

SPB-7 Effect of Structural Steel Coatings on Stud Weld Quality

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Stud welding through deck to steel beams is a common practice in manufacturing steel/concrete composite structures. In order to enhance corrosion resistance, coatings are used on the steel beams. Because of the layer between the stud and base metal and the large size of the studs, conventional stud welding procedures do not produce consistent welds. The major objective of this study was to accurately describe the difficulties associated with stud welding on coated steels. From this information, possible solutions were proposed and development work was performed on these solutions.

Stud welding was done using the Nelson Nelweld 6000, with $\frac{3}{4}$ " steel studs on bare and coated steels. Coatings included zinc (hot-dip galvanized), zinc-rich primers, and alkyd paint. The Nelweld control system and gun were used to optimize parameters for testing and to examine welding variables such as pilot arc time, weld time, plunge time, lift, plunge length, and current. Power curve data were collected and analyzed with the timing and gun cycle. The welds were examined ultrasonically and tested in tension and bending. Fracture surfaces were examined with optical and scanning electron microscopy with EDS.

Conventional parameter optimization was not able to produce consistent, sound welds. Failures in the weld were a result of coating and oxide inclusions as well as un-expulsed zinc and aluminum. Studs also occasionally had severe melt-back and asymmetric weld zones, both evidence of arc blow and a cathode spot on the base metal. Procedures to constrict the arc with a magnetic field from the welding cable produced more symmetric welds but caused greater problems by trapping inclusions. Pulsing power early in the weld cycle is proposed as a possible solution for removing contaminants from the weld zone while preventing arc blow problems. The current stud welding system must be modified to gain more control over the power curve, to produce a repeatable, high-quality weld that can be adapted for a variety of steel coating conditions. As coated steels become an industry standard, the ability to produce consistent, quality stud welds is essential.