

Full penetration hybrid laser arc welding of up to 28 mm thick S355 plates using electromagnetic weld pool support

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The laser hybrid welding process offers many advantages regarding deep penetration, increased welding velocity and with the help of the supplied filler wire an improved bridgeability to gap and misalignment tolerances. High power laser systems with a power of approx. 30 kW are already available on the market. Nevertheless, multi-layer technology with an arc process is still used for welding of plates from a thickness from 20 mm. A potential cause is the process instability with increasing laser power. It is inevitable that gravity drop-out due to the high hydrostatic pressure at increasing wall thickness especially at welding in flat position and with a low welding speed. The surface tension decreases with increasing root width resulting from low welding velocities. To prevent such inadmissible defects of the seam a use of weld pool support is required. Usual weld pool support systems such as ceramic or powder supports require a mechanical detachment, which is time-consuming. The electromagnetic weld pool support system described in this work shows an alternative weld pool support, which works contactless. It is based on generating Lorentz forces in the weld pool due to oscillating magnetic field and induced eddy currents. This innovative technology offers single pass welds up to 28 mm in flat position and reduced welding velocity with a laser power of just 19 kW. It also leads to improved mechanical-technological properties of the seams because of the slow cooling rate. With usage of an electromagnetic weld pool support the limitation of the hybrid laser arc welding process in the thick sheet metal will be extend.

Notes
