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Questions and comments

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More on Welding

A former acquaintance sent me an e-mail after reading my article "Welding Concurrent with Metal Stamping." As I stated in the piece, I use welding in stampings, although I don't know the technicalities thereof.

Lee Warncke, however, possesses expertise and experience necessary to comment, and a synopsis of his letter follows. He has my gratitude for the information and for allowing it to be passed on.

Hi, Larry:

I was reading your article during lunch today and thought I would give you some feedback from experiences, in particular regarding process control parameters required to make acceptable resistance welds.

The biggest variable that must be controlled in any type of (resistance weld), that is, spot weld, projection weld, flash weld, end flash butt weld and the like, is current density at the weld interface.

The major variables for current density are:

- Variance of line current (mostly a problem during peak power demands in the summer).

- Electrode geometry, and more importantly, the change (mushrooming) of the electrode faces. Primary causes for mushrooming are too soft an electrode material, too high a welding pressure (load), too small an electrode contact face, and most importantly, too high a welding current. These conditions cause excessive heat buildup and softening of electrode tips.

- Weld current shunt effects are caused by welds being too close together, multiple welds within one electrode or shunting through part contacts other than where the weld is supposed to occur.

Surface contaminants can act as an insulator and result in a bad weld.

- Reaching and maintaining a steady state temperature of electrodes through constant cooling methods is recommended.

The actual process sequence in resistance welding consists of three parts:

- 1) Electrode contact and squeeze time at pressure (load),

- 2) Weld cycle,

- 3) Hold time at load required for metal to go from a liquid state to solid and develop enough strength to prevent hot tears.

Weld nugget testing should be performed using a shear method, if possible.

As far as the weld type with the least process variables, I would recommend that a project weld be used that will define clearly the current density within the pan, and use slightly larger flat-faced electrodes made of a CDA alloy C15760, which can withstand higher temperatures and loads. This will take care of the mushrooming effects. Then, set welding parameters to run on the upper limits of power, since current density always will decrease, never increase.

Another variable worth mentioning is the result of excessive weld temperature and high pressure (load). This results in electrode sticking, because finite diffusion bonding occurs at the electrode surfaces and those of the part.

And finally, like any other tool, scheduled electrode maintenance ideally is determined using SPC or similar methods. A good rule of thumb in resistance welding is to fix it at regular time intervals, whether it is required or not.

Regards, Lee A. Warncke

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