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Can I Weld Aluminum to Steel?

Q – Can I weld aluminum to steel with the GMAW or GTAW welding process?

A – While aluminum can be joined to most other metals relatively easily by adhesive bonding or mechanical fastening, special techniques are required if it is to be arc welded to other metals such as steel. Very brittle intermetallic compounds are formed when metals such as steel, copper, magnesium or titanium are directly arc welded to aluminum. To avoid these brittle compounds, some special techniques have been developed to isolate the other metal from the molten aluminum during the arc welding process. The two most common methods of facilitating arc welding of aluminum to steel are bimetallic transition inserts and coating the dissimilar material prior to welding.

Bimetallic Transition Inserts: Bimetallic transition materials are available commercially in combinations of aluminum to such other materials as steel, stainless steel and copper. These inserts are best described as sections of material that are comprised of one part aluminum with another material already bonded to the aluminum. The method used for bonding these dissimilar materials together, and thus forming the bimetallic transition, are usually rolling, explosion welding, friction welding, flash welding or hot pressure welding, and not arc welding. The arc welding of these steel aluminum transition inserts can be performed by the normal arc welding methods such as GMAW or GTAW. One side of the insert is welded steel-to-steel and the other aluminum-to-aluminum. Care should be taken to avoid overheating the inserts during welding, which may cause growth of brittle intermetallic compounds at the steel-aluminum interface of the transition insert. It is good practice to perform the aluminum-to-aluminum weld first. In this way, we can provide a larger heat sink when the steel-to-steel welding is performed and help prevent the steel aluminum interface from overheating. The bimetallic transition insert is a popular method of joining aluminum to steel and is often used for producing welded connections of excellent quality within structural applications. Such applications

as attaching aluminum deckhouses to steel decks on ships, for tube sheets in heat exchangers that have aluminum tubing with steel or stainless steel tube sheets, and for producing arc welded joints between aluminum and steel pipe lines.

Coating The Dissimilar Material Prior To Welding: A coating can be applied to steel to facilitate its arc welding to aluminum. One method is to coat the steel with aluminum. This is sometimes achieved by dip coating (hot dip aluminizing), or brazing the aluminum to the surface of the steel. Once coated, the steel member can be arc welded to the aluminum member, if care is taken to prevent the arc from impinging on the steel. A technique must be used during welding to direct the arc onto the aluminum member and allow the molten aluminum from the weld pool to flow onto the aluminum coated steel. Another method of joining aluminum to steel involves coating the steel surface with silver solder. The joint is then welded using aluminum filler alloy, taking care not to burn through the barrier layer of silver solder. Neither of these coating type joint methods are typically depended upon for full mechanical strength and are usually used for sealing purposes only.

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