Spot Welding Analysis

Resistance Meter RM3545 and Memory HiCorder MR8870

Increasingly complex electrical equipment such as automobiles and robotics are comprised of many moving parts. To ensure that frames and workpieces are joined appropriately, the spot welding must be of top quality. On the other hand, production lines are constantly being pressured to improve throughput and reduce downtime. A quantitative method to verify the integrity of spot welding is fully supported by the Hioki RM3545 Resistance Meters paired with the MR8870 Memory HiCorder.

Spot welding is a very common process used to join two or more pieces of metal together. One of the main applications is in the automotive manufacturing industry, where sheet metal is welded to form the various frames of a car. The process requires the workpieces to be held together by two opposing electrodes with a specific level of force while an appropriate amount of electrical current is passed through the electrodes. There is natural resistance to the flow of current via the workpieces at the pressure point, which creates heat to form molten metal between the pieces of metal, eventually forming a "weld nugget" and connecting the two workpieces at that joint.

To measure, the RM3545 is connected to the two electrodes, and upon applying the prescribed force without any current flowing, the customer records the resistance change using the MR8870. This is accomplished thanks to the fine 1 μΩ resolution of the RM3545 and the quick 10ms sampling of the MR8870.

Indeed, the RM3545 can be used by itself if a PLC system is available to facilitate the control and data acquisition; however, by taking advantage of the meter's D/A output function, the customer was able to find an easier solution by pairing it with the economical MR8870 to capture the quickly changing low resistance values. The system delivered clear data regarding the differences in resistance as well as the time it took for the waveforms to stabilize when the workpiece changes, enabling the customer to maintain quality, reduce downtime, conduct preventive maintenance, and improve throughput.

Spot welding production lines are maintained not only by measuring the resistance between electrodes but also by managing the squeeze force of the electrodes, the flow of current, as well as the temperature of the water in cooling systems, which all necessitate test and measurement equipment. In addition, spot welding is not limited to the automotive industry. Any product that is made of or uses metal, for example household appliances, battery packs, even jewelry, will often be manufactured using this technique. Companies that strive to be competitive by improving quality and reducing defects should be concerned with the good operating condition of their spot welders.

In order to maintain production quality, a large automotive frame manufacturer sought to analyze the contact area of the weld based on physical changes to the electrode, such as deformation or wear and tear, or to the workpieces, such as thickness or type of metal, using the RM3545 Resistance Meter and the MR8870 Memory HiCorder.

The contact area between the electrode and sheet metal is a very important parameter contributing to the quality of a weld, and is in direct correlation to the electrodes’ resistance. As such, you can analyze variations in the contact area by looking at the variations in the electrode resistance. It is expected that the smaller the resistance, the larger the contact area.