

## Compensating for Varying Material Conditions in Resistance Welding

### GENERAL:

Unitek Equipment's advanced weld heads and closed-loop power supplies provide exceptional control over the force and energy variables in resistance welding. In addition to controlling these variables, consistent part placement and material control are required to achieve consistent welding results.

Although inspection and control procedures are used to eliminate the majority of weld material problems, it is not uncommon to see large variations in oxide levels and plating thickness on parts to be welded. To address these varying material conditions, and help avoid inconsistent welding results, the "Active Part Conditioner" (APC) feature, now standard on all Unitek Equipment HF25 welding power supplies, should be used.

### BACKGROUND:

In order for a resistance weld to occur, surface oxides must first be displaced, and a current path established. The first pulse in a dual pulse weld is typically used to displace oxides and break through plating. Since surface oxides and platings can vary from part to part, the amount of first pulse energy required to establish the current path may vary from weld to weld. Varying oxide levels can also cause the weld heat to vary in magnitude because of variations in the electrode-to-part

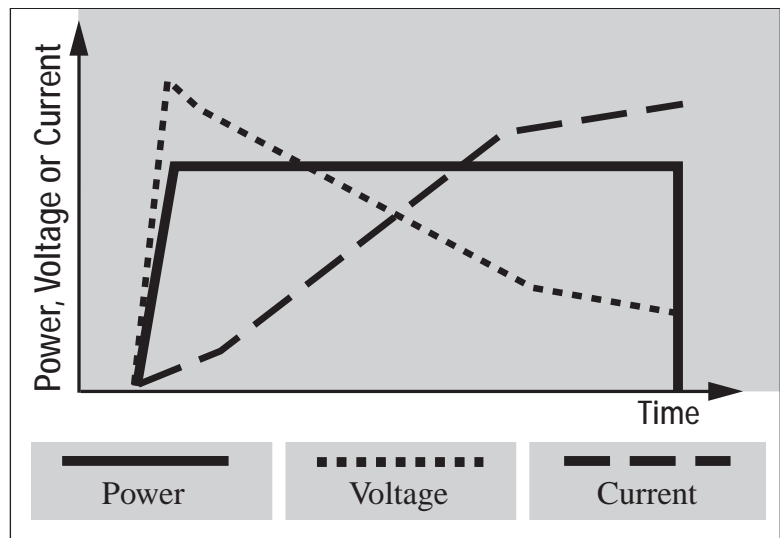


Figure 1: Constant Power Pulse

and part-to-part resistance values. The APC feature automatically adapts the first pulse energy to the varying condition of the parts.

### THEORY OF OPERATION:

Both the constant current and constant voltage feedback modes are limited in their ability to cope with varying levels of plating and oxides. When constant current is used on heavily oxidized parts, the power supply ramps the voltage to very high levels in order to achieve the initial current flow. The rapid input of current, along with the high voltage level is likely to cause weld splash, especially with round parts. Constant voltage is also not ideal for this purpose, as the voltage may not reach sufficient levels to break through heavy oxides or plating.

Constant power is ideal for this purpose (figure 1). In any electrical circuit, power is defined as the product of current and voltage. When welding in the constant power mode, the voltage is initially high, since current flow is restricted by the oxides. As the oxide layer breaks down, more current flows and the voltage level drops. Weld splash is avoided, since the current and voltage are never simultaneously at high levels.

APC utilizes the benefits of constant power in the first pulse of a dual pulse weld. In addition, it terminates the first pulse energy when a user set current limit is reached (see figures 2 & 3 next page). Since the rise in current is an indication that the oxide is breaking down, APC assures that each and every part has established a

current path, and is ready to weld. The second pulse, which is usually set for constant current or constant voltage, is then used to achieve the weld.

dized parts will take longer to condition than clean parts. The first pulse should be programmed to allow enough time for the current to break through even

power level should be decreased. If the current does not rise sufficiently, the power level should be increased.



Figure 2: Dual Pulse Weld with First Pulse Current Limit



Figure 3: First Pulse Terminates when Current Limit is Reached

When programming the second pulse, an upslope may still be required to avoid weld splash. Constant current should be used for welding flat parts, and constant voltage should be used for welding wires or other round parts.

#### FIRST PULSE PROGRAMMING:

The time required to break through the oxide layer will vary from part to part. Heavily oxi-

the most heavily oxidized parts. The level of power programmed in the first pulse will depend greatly on the size of the parts, electrodes used, and welding force. The HF25's internal monitor should be used to observe the current waveform during the first pulse. The current waveform should start out low, increase dramatically, and then level out. If the current waveform rises too rapidly, or weld splash occurs, the

The current waveform flattening out is an indication that the resistance has stabilized and the parts have come into closer contact. The current limit should be set at the level just before the waveform flattens out. The purpose of the first pulse is to displace the oxides and break through plating. The second pulse should accomplish the weld.

If the first pulse achieves anything more than a tack weld, the power level or current limit should be reduced.

#### SUMMARY:

The resistance welding process calls for consistency of energy, force, part placement and materials. The presence of heavy oxides and plating inconsistencies can have a negative effect on weld quality. Unitek Equipment's HF25 with APC can be used to help cope with these problems as it consistently displaces the surface oxides and establishes the current path prior to welding.

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