

OPTIMAL WELDING TECHNOLOGY OF HIGH STRENGTH STEEL S690QL

Dušan Arsić^{1,*}, Vukić Lazić¹, Ružica Radoslava Nikolić^{1,2},
Srbislav Aleksandrović¹, Branislav Hadzima^{2,3}, Milan Djordjević¹

¹ Faculty of Engineering, University of Kragujevac, Sestre Janjić 6, 34000 Kragujevac, Serbia

² Research Centre, University of Žilina, Univerzitná 8215/1, 010 26 Žilina, Slovak Republic

³ Faculty of Mechanical Engineering, University of Žilina, Univerzitná 8215/1, 010 26 Žilina, Slovak Republic

*corresponding author: tel.: +421948610-520, e-mail: ruzicarnikolic@yahoo.com

Resume

In this paper, the detailed procedure for defining the optimal technology for welding the structures made of the high strength steel S690QL is presented. That steel belongs into a group of steels with exceptional mechanical properties. The most prominent properties are the high tensile strength and impact toughness, at room and at elevated temperatures, as well. However, this steel has a negative characteristic - proneness to appearance of cold cracks. That impedes welding and makes as an imperative to study different aspects of this steel's properties as well as those of eventual filler metal. Selection and defining of the optimal welding technology of this high strength steel is done for the purpose of preserving the favorable mechanical properties once the welded joint is realized; properties of the welded metal and the melting zone, as well as in the heat affected zone, which is the most critical zone of the welded joint.

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1. Introduction

In order to establish the optimal welding technology of any steel one first has to estimate its weldability. That property is being influenced by many different factors, out of which the most important ones are the chemical composition of the base metal (BM), the type of the filler metal (FM) and the welding procedure. The other factors affecting the weldability are the quantity of hydrogen diffused from the weld into the base metal, thickness of the part to be welded, type and distribution of joints, heat input, type of the applied heat treatment and order of deposition of individual welds – layers and so on. The chemical composition data are usually obtained from the manufacturer of particular steel; however, it is always useful to verify them by additional tests in accredited laboratory. Then, one has to perform tensile test

and the impact test of the base metal, to verify its mechanical properties. The establishing of steel's weldability is also done by calculating the chemically equivalent carbon. Finally, one has to perform the test weldings on models – samples from the base metal with application of various filler metals, varying the heat input, welding procedure and eventual additional heat treatment. Performing a sort of sensitivity theory, by keeping all but one parameter constant, and repeating the procedure for all the parameters, one comes up with their optimal combination, in this case the result is the optimal welding technology for the high strength steel S690QL.

2. Weldability of the base metal

The S690QL class steel is a special thermo-mechanically obtained (TMO) low-alloyed steel which, according to ISO 15608

