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Resistance Spot Welding of Zinc Coated Steels*

The resistance spot welding of zinc coated steels have long caused problems for fabricators. Fortunately, those problems have been addressed by major steel producers, research centers and automotive manufacturers who have developed simple but, effective solutions. The basic problem encountered in welding zinc coated steel, is one of generating sufficient heat to weld steel without drastically disturbing the zinc. Unfortunately, zinc has a melting point of about 30% of that of steel. Also, zinc will boil at about 60% of the melting point of steel, further complicating the welding process.

To help further compound the problem, zinc will amalgamate with copper under heat and pressure, forming brass. Since resistance welding is a method of joining metals by the application of heat and pressure using copper electrodes; a problem is created.

The problem, of course, is that when sufficient heat energy is applied to the weld area of zinc coated steel to join the steel, the zinc will be evaporated from the surface of the steel. Witness the white, zinc oxide ring that forms around the weld area. During this time in the weld cycle, the evaporation of the zinc also leaves an open secondary condition between the electrodes of the welding machine and the work before the pressure system can "follow up" to close the gap left by the missing zinc.

Essentially, the electrodes come down "hot" on the steel, causing both zinc and parent metal expulsion. The increase in heat and pressure also begins to cause the zinc to amalgamate to the copper electrodes. The brass on the copper now increases the surface contact resistance of the electrodes to the work for the next weld, which increases the heat, which causes more zinc "pick-up", which increases the resistance, which increases the heat, which increases the.... As this process continues, sooner or later, and usually sooner, the electrodes begin to destroy themselves, producing continually poorer quality welds.

One solution, which has been used, is slope control. Electronic "up-slope" was introduced to the industry in about 1953, providing a means of "programming", the amount of heat energy that could be applied to a weld as a ramp function, by automatically phase width modulating the firing point of the current with respect to voltage from a smaller to a larger amount. Slope controls can be effectively used as a means of reducing the initial heat energy application to the work in a resistance welding process, and then "sloping" the amount of heat energy applied, to higher value, with respect to time. This reduces the tendency of the zinc to alloy itself to the face of the copper-alloy electrodes.

Zinc coated steel normally require longer weld times than equal thicknesses of clean uncoated mild steel. Unfortunately, longer weld times can reduce electrode life due to heating and mushrooming of the electrode.

Pulsation welding is often recommended as a means to improve electrode life and produce better welds in zinc coated steels. A pulsation control function permits the operator to take a longer single impulse weld time of perhaps 45 cycles duration (45160 of a second) and break it into 3 pulses; each pulse having 15 cycles duration and placing 3 or 4 cycles of cooling recovery time between each pulse. Although very brief, these cooling intervals between pulses do help to keep the electrodes cooler and extend their life.

Pulsation welding also helps to produce a better weld, as the zinc coating tends to flow away from the immediate weld area due to the weld force applied by the electrodes. The heat affected weld zone retains some of its zinc protection and weld splash is reduced.

Prior to the introduction of microprocessor-based welder controls, up-slope and pulsation functions were expensive options, often not available from some welder manufacturers. The use of both up-slope and pulsation functions in the welding schedule have permitted fabricators to overcome the problem of welding zinc coated steels. In addition electrode manufacturers have now developed new alloys which provide improved electrical conductivity with high hardness to resist wear and which reduce the affinity to pick-up or alloy with zinc.

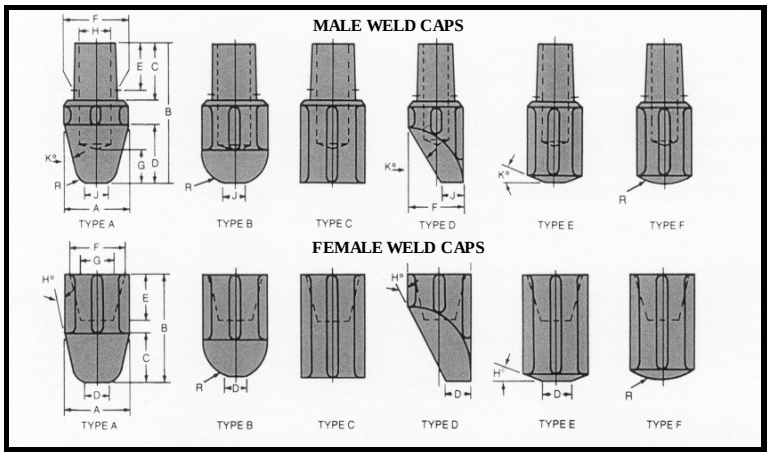
*Courtesy of ENTRON® Controls
FFA #15

NITRODE & Z-TRODE COLD FORMED WELDING CAPS

The Nippert Company has developed and refined a complete selection of cap shapes and styles and materials for your resistance welding needs. Shown below are the standard male and female cap designs. Nippert NITRODE and Z-Trode welding caps will meet your operational needs and your highest quality standards.

Resistance Welding Equipment & Supply Co. stocks a large supply of both male and female Nippert weld caps. As you will see by the information provided below, these welding alloys have been proven to out weld class 2 copper caps time and again. Nippert is committed to setting the standard in manufacturing methods and in quality control for its welding electrodes. Nippert maintains complete statistical process control (SPC) over every aspect of electrode manufacturing. Alloys are certified in their own metallurgical laboratory.

But perhaps the best testimony to Nipperts manufacturing quality comes from the customers. Nippert has received special recognition for its consistent quality from Ford, General Motors and Chyrsler.



We had the distinct pleasure of touring the Nippert facility and can attest to their claims.

If you have been thinking of trying out a new alloy. Contact our office and we will send you samples of either the NITRODE or Z-TRODE alloy welding cap of your choice at no charge. Test them on your own application. We feel you will find these caps will last longer then any standard Class 2 weld cap.

NITRODE™ Cold Formed Dispersion-Strengthened "Best Quality" Cap Electrodes

NITRODE is the most cost-effective cap electrode available for all your resistance welding applications including the heavier coated steels. Composed of CDA Alloy C15760 dispersion-Strengthened copper cold-formed by Nippert, Nitrode has consistently outperformed RWMA Class 2 Chromium copper electrodes in anneal resistance, conductivity, service life and maintenance costs. NITRODE material melts at 1700 Deg F! Class 2 melts at 930 Deg F

LONGER WELDING LIFE	NITRODE resists annealing and last longer than any class 2 electrode.
NONSTICKING CHARACTERISTICS	NITRODE permits no-stick welding of galvanized steel and other coated metals.
RESISTS MUSHROOMING	NITRODEs resistance to mushrooming requires only one fourth the dressing frequency of class 2 electrodes, minimizing line interruptions and rewelds.
WORKS ON ALL STEELS	NITRODE has demonstrated superior welding performance for a variety of steels, including high strength/low alloy, nitrogenized, low-carbon and zinc coated, galvanized and many others.
MORE COST EFFECTIVE THAN CLASS 2	In actual production tests at a major automotive assembly and stamping plant, NITRODE analyzed to determine maintenance savings, energy savings and increased life span. Overall, NITRODE proved significantly more cost efficient than class 2 electrodes.