INOVATIVNI I UČINKOVITI SUSTAVI ZA NAVARIVANJE

INNOVATIVE AND EFFICIENT CLADDING SYSTEMS

J. KREINDL [1)]

Ključne riječi: sustavi za navarivanje, navarivanje, tvrdo navarivanje

Key words: cladding systems, surfacing, hardfacing

Sažetak: ETR sustav (Endless Torch Rotation – sustav s beskonačnom rotacijom pištolja za zavarivanje) je inovativan i učinkovit sustav za navarivanje. U prvom dijelu rada je obrađena ETR oprema, a u drugom tvrdo navarivanje s korozijski i erozijski otpornim dodatnim materijalom. Tehnologija tvrdog navarivanja je ilustrirana na primjerima iz kotlogradnje.

Abstract: ETR (Endless Torch Rotation) system is an innovative and efficient system for cladding. First part of the paper is devoted to the ETR equipment and the second part elaborates the hardfacing with corrosion and erosion resistant filler metals. Hardfacing technology is illustrated on the examples from boiler manufacturing industry.

[1)] Fronius International GmbH, Austria

1. INTRODUCTION

The new ETR system complies with the features of the "conventional" TIG Hot Wire Cladding System as regards weld quality, functionality and software features (e.g. "Bore-to-Bore"-Function).

At the core of the ETR Welding System is the so-called "transfer module" that conducts all media required for welding (shielding gas, torch coolant) as well as the welding power and electrical signals through a rotary transmission to the welding head. Thanks to its "co-rotating" filler wire spool and wire feeder the ETR-S also ensures an optimum wire transport. Moreover the ETR-S features a long slide that bears the inside cladding torch (an AW 45-ZMH with an operating length of 650 mm). This slide is used for adjusting the required bore diameter (up to 200 mm), however, during welding it also performs the function of the Arc Voltage Control (AVC). The entire system is mounted on an FCS cross-slide which in turn is fastened on a FCB tripod unit. [1]

Exact positioning is then performed by means of a software function ("Automatic-Centering-System") that automatically centers the ETR system: The inside of the bore to be clad is automatically scanned at four different points which allows to determine the exact center of the bore and to automatically position the ETR System in welding position.

Typical attributes of some valve blocks are a large number of bores (picture 1) in various locations, high-strength materials and increased wear resistance through the addition of cladding. To increase productivity, the Technical Managers in Dunfermline opted for the ETR (Endless Torch Rotation) and hot wire TIG cladding system from Fronius. And their confidence has been rewarded, with the throughput time for each valve block being reduced by 40 %. At the same time the amount of work involved has fallen and the overall quality has increased.

Picture 1 Valve block are a large number of bores

At the heart of the ETR system is the transfer module (picture 2). It routes all the required media, the welding current and the electrical control signals to the torch (picture 3), which, together with the wire feeder, rotates about the bore axis. The system thus carries out two additional functions: firstly it determines the bore diameter and secondly it performs automatic arc length correction during welding. The central FPA9000 system controller (picture 4) ensures optimum control of the welding processes and the geometric movements. At FMC it runs special "Bore-to-Bore" software. This software specializes in fully-automatic control of the welding processes on the valve drill-through.

Picture 2 ETR system's transfer module

Picture 3 Torch AW 45 ZMH

Picture 4 System controller FPA 9000

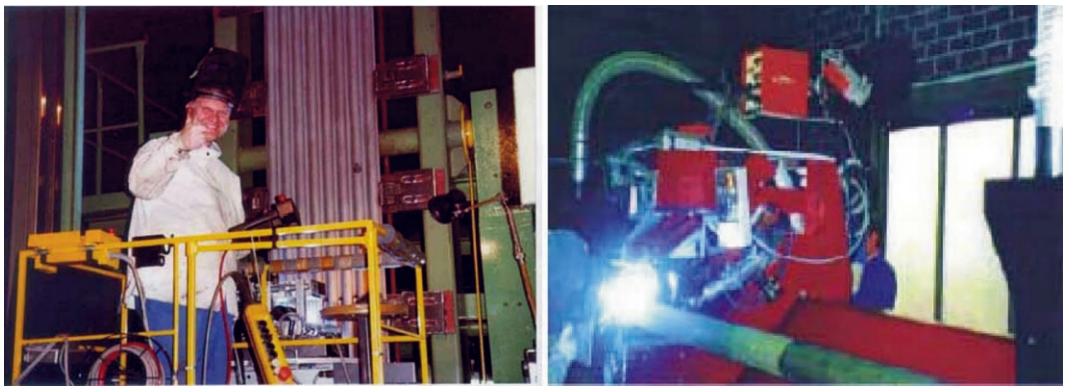
A valve block can weigh up to 10 tons (picture 5) and can have as many as 12 bores and corresponding cut surfaces. These have to be clad with up to three weld layers 5 to 12 mm thick (picture 6). Aligning the block with the centre point of the relevant valve seat bore on the rotary table is frequently difficult and insufficiently precise. Additional machining is required between each individual layer of cladding, which takes up even more time. Instead of always having to reposition and turn the heavy and complex work piece after each cladding operation, the welding experts have now transferred these operations to the tool/torch guide. The innovative ETR system from Fronius is centered using a column and boom and cross slides. Precise alignment is performed by an automatic self-centering function in the FPA 9000 controller (picture 4). As the ETR system and torch (picture 3) are significantly more mobile than the heavy work piece, the whole process is highly accurate and much more straightforward. The movement and switching off of the torch before the drilled and cut areas of the work piece is controlled by an NC program, as is the subsequent automatic start-up. The manual interruption of the welding process and subsequent re-ignition are now things of the past.

Picture 5 Heavy valve block cladding

Picture 6 Bore in vale block

2. MAG - HARDFACING WITH CORROSION AND EROSION RESISTANT FILLER METALS

The attempts of operators of power stations to increase efficiency and availability of the plant are among other reasons also made for economic reasons. Complex processes take place in the plants during operations which lead to undesired side effects of power generation. The wear of power station components in boiler conditions is always caused by chemical and mechanical effects taking place at the same time with the extent of wear varying considerably. If the materials loss is predominantly caused chemically we talk about corrosion and if is manly caused mechanically we talk about erosion. In order to counteract these wear mechanisms materials with increased service life are used. The welding technology is very important in order to protect the surface of power station components which are subject to intensive wear.



Picture 7 Cladding unit

Picture 8 Cladding vertical down (PG) (left) and cladding horizontal (PC) (right)

Apart from joint welding, hardfacing has been successfully used for many years for repair welding and cladding. In power station engineering hardfacing has been used only as a form of sanitation as a temporary solution. In conventional steam generation small heating surface areas affected by wear are hardfaced by electric/TIG/MAG welding procedures with filler metals of the same type. For process-related and economic reasons the MAG welding procedure has been developed, tested and adapted to the individual applications of our customers. The plating procedure, also called "cladding", is always used for two different applications:

1. Cladding on new tubes (picture 9 and 10) and evaporator walls for protections against corrosion and erosion. It is mainly performed during prefabrication or in the construction of new boilers.
2. Sanitation of boiler components is operation which has been strained by corrosion and /or erosion.
   - If the wear has been caused by erosion, highly wear resistant filler metals of the same type are used.
   - If the wear has been caused by corrosion, filler metals on nickel basis are used.

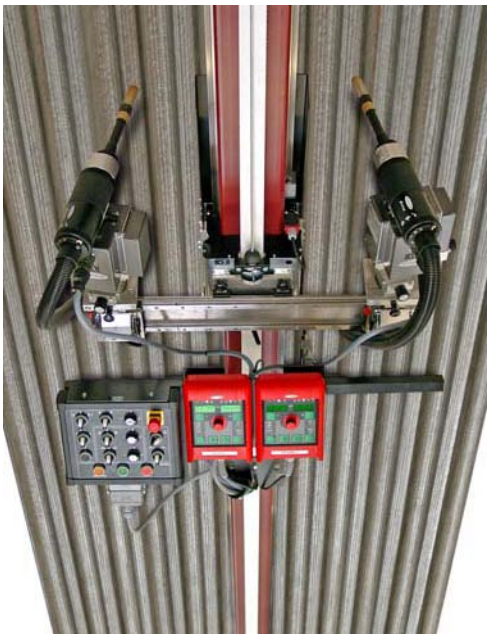
The overlay is used as a first time overlay or a renewal of an existing overlay. It can be applied automatically. Ni based alloys Cr-Ni-Fe, Cr-MO-Fe and Mo-Fe are used as overlay materials. Fabrication of tube –fin-tube walls up to 6 m length, water cooling, flexible scaffolding for the continues control of the welding process with the double head welding guns (Picture 13).

Picture 9 Cladding tube

Picture 10 Cross section of tube

Picture 11 Cladding of individual tube

Picture 12 Bent tube – bending angle 180°



Picture 13 Double head welding system

3. LITERATURE

[1] Fronius International GmbH, Austria: Cladding system ETR-S, 2007, http://www.fronius.com/cps/rde/xchg/SID-0AFF0106-4E96C466/fronius_ international/hs.xsl/79_2351_ENG_HTML.htm