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World Leader in Precision Metals Joining

Putting Active Part Conditioner (APC) to Work

GENERAL:
It is not uncommon for parts that are resistance welded to have varying levels of oxidation on their surfaces, which changes the contact resistance from part to part. Since weld heat is directly proportional to contact resistance, varying oxide levels can lead to inconsistent heat generation and poor welding results. The Active Part Conditioner (APC) feature, is standard on Unitek Equipment models UB25, DC25 and HF25, is an effective tool for overcoming varying oxide levels on parts.

BACKGROUND:
Surface oxides can occur for many reasons. Oxides are formed when metals are exposed to air. Parts that are stored for long periods of time can have excessive oxides on their surfaces. Sometimes, the oxidation can be attributed to previous steps in the manufacturing process. When oxidation is present, welding results can vary. Spending valuable production time and resources to clean the parts prior to welding is normally not a practical solution.

APC uses the first pulse of a dual pulse weld to break through oxide layers and establish a current path. The second pulse welds the parts. APC is unique in that the first pulse automatically adjusts to the oxide level of the parts. The advanced user interface of the UB25, DC25 and HF25 allow for easy programming of the APC function.

THEORY OF OPERATION:
APC uses a constant power first pulse to break through surface oxides. In a constant power pulse, the voltage starts out high and the current starts out low because the initial workpiece resistance is high. The current increases as the contact resistance breaks down. The current will normally level off after a good current path has been established. APC is programmed to shut off the first pulse when a predetermined current level is reached, allowing the second pulse to generate heat and accomplish the weld. The first pulse “conditions” the parts by consistently breaking through the oxide layer. The time required to break through the oxides will vary from part to part. Heavily oxidized parts will take longer to condition than clean parts. The first pulse is programmed to allow enough time for the current to break through even the most heavily oxidized parts.

PROGRAMMING APC:
The first step in programming APC is to determine the constant power level for the first pulse. Different parts will require different power levels to start: smaller parts will require less power and larger parts require more power. The purpose of the first pulse is to break through the oxide layer and establish the current path, not to weld the parts.

If the initial power level for the first pulse is not known, start with a very low setting of 0.100 kW for 9 milliseconds. Use 150 milliseconds of squeeze time and 100 milliseconds of hold time. Do not program upslope and downslope. Program the second pulse for 0 milliseconds (See Figure 1).

Figure 1: Initial Power Pulse

Fire the pulse through several sets of parts. Press the “ENERGY” button to view the monitor screens. Look at the resistance, voltage and current graphs. Resistance should start out high and drop down quickly. Voltage should also start out high and slowly decrease. Current should start out low and increase. If the current does not rise quickly enough, a higher power setting may be required. Return to the RUN screen and adjust the power level up in 0.100 kW steps. Use the current monitor to determine the proper setting. The current should come up

TECHNICAL APPLICATION BRIEF

Figure 2: Monitored Current Graph

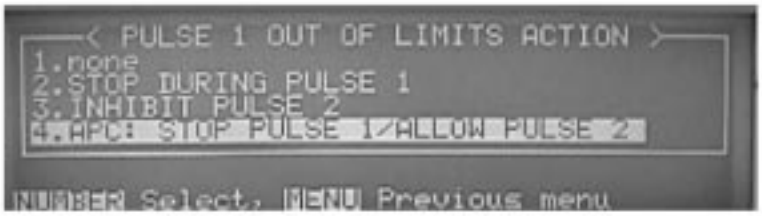

Figure 3: Choose Out of Limits Action

Figure 4: First Pulse Terminates when Current is Reached

and level off in 4-6 milliseconds. If the current comes up too fast, the power setting is too high. If the current does not level off, or comes up too slowly, the power setting is too low. Experiment with different power settings until the current graph looks acceptable and the parts are just starting to stick together (See Figure 2).

The current limit can now be established. Program the upper current limit to the level just before the waveform flattens out. Press the COOL button to program the action for reaching the current limit. Choose "4. APC: STOP PULSE 1/ALLOW PULSE 2" (See Figure 3).

Fire the pulse through both heavily oxidized and clean parts. The pulse should terminate in 3-7 milliseconds for all parts. Make adjustments to the power setting and current limit as appropriate.

Add 2 milliseconds of cool time. Program the second pulse as normal to do the weld. Add upslope to the second pulse if weld splash occurs. The second pulse can be programmed for constant current, voltage or power based on the part and process challenges of the application.

Make several welds on both heavily oxidized and clean parts. Verify that the first pulse terminates when the current limit is reached (See Figure 4).

SUMMARY:
APC is an easy to use, effective tool for combating the problems associated with surface oxides. APC consistently displaces surface oxides resulting in increased yields and less variation for many resistance welding applications.

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