



RESISTANCE WELDING EQUIPMENT & SUPPLY CO. FFA # 8

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Selection Of Spot Welding Electrodes

Spot welding is the most widely used resistance welding process. Spot welding electrodes are subjected to the most severe service of any current carrying member of the resistance welding process. These electrodes must transmit both the welding current and the welding force through the same area of contact, which is the weld area. By comparison projection welding and flash and upset butt-welding electrodes have an area of contact much greater than the weld area. Therefore, both current and force densities are considerable less. The high current densities that spot welding electrodes are called upon to carry can only be accomplished with effective water-cooling.

Selection of the proper electrode material is very important to assure correct current carrying capability. Some other factors, which affect spot welding materials selection, are resistance to electrode pick-up and sticking. Both are a result of overheating of the electrode and work piece. The severity of these conditions can be reduced through proper electrode selection and proper welding machine set-up. The goal of these changes or adjustments would be to arrive at the ideal interface temperature between the electrode and work piece.

Many alloys are now available to produce spot welding electrodes with each having its own advantages depending on the application. There are differences in the electrical conductivity, hardness (wear resistance) and annealing (softening) temperature of these materials. Of course, the ideal electrode material should have the compressive strength of steel and the electrical conductivity of silver, but no such material is available. Therefore, the application will dictate the importance of high conductivity versus electrode life and long service between dressings.

The following chart of COPPER ALLOYS & INFORMATION indicates that increased wear resistance (hardness) of alloyed copper is accompanied by lower conductivity. This suggests selection of electrode material in the classification, which has the least conductivity that will produce good welds on a given application, so as to take advantage of the greater wearing properties. The annealing (softening) temperatures of electrode materials, which are important to long electrode life, should also be considered. Most copper alloyed materials have annealing temperatures approaching 930 deg F. while the *dispersion strengthened materials have annealing temperatures as high as 1700deg F.

The welding machine is designed to furnish the electrical system, the mechanical system and a suitable control system. Then, it becomes the function of the electrodes to conduct the current and to withstand the high forces so as to maintain a uniform contact area and to insure the proper relationship between current, time and force. Care in the selection of the proper electrode is very important to achieve satisfactory welds. However, even with the best electrodes available good welds cannot be produced unless the machine is furnishing the correct welding current, weld time and weld force.

COPPER ALLOYS & INFORMATION - FOR SPOT WELDING

Alloy	RWMA Class	Hard	Elec. Cond & Desc	Use To Weld
ELCALOY	1	70B	90% CU + CADMIUM	ALUMINUM SPOT WELDING
CMW 3	2	83B	85% CU + CHROMIUM	CRS & GENERAL WELDING
CMW328 (ZIRCONIUM)	2	83B	85% CU + ZINC + CR	LIGHT GAUGE COATED GALVZ, ALUMINIZED ETC.
AMPCO 940	3	90B	45% CU + SI + NI	PROJ. WELD DIES, - MED.
CMW 100	3	100B	48% CU + BERYLLIUM	PROJ. WELD DIES, - HEAVY
10W3 ELCONITE	11	98B	45% CU + TUNGSTEN	FACING NUT TIPS, ETC.
100W MOLY	14	90B	30% MOLYBDENUM	COPPER BRAZING AND WELDS
NITRODE (GLIDCOP)	20	75B	85% * CU + AL	COATED MATERIALS HEAVY

QUICK REFERENCE GUIDE FOR SPOT WELD ALLOYS

GOOD	CMW 3	CLASS 2 ALLOY	CRS, GENERAL APPLICATIONS ETC.
BETER	CMW 328	ZIRCONIUM	LIGHT COATED ALLOYS, ALUMINIZED
BEST	NIPPERT	CLASS 20	HEAVY COATED ALLOYS, ROBOTS, ETC.

MATERIAL TO WELD	TIP ALLOY	SUGGESTIONS: / TIP / PRES / TIME
CRS STEEL	CLASS 2	POINTED NOSE, MED PRESS, SHORT TIME
HOT ROLL (SCALLY)	ZIRCONIUM	TRUNCATED, HI PRES, PULSATION ETC.
STAINLESS	CLASS 3	POINTED, HI PRES, SHORT TIME
GALVANIZED	ZIRCONIUM	POINTED, HI PRES, LONG TIME
GALVANIZED (HEAVY)	CL20 - NITRODE	TRUNCATED, HI PRES, LONG TIME
ALUMINIZED (LIGHT)	CL-2-ZIRCONIUM	TRUNCATED, HI PRES, LONG TIME
HSLA / HCLA	CL20 - NITRODE	TRUNCATED, HI PRES, LONG TIME
ALUMINUM	CLASS 1	RADIUS, LOW PRES, SHORT TIME
COPPER	CLASS 14 MOLY	FLAT, LOW PRES, SHORT TIME

DOHM and Cupal are acronym for dispersion – strengthened copper – aluminum powder metal alloys like Nitrode.

***DISPERSION STRENGTHENED MATERIALS:** These materials are primarily strengthened by blending a metal oxide with copper. Blending (mixing) can be accomplished by a number of mechanical and/or chemical processes. After mixing of the metal oxide with copper, the resultant dispersed material can be treated as follows:

1. COMPACTED UNDER PRESSURE AND/OR TEMPERATURE INTO SHAPES, BARS OR WELD CAPS.
2. SINTERED AT HIGH TEMPERATURE.
3. HOT WORKED.
4. COLD WORKED AS REQUIRED.

These alloys exhibit superior resistance to softening at temperature as high as 1700 degrees F with no loss in tensile strength. At room temperature and high temperature, they have electrical and thermal conductivity similar to pure copper. CDA C15760 Nitrode by Nippert is one of the most popular of these type alloys. DOHM is a similar type. For comparison, Class 2 alloys turn soft at 930 degrees F. Use Nitrode material for welding Galvanized or Aluminized materials, HSLA or HCLA and High Production runs.

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