

The Importance of Squeeze Time in Resistance Welding

GENERAL:

Controlling the electrode force is a critical part of successful resistance welding. Repeatable weld force provides for consistent welds. For this reason, all AMADA WELD TECH weld heads include a standard force-firing feature that initiates the power supply when a preset electrode force is reached. In addition to force firing, a sufficient amount of squeeze time, typically 150 milliseconds (9 cycles @ 60 Hz), is required to allow the weld head to settle prior to the application of weld current.

BACKGROUND:

The heat generated in a resistance weld is represented by the formula: $Q = I^2Rt$, where, Q = heat generated; I = weld current; R = work piece resistance; and t = weld time. Electrode force affects the work piece resistance (R), which directly affects the heat generated at the weld (Q). An increase in force reduces the work piece resistance (R), resulting in less generated heat (Q), if the weld current (I) and weld time (t) are held constant.

ELECTRODE FORCE PROFILE:

Figure 1 represents a plot of electrode force vs. time for a AMADA WELD TECH Model 80A (20 lb.) pneumatic weld head. In this example, the firing force has been adjusted to 10 lb.

When the electrode first contacts the work piece, an initial impact force occurs. This is followed by an unavoidable “force ringing” which starts out high and gradually decreases in amplitude as the electrode force builds up to the firing force. The amplitude of the impact

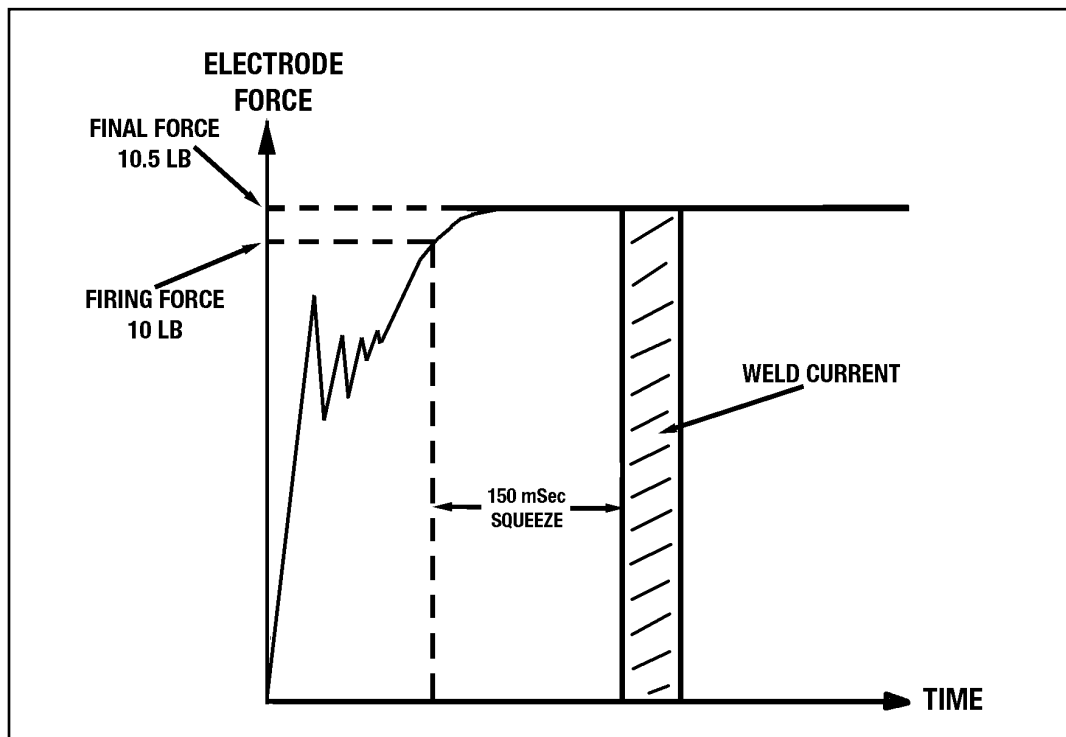


Figure 1: Electrode Force vs. Time for Model 80A weld head

force and degree of ringing are primarily affected by electrode down speed. The faster the down speed, the greater the impact force and ringing. In the example shown in Figure 1, the down speed of the electrode has been carefully adjusted to minimize the impact force and ringing, while still allowing for a fast production rate. Note the difference in firing force and final force. If the weld current is initiated immediately after the firing force is reached, the actual welding force could be anywhere between the firing force and final force. Adding squeeze time to the weld schedule ensures consistency in the welding force since the electrode force will have stabilized by the time the weld current is delivered.

EXCESSIVE IMPACT FORCE AND RINGING:

In an effort to increase production rates, some operators of air actuated heads increase the electrode down speed to a point where excessive impact force and force ringing occur. An example of this bad practice is shown in Figure 2.

If the weld current is initiated immediately after the firing force is reached, the electrode force will still be ringing, and the actual welding force will be inconsistent. Again,

adding squeeze time to the weld schedule assures that the weld head has settled and the welding force is stable.

SUMMARY:

Changes in electrode force can greatly affect the amount of heat generated in a resistance weld. Force fired weld heads are highly recommended, since they ensure that a preset electrode force is reached before the power supply is initiated. In combination with force firing, squeeze time should be programmed into the welding power supply to allow enough time for the electrode force to stabilize. In the case

of a properly adjusted pneumatic weld head, squeeze time eliminates the problems associated with differences between the firing force and the final force. If a weld head is improperly adjusted, with the down speed set too fast, excessive impact force and ringing can occur. In this case, squeeze time permits the weld head to settle prior to the application of weld current. In most cases, a squeeze time of 150 milliseconds is sufficient to ensure consistent weld force.

For more information regarding electrode force control, refer to Nuggets Volume 2/No. 1, May 1999.

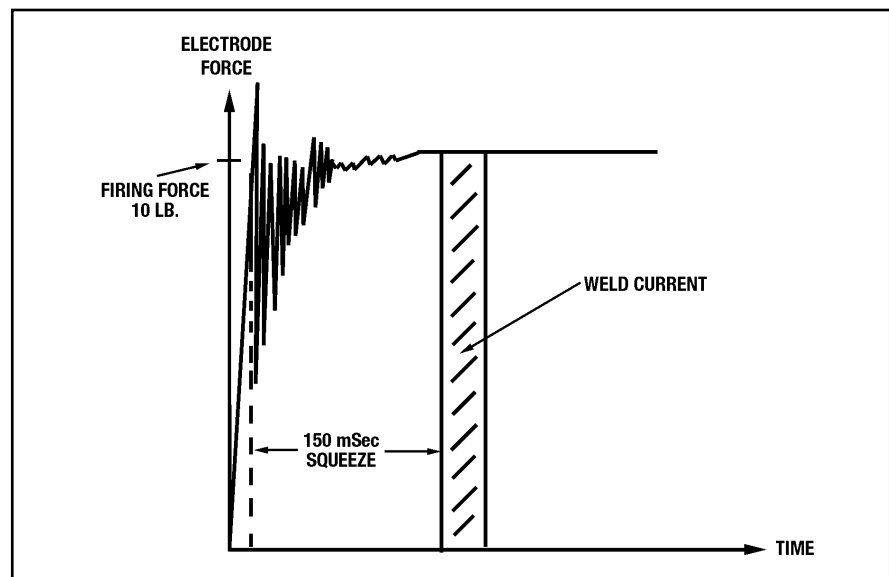


Figure 2: Electrode Force vs. Time for an improperly adjusted weld head