VISOKOUČINSKO ZAVARIVANJE POMOĆU JEDNOG I DVA ELEKTRIČNA LUKA

HIGH DEPOSIT WELDING WITH SINGLE AND TANDEMPROCESS

Josef KREINDL[1]

Ključne riječi: visokoučinsko zavarivanje, jedan ili dva električna luka

Key words: high deposit welding, singleprocess and tandemprocess

Sažetak: Visokoučinsko zavarivanje smatra se ono koje ima količinu nataljenog depozita od 8 kg/h. Prema definiciji ovo vrijedi za punu žicu promjera 1.2mm i brzinu zavarivanja od preko 15 m/min. Primjenjen je novi TIME 5000 digital sistem za zavarivanje sa 15 do 25 mm slobodnim krajem žice. Ova duljina koja je iznad 15 mm , komparirana s normalnim MAG postupkom zavarivanja, znači zagrijavanje žice koje omogućuje veće brzine zavarivanja a samim tim i veće količine nataljenog metala. Time Twin postupak f. Fronius predstavlja u stvari tandem postupak zavarivanja. Električki izolirana dva luka međusobno se podržavaju i optimiraju neovisno jedan od drugog. Odvojeno se kontroliraju i izvođenje i dodatni parametri kao što je dužina el. lukova tako da se postižu stabilni el. lukovi uz savršeno odvajanje kapi .

Abstract: High-performance welding starts at deposition rates of 8 kg/h. According to definition this applies for solid wire electrodes of 1.2 mm diameter and wire feed speeds over 15 m/min. With the new TIME 5000 Digital welding system a 15 to 25 mm stick-out supports the high-performance welding process. This length which is greater by up to 15 mm compared with normal MAG (metal active gas) welding means that the wire is heated up which, therefore, makes higher wire feed speeds and deposition rates possible.

TimeTwin by Fronius is a tandem welding process. On account of the electrical insulation of the two electrodes, two electric arcs are generated that can be adjusted and optimised independently of one another. Both the performance and additional parameters - such as, for instance, the lengths of the two electric arcs - can be controlled separately, which means that it is possible to achieve a stable electric arc and perfect drop release for both electric arcs.

[1] Fronius International GmbH, Technologie Center, Buxbaumstr. 2, 4600 Wels, Austria

1. INTRODUCTION

Demand is increasing steadily for welding processes that assure superlative welding quality and simultaneously boost profitability and cost-effectiveness. This is feeding the development of high-performance welding processes having an increased deposition rate. These methods are characterised by a deposition rate of more than 8 kg/h in the case of steel. Users are converting this greater deposition rate either into larger seam cross-sections or into greater welding speeds.

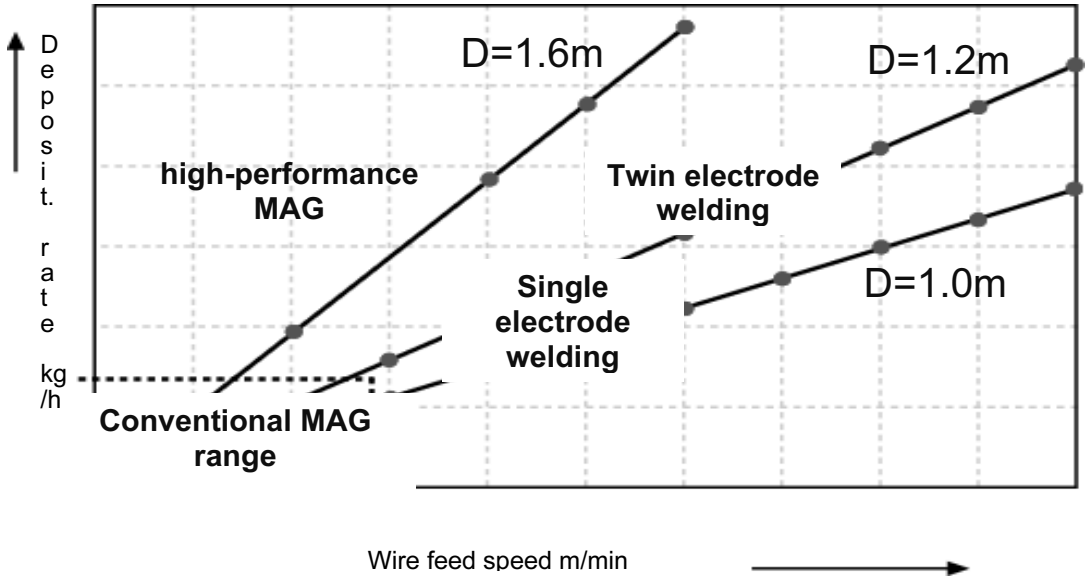

Table 1. DVS leaflet 0909/1

2. SINGLE WIRE

The digital TIME process opens up even greater potentials for increased productivity with a 30% higher deposition rate when welding thick steel plates. The basis for this comparison is the "TIME" high-performance welding process that has been around since the 90s. In addition to excellent profitability, the new TIME process stands out due to the advantages provided by digital systems such as outstanding welding characteristics, the 100% reproducibility of all results, digital microprocessor control and a modular system concept. Above all, they benefit users who wish to use manual high-performance welding for greater weld lengths and cross-sections. Machine constructors, structural steel fabricators, constructors of building machines, cranes and ships are now able to achieve deposition rates of up to 11 kg/h at 40% duty cycle!

The type of shielding gas is specific for TIME welding. Depending on the process and boundary conditions, the experts recommend 2-component gases based on Argon/CO2 or 3/4-component gas based on Argon/CO2/O2/Helium. Here too the advantages of the digital technology are evident: the parameter sets for numerous shielding gas mixtures are stored and can easily be called up by way of the synergic function. This also applies to further process know-how. There is a built-in 3-parameter control to prevent welding defects when starting

and stopping. Thus the user can set desired values regardless of the main output or can adjust the length of the arc to suit.

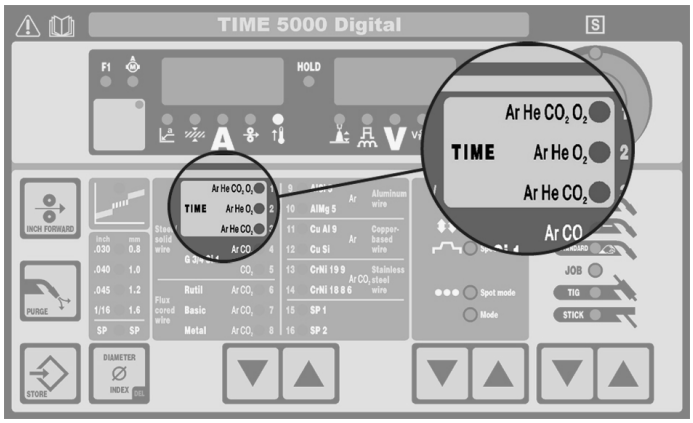

Figure 1. The TIME 5000 Digital welding system is suitable for both high-performance and standard welding processes.

2.1. Application area for Single wire

Shipbuilding
Manual and automated frame welding on primed sheets

Steel construction
Fillet- and butt weld in all welding positions even useable at building sites

Automobile building
Here particularly high demands are made against the dynamic characteristics of a welding seam

Mechanical engineering
Optimal operational area bedcause there usually to fill large seam volumes are as well as there are long welding seams

Container building
Mainly automatize used on longitudinal and circumferential seams. Welding speed depend on material thickness up to 2,3m/min.

Figure 2. The new TIME 5000 Digital now offers the advantages of digital welding technology in the TIME high-performance welding process so that the user can also call up the welding parameters as a function of the gas mixture

3. TANDEM PROCESS

3.1. Welding process

If two simultaneously welding wire electrodes are employed in MSG welding, then basically two variants are possible:

- In twin-wire welding, the two wire electrodes are guided jointly through the same contact tube which means that both electrodes have same electrical potential on a continuous basis.
- In the case of tandem welding on the other hand, each electrode has a separate contact tube. The contact tubes are electrically insulated from each other. It is thus altogether possible that the two electrodes have different electrical potentials.

These two variants are illustrated schematically in Figure 3.

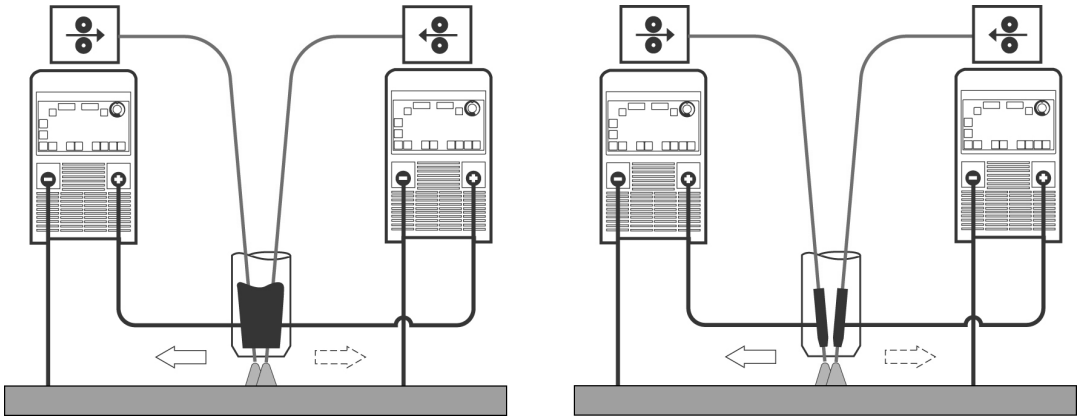

Figure 3. Twin-wire welding with a common contact tube (left) and tandem welding (right) in which the two contact tubes are electrically insulated from one another

TimeTwin by Fronius is a tandem welding process. On account of the electrical insulation of the two electrodes, two electric arcs are generated that can be adjusted and optimised independently of one another. Both the performance and additional parameters - such as, for instance, the lengths of the two electric arcs - can be controlled separately, which means that it is possible to achieve a stable electric arc and perfect drop release for both electric arcs.

3.2. Welding equipment

For the tandem process TimeTwin, the availability of two power sources is essential because two electric arcs need to be powered. However, it is not sufficient to simply adapt the power sources to this process. Instead, all the equipment must be adapted. Basically, that includes the welding torch, the wire advancing mechanism and the cooling circuit. Basic diagrams of these components are shown in Figure 4. and they are described in detail below.

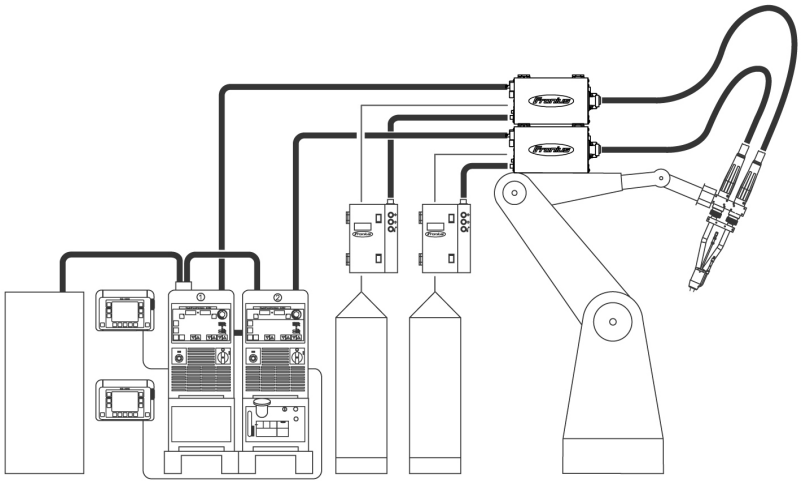

Figure 4. TimeTwin basic diagrams. In standard practice, this process is only used in automated applications.

3.3. Welding torch

In the tandem process, two wire electrodes must be maintained for the welding process. Although in this process the contact tubes of the two electrodes are electrically insulated from one another, they also run through a common gas nozzle which entails that the two electrodes must share a common welding torch. Figure 5. shows a schematic representation of the foremost section of the torch. Here, the electrical insulation of the two contact tubes can be seen very clearly.

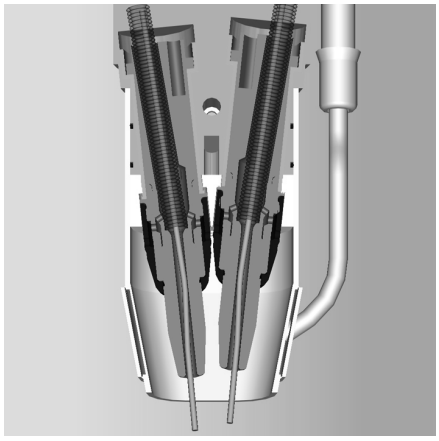

Figure 5. Detailed view of the welding torch for the tandem process TimeTwin. Here, the two contact tubes are electrically insulated from one another.

3.4. Welding speed and deposition rate

Using the TimeTwin, it is possible to achieve considerable increases in the deposition rate compared with conventional electric arc welding processes. The user can convert this higher deposition rate either into a higher welding speed or into a greater cross-sectional area of the seam. In most applications, the increase in welding speed is of chief significance. The exact factor by which the welding speed can be increased depends on the material, the thickness of the sheet metal, the geometry of the seam, the welding positions etc.

In general, it can be said that the welding speed using TimeTwin can be increased by a factor of approximately 2-3 compared with that of MSG processes and by a factor of 2 with respect to the Time process. The exact increase depends on the specific application. In the case of TimeTwin, it is possible to accomplish welding speeds of up to 7 m / min. and deposition rates of up to 30 kg / h in the case of steel.

3.5. Applications

TimeTwin is already being used in a large number of applications. These applications fall into the categories joint welding, welding-to-order. There are also many areas in which TimeTwin can be used, including for instance the following:

- Rail vehicle construction
- Shipbuilding
- Automotive engineering
- Tank construction
- Plant construction
- Digging machines and special mechanical engineering
- Pipeline construction

The TimeTwin process can be used with all standard auxiliary construction materials. In general, the following wires can be used in the TimeTwin process:

- Aluminium and its alloys
- Steel

- CrNi
- Filler wires

Standard protective gases are also used for this process. That enables a high level of flexibility and the simple upgrading of an existing single-wire plant to TimeTwin. Table 2. summarises the protective gases used for various basic materials and types of electric arc:

Basic material	**Protective gas**
Non-alloy and low-alloy steel / pulse welding	90% Ar / 10% CO_2 or 82% Ar / 18% CO_2
Non-alloy and low-alloy steel / standard welding	95-98% Ar / 2-5% O_2
Aluminium / pulse welding	Ar or Ar / He mixture
Stainless steel / pulse welding	97.5% Ar / 2.5% CO_2

Table 2. Protective gases used for various basic materials and electric arc types

4. SUMMARY

This article presented the tandem process TimeTwin. By contrast to twin-wire welding, this process is distinguished by two contact tubes which are electrically insulated from one another so that the two electrodes can have different electrical potentials. On the one hand, two power sources are required for this process and these communicate via a data bus so as to synchronise the construction-material transition. At the same time, welding torches, wire advancing mechanisms etc. must also be adapted for this process.

The TimeTwin process is characterised by a high welding speed, a high deposition rate, reduced thermal input and less splashing. Apart from that, welding in both directions and also single-wire welding are possible. Furthermore, this article presented three different applications in which it was possible to achieve top welding speeds and, at the same time, excellent welding quality.