RESISTANCE WELDING EQUIPMENT & SUPPLY CO.
2045 EAST 46th STREET
Phone: 317-251-9406
Fax: 317-251-9407
INDIANAPOLIS, IN 46205-1472
wesco@iquest.net

Resistance Welding Force Issues

A God Weld = a proper combination of four variables:
Current + Time + Force + Electrode Diameter.

Pressure change is important because:

A. It forces the material to welded to intimate contacts.
B. It tends to break through films found on surface layers of the materials to be welded.
C. It presses the sheets to be welded together and restricts the passage of current to this area.
D. It reduces the formation of porosity and cracks in the welded area.
E. A smaller force maintains a low value of contact resistance between the welding tips and sheets to be welded, reducing the tendency of sticking or alloying of the electrodes to materials being welded.

The influence of force on the quality of the spot welds is important. The force supplied to the work to be welded, the method of application, and the inertia of the moving parts, will greatly influence the quality of the spot weld.

The nature and change of the contact resistance during welding, is the complex phenomenon involving such factors as the physical properties of the surface films, persistence of the pressure application, and the variations of the physical properties of the metal and film surfaces with elevated temperature,

As the force is increased, the contact resistance decreases, and in accordance with the heat formula for a given condition of the materials being welded, this decrease in resistance will require a greater amount of current to develop the same amount of heat in the same time interval. The decrease in resistance with increased pressure will allow more current to flow. It might appear desirable to decrease the force and thus increase the resistance, enabling the use of a lower current consumption. However, the use of a low force is conductive to several undesirable features. A low pressure may cause sparking and sticking between the electrodes and sheets, resulting in rapid electrode deterioration and unsatisfactory appearance of the spot weld. It may not produce sufficient forging pressure to prevent porosity or cracks in the weld area too. Another factor is a lower tensile strength of the weld.

Resistance Welding Force Issues (continued)

The spot welding of low carbon steels has many variables and is dependent upon the thickness of the thinnest outside pieces. The changes in electrode force, weld time, and weld current, are quite large. For instance, the welding of a standard piece of SAE 10-10 low carbon mild steel, .032 requires a net electrode force of 400 lbs., with a recommended weld time of 8 cycles and with a welding secondary current of 8000 amperes. The minimum weld spacing again is quite important with a recommended spacing minimum of ½ inch for .032 of mild steel. As an objective comparison, the .109 of 10-10 mild steel required 1600 lbs., of net electrode force and the weld time now has increased to 23 cycles, and the welding current has increased to 17500 secondary amperes.

From this, it is seen that a good weld must necessarily consist of changes in current, time, and pressure, as the material thickness increases. Any attempt for a compromise of any of the three variables would result in something less than might be desired for a good structural weld. Following the charts for the secondary amperage necessary to raise the BTU input of the material being welded is quite necessary. The amount of time that this current is supplied to the material is also important. From the above, it shows that the equation heat, plus time, plus pressure, equals a good weld.

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Visit us on the World Wide Web at: www.spotweldequip.com