stano – Operational Problems in Welded Joints of Flow Sensors Used in Power Engineering

DOI: *10.17729/ebis.2020.2/7*

The paper presents operational problems present in fluid and gas flow measurement systems. Tests (involving laser welded tubes made using a focused and a defocused beam) were concerned with the quality of welded joints. The tests revealed that the use of the focused beam resulted in the formation of cracks in the welds. In addition, post-weld observations revealed undercuts on the weld face side, responsible for the thinning of the tubes, yet without compromising their service life.

M. Böhm – Determination of the Fatigue Service Life of Welded Joints Using the Spectral Method Defined in the Frequency Domain

DOI: *10.17729/ebis.2020.2/8*

The paper discusses presently experienced problems concerned with forecasting the fatigue life of welded joints in terms of the spectral method defined in the frequency domain. In addition, the article presents the primary assumptions of the spectral method and describes the issue related to the recognition of the mean stress value and loads above the material yield point.

M. Prażmowski, P. Fras – The influence of cutting techniques on the structure and properties of low-alloy martensitic steels

DOI: *10.17729/ebis.2020.2/9*

The paper analyzes the flow of cutting techniques on the structure and properties of low-alloy martensitic steels. Steel with increased abrasion resistance of four manufacturers was selected for testing. The cutting process was carried out using a gas torch, plasma, water-abrasive stream and band saw. Sheet hardness testing in the pre-treatment state and distribution of hardness in the cutting zone, surface roughness measurements after the cutting process and metallographic testing of the native material (NM) and heat affected zone (HAZ) were carried out. In the case of wear-resistant steels, the cutting method has a significant impact on its operational properties. From

the surface quality point of view, the best results were obtained for the plasma cutting process, which was confirmed by measurements of surface roughness. Cutting using gas burners and plasma caused deterioration of mechanical properties of steel in the cutting zone. This effect is associated with the formation in this area of the HAZ, with morphology similar to HAZ arising during the welding process. Hardness measurements and metallographic tests in the cutting zone showed a significant decrease in steel hardness, which is the result of structural changes under the influence of heat.

D. Andrzejewski, B. Werakso – FSW welding of aluminium using tools of various geometry

DOI: *10.17729/ebis.2020.2/10*

It has been presented investigation of aluminium friction stir welded joints using tools of various geometry. There has been described effect of determined parameters for the quality, consistency and the correctness of the FSW technology. There has been also investigated microstructure of the joints

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