Electrode Force Control for Foot and Air Actuated Weld Heads

GENERAL:

There are many variables associated with the resistance welding process. The three primary variables are weld current, weld time, and electrode force. Secondary variables include, but are not limited to: electrode materials, electrode face size, polarity, material quality, and material composition. When attempting to optimize the resistance welding process, many technical articles tend to focus on weld current and time to the exclusion of electrode force and the secondary variables. This Nugget will explain the importance of force control in production manufacturing environments.

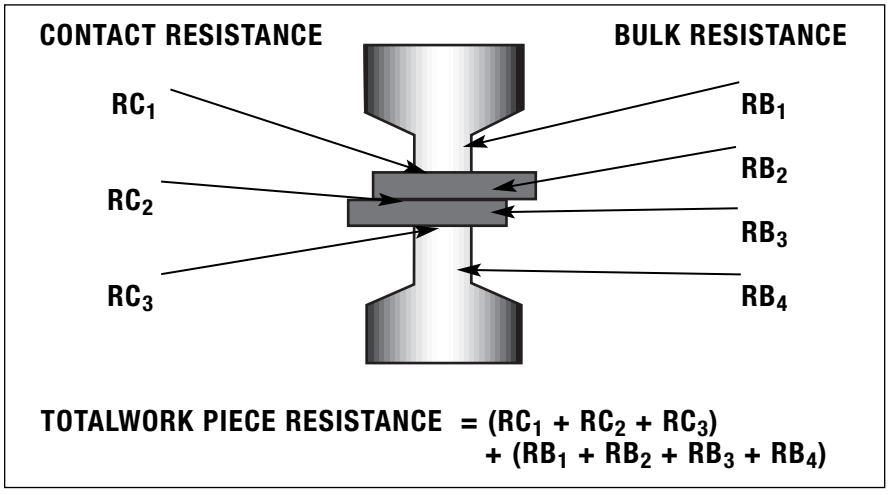

Figure 1: Contact and bulk resistance in an opposed electrode configuration.

BACKGROUND:

The heat generated at the weld is greatly affected by the electrical resistance of the work pieces. The total resistance of the work pieces is the sum of the bulk and contact resistance values (Figure 1). Bulk resistance values are a direct result of the materials used and are not affected by electrode force prior to the application of weld current. On the other hand, contact resistance values are directly affected by electrode force. Low force results in high contact resistance. High force reduces the contact resistance.

WELD HEAT VS. ELECTRODE FORCE

The heat generated in a resistance weld is represented by the formula: Q = I2Rt, where, Q = heat generated; I = weld current; R = work piece resistance; and t = weld time. Using this formula, the weld heat (Q) will increase in direct proportion to the work piece resistance (R) if the weld current (I) and weld time (t) remain constant. Because of this, lower force settings typically result in hotter welds and higher force settings result in cooler welds.

PROCESS CONTROL PROBLEMS

Given the precision of weld current and time control available in power supplies made by AMADA WELD TECH and other manufacturers, many production welding problems can be attributed to poor control over electrode force. Problems associated with inconsistent welding force can often be traced to: a) incorrect firing force adjustment, b) lack of operator training on foot actuated weld heads, and c) incorrect air regulator adjustment on air actuated weld heads.

To increase production rates, some operators of foot actuated weld heads press the foot pedal as rapidly and as hard as possible. With air actuated heads, the air pressure is often increased to maximum settings to increase production speed. Both of these process errors cause the moving electrode to severely impact the weld parts, resulting in excessive force ringing, over force, and cold welds.

FIRING FORCE VS. WELDING FORCE

Ideally, the welding force (actual force applied during the weld) should be no more than 5% above the firing force (force required to close firing switch). Figure 2 represents a plot of Electrode Force vs. Time for two different operators using an AMADA WELD TECH Model 80F Weld Head. In this example, the firing force has been adjusted to 4.75 lb.

The firing force is consistent regardless of the operator, but the rapid, hard actuation by Operator 1 results in a cooler weld due to the resulting higher welding force. The proper actuation by Operator 2 results in a hotter, more consistent weld, since the welding force is very close to the firing force.

The same problem can occur with air actuated weld heads. If the air pressure regulator is set too high, the welding force will be much greater than the firing force.

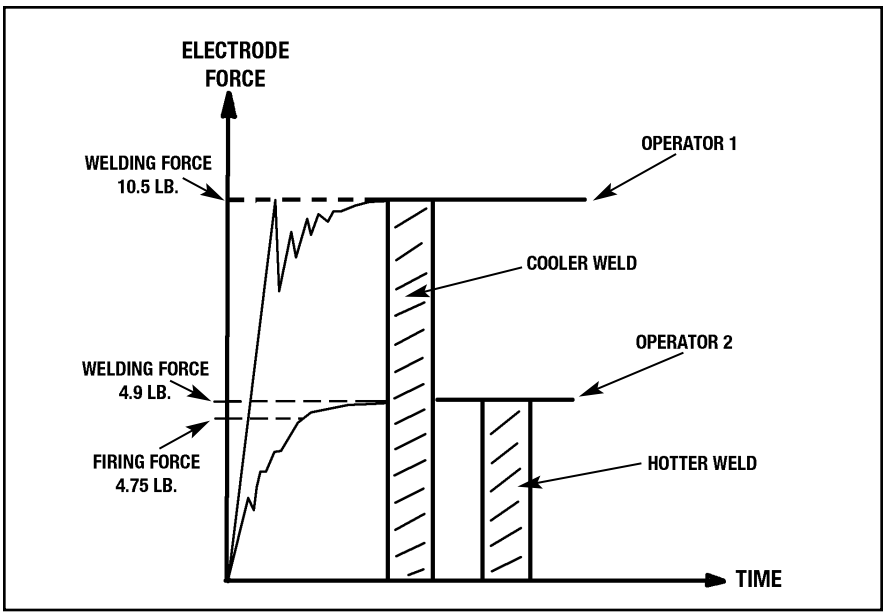

Figure 2: Electrode Force vs. Time for two different operators.

SUMMARY:

Force control is equally as important as current control for consistent generation of weld heat. An equivalent amount of attention should be given to each in the development, optimization and control of the welding process. For foot actuated weld heads, the operators should be trained to apply just enough force to trigger the welding power supply. This will result in more consistent, reliable welds. For air actuated weld heads, the regulators should be set to provide just enough air pressure to trigger the power supply.

For simplified set-up and operation of air actuated heads, EZ AIR® versions of AMADA WELD TECH weld heads are recommended. EZ AIR technology eliminates the over force problem associated with improperly adjusted air regulators by closing off the input air when the firing force is reached. EZ AIR heads have just two adjustments: down speed and firing force.

The use of a force gauge is highly recommended when setting up any weld head. Detailed set-up and operating instructions can be found in the User's Manuals for all foot and air actuated AMADA WELD TECH weld heads. For more information about weld heads, visit our website or contact AMADA WELD TECH Applications Engineering.

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