

COMPARING HOT-WIRE GAS METAL ARC WELDING (HW-GMAW) IN TERMS OF HOT-WIRE POLARITY, WELD DIRECTION, AND CONTACT TIP DISTANCE TO THE WELD POOL TO COLD WIRE GAS METAL ARC WELDING (CW-GMAW) AND STANDARD GAS METAL ARC WELDING (GMAW)

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ABSTRACT

Gas metal arc welding (GMAW) is robust and versatile welding process used in the construction of different structures such as cars and ships. However, this process is frequently limited in its applications due its productivity. One way of increasing productivity in GMAW is the use of auxiliary wires, this wire can be kept cold (non-energized) as in cold-wire (CW) GMAW or can be resistively heated as in hot-wire (HW) GMAW. However, the lack of knowledge on arc dynamics and parameter effects on welding suitability usually limits the applications of these auxiliary wire welding processes as derivatives of standard GMAW. This study aims to provide a basis for the application broadening of HW-GMAW, for example, to structural heavy gauge welding applications. This work reports the effect of weld direction, hot-wire polarity, and contact tip distance to the weld pool on arc stability and bead geometry and compares the results to CW-GMAW and GMAW welds. Welds performed in flat position, bead on plates, in globular and spray modes were recorded using high speed imaging with synchronized current and voltage acquisition. Subsequently, the welds were analyzed using standard metallography. The results point out to differences in stability depending on the polarity and contact tip location which are reflected on the nominal heat input values, metal transfer dynamics, and geometry of the beads.

Keywords: HW-GMAW, CW-GMAW, GMAW, arc dynamics, bead geometry.