Quality advantages from double-coated electrodes

Alain Laurent, business developer for Lincoln Electric's Oerlikon brand, highlights the advantages of Tenacito doublecoated SMAW electrodes.

n exclusive Oerlikon extrusion process for 2.5 and 3.2 mm SMAW electrodes has been developed to produce two separate flux coatings around electrode wires. The result is the Tenacito double-coated electrode range of high-quality welding electrodes.

"During manufacturing the two coatings are applied simultaneously in a single extrusion operation. Each coating has different but complementary chemical compositions, which together result in much better arc stability and weld quality," says Laurent.

He says that single electrode coatings have to contain both electrical conducting elements necessary to establish an ionising path for a stable arc, and those for the protective gaseous atmosphere to prevent oxygen, hydrogen, and nitrogen pick-up by the molten metal.

In addition, the coating provides the ingredients to form the protective slag over the hot metal and various flux constituents that help to remove oxides and other impurities from the molten metal.

With double-coated electrodes, the constituents required in an electrode coating are split between the two layers. The inner layer contains the ionising and conducting ingredients. "This enables a strong and stable arc to be concentrated around the wire.

"The second coating, however, which contains the shielding and slag-



In a comparative test, the double-coated Tenacito electrode (left) enabled the full 15 mm gap to be bridged. This was not possible with a conventional electrode (right).

forming elements, is non-conductive, that helps to concentrate the electrical arc to the inner core of the electrode, resulting in a rigid arc that is easier to direct into the root of a welding groove," he explains, adding that single electrode coatings are usually more insulating, which are, therefore, more difficult to direct into narrow gaps.

Advantages of the double-coated electrode solution include:

- A very stable arc that is insensitive to the effects of arc blow.
- Sustained high-quality fusion at very low weld-current settings.
- Excellent usability for the operator.
- Exceptional wetting even at low current.
- High tolerance for irregular gaps.
- Superior metallurgical purity.
- Stable arc with low spatter levels.

"The inside coating enables a deep crater while welding, which gives excellent stiffness and positional control as well as deeper penetration," Laurent adds.

Describing a comparative test performed using 3.2 mm electrodes in the 3G, vertical up (PF) position on 10 mm plates with 60° V-groove weld preparations, Laurent says that both plates were prepared with a 3.2 mm root gap at the bottom, opening to a 15 mm gap at the top.

"With the single coated electrode, a welding current of 100 A was used at

the start of the weld and was reduced to maintain control. After 200 mm of welding, the current had been reduced to the lowest possible with this electrode (85 A) and the gap could no longer be bridged.

"Using the doublecoated Tenacito electrode, however, the starting current of 95 A at the bottom could be reduced to just 65 A at the top of the plate, which enabled the full 15 mm gap to be bridged at the



Tenacito double-coated SMAW electrodes have an inner coating to provide a narrow arc with high arc stiffness, stable metal transfer and low-spatter, while the outer coating produces the slag and weld metal metallurgy required.

top of the 290 mm plate.

The Tenacito R electrode available in diameters of 2.4 and 3.2 mm has been qualified for pipe welding procedures using S355 steel on 20-inch pipe with a 0.812-inch wall thickness. "With preheating of between 60 °C and 100 °C from the root to the capping pass, and weldability acknowledged by welders, even for the DC+ root pass, the X-ray, and ultrasonic NDT results along with the bend tests and micrographic examination results were all better than results from single coated electrodes," Laurent points out. In addition, less grinding was required, penetration was better and the weld bead was more regular.

"This basic double coated MMA electrode has a very low hydrogen content making it ideal for reliable, crack-free and tough welded joints on steels with a yield strength greater than 420 MPa. The weld metal is of high metallurgical purity, is ageing-resistant, retaining ISO-V toughness to -60 °C and it passes CTOD tests," Laurent tells *African Fusion*.

X-ray quality welds with Tenacito R can be readily achieved on critical applications when welding steels such as C45 and C60 – and these electrodes are also approved for railway welding.

Double-coated electrodes are also available for C-Mn and low-alloy steels (38R); for nickel-alloyed structural steels (70B); for HYSS offshore applications (65R); and for applications with yield strengths of up to 700 MPa (80CL).