

## New system for underwater welding developed



*Prototype controller which will be fitted into all new Piranha II units as standard. After pre-selecting the desired parameters the unit will automatically control the current and weld time cycles and provides a display of current and volts.*

Speciality Welds from Cleckheaton, West Yorkshire/UK has developed a new system for underwater welding named Hammerhead which allows to obtain high quality wet welds without the need for experienced, trained and or qualified welder-divers. The Hammerhead wet-spot welding

process results in a quick and reliable joining method by means of a spot/plug weld, using a standard 3 phase DC welding power source and the so called Piranha II control unit. By removing the actual welding skills from the operation, there's no need for the diver-welder to control parameters like travel speed, electrode angles, arc length etc, as associated with conventional welding skills. There's even no need to have good visibility, as the diver doesn't need to see or control an arc in the conventional sense, so even in poor visibility conditions high, repeatable quality welds are produced time after time.

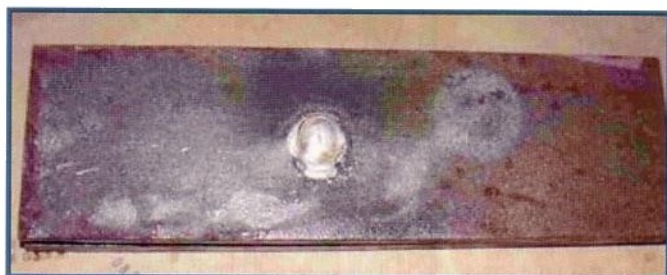
The Hammerhead wet-spot welding electrode will penetrate the two materials required to be joined and then through the control unit the currents necessary to pierce will be set. The filling of the hole results in a spot/plug weld being formed, which has sufficiently penetrated both sets

of material to form a sound joint, similar in principle to a rivet. Typically the shear strength is generally assumed to be 4/5 the ultimate tensile strength for most steels. The Hammerhead electrode offers a tensile strength of 650 N/mm<sup>2</sup> and will offer a shear strength of approx. 520 N/mm<sup>2</sup>. Therefore a 10.0 mm diameter weld nugget will produce a maximum load capability of 40.840 N per spot.

The Piranha II control system sits above water and controls the primary and secondary current values. They are selected in accordance with a set of guideline tables, which have calculated the average



*Piercing effects of the first current.*



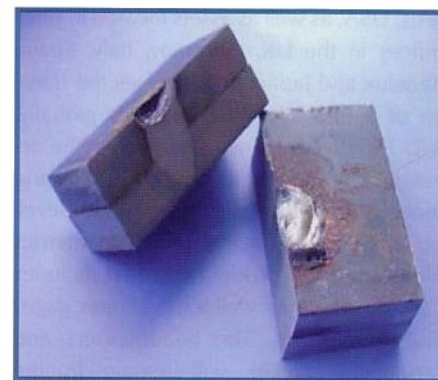
*Actual finished weld profile.*

weld/time cycles used for that particular size of electrode and thickness of material. The operator can then make any minor adjustments as are necessary to ensure adequate weld quality on site.

The first current value allows the electrode to pierce the material directly, creating a hole through which the materials can be joined together. During this operation the diver or indeed robot only needs to apply sufficient pressure to the electrode to push it through the materials to be joined. Absolutely no welding skills are required. After the first weld cycle is completed and the depth of penetration is achieved, a second current is automatically initiated which then allows the electrode to fill up this hole, thereby creating a spot/plug weld, which has penetrated both sections of material.

The selection of electrode size is matched to material thickness, with two sizes of electrode available, 3.2 mm and 4.0 mm. These two electrodes will comfortably join combined steel thickness of up to 32 mm. The Piranha system has a timer and current control device built in, which allows for the appropriate time cycle to be set by and controlled by the operator, so all control other than the pressure applied by the diver (or robot) is preset and controlled automatically.

Although the process is not completely automatic, as after all it is still 'manual metal arc', however, the skills necessary for a diver to produce a weld have been removed, as have many of the traditional preparations and environmental factors, which normally have such an influence on welding underwater. So contractors can se-



*Two 10.0 mm steel plates having been joined together using the Hammerhead welding electrode/system. The plug/spot weld created has penetrated through both the materials providing a clean, sound weld nugget.*

lect their best divers without having to worry about them having any welding abilities. The final weld quality is also improved, with the majority of the weld being confined within the through thickness of the material, factors such as erosion or corrosion are less of a concern. The heat-affected zone (HAZ) is smaller, the overall weld hardness is lower and the potentials for weld defects are minimised. (According to press information from Speciality Welds)