

# COPPER BASE ALLOYS



SJ Smith Supply 319-324-5237, Fax 319-324-1336 (authorized distributor CMW Inc.)

Long electrode life is of paramount importance to the user of resistance welding equipment. Selection of the proper CMW alloy or combination of alloys will help to give improved weld strength and electrode life.

CMW electrodes are fabricated from alloys selected from the results of laboratory and practical field tests. For special problems, CMW engineers will make recommendations based on their years of experience.

## Typical Physical and Mechanical Properties of CMW® Copper Based Alloys

CMW ALLOY	Condition	Principal Elements	Class #	R.W.M.A. Alloy Number	Hardness Rockwell	Electrical Conductivity %I.A.C.S.	Ultimate Tensile Strength, psi	Elongation % in 2"	Permanent Softening Begins at	
									°C	°F
CMW® 28	Wrought**	Copper, Zirconium	1	1.15000	70 B	90	66,000	10	500	930
CMW® 3	Cast	Copper, Chromium	2	2.18200	70 B	80	50,000	20	500	930
	Wrought***									
CMW® 328	Wrought***	Copper, Chromium, Zirconium	2	2.18150	83 B	85	75,000	15	500	930
CMW® 353	Wrought	Copper, Nickel, Silicon, Chromium	3	3.18000	94 B	48	100,000	13	455	850
CMW® 100	Wrought	Copper, Nickel, Beryllium	3	3.17510	100 B	48	110,000	10	455	850
CMW® 73	Wrought	Copper, Beryllium	4	4.17200	38 C	23	170,000	4	375	710
ELKALOY® D	Cast	Copper, Aluminum	5	5.95300	92 B	13	85,000	15	620	1150
Copper	Cast	Pure Copper		—	30 B	95	25,000	50	200	390
	Wrought									
CMW® DSC	Wrought	Copper, Al <sub>2</sub> O <sub>3</sub>	20	—	75 B	85	54,000	25	800	1475

Note: All properties shown are TYPICAL and should not be used for specifications  
 \* Cold drawn bars up to 1" diameter  
 \*\* Cold drawn bars up to 5/8" diameter  
 \*\*\* Heat treated and cold drawn bars up to 1" diameter

## TYPICAL USAGE

**CMW® 28** material is recommended for spot welding of coated steels and high conductivity materials, excluding copper and silver.

**CMW® 3** material is recommended for spot and seam welding cold and hot-rolled steels and coated materials as well as current carrying shafts and arms, back-up bars for both resistance and arc welding and electrical current carrying structural parts and springs.

**CMW® 328** material is recommended for spot and seam welding cold and hot rolled steels. There is some evidence that CMW® 328 outperforms CMW® 3 material when welding coated or galvanized steels.

**CMW® 353** material is recommended for heavy duty offset holders, back-up bars, flash welding dies, current carrying structural members, shafts and bushings in combination with CMW® 3.

**CMW® 100** material is recommended for spot and seam welding stainless steel and high temperature heat resisting alloys requiring high weld forces, flash welding dies, back-up bars, projection welding electrodes, and high strength, high conductivity electrical components and springs.

**CMW® 73** material is recommended for flash welding dies, springs, electrical components, high strength back-ing material for brazed assemblies and wire guides.

**ELKALOY® D** material is recommended for butt and flash welding dies and clamps for cold rolled and stainless steel, current carrying structural parts, jigs and fixtures, pickling racks and baskets.

**CMW® DSC** material has exceptional resistance to deformation when welding, and is highly recommended as welding caps for welding coated and galvanized steels. It allows a stable start-up, and generally outlasts other cap materials when welding parameters are not carefully controlled. The material requires upset cold work to develop its properties, and is therefore only available as caps or cap blanks.

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ELKONITE® is the registered trade mark of CMW used to identify a group of metal compositions whose elements consist basically of the refractory metals tungsten, molybdenum and tungsten carbide combined with copper. Combinations of these elements produce dense, hard metals of superior wear resistance and strength at elevated temperatures, coupled with good thermal and electrical conductivity. The mechanical and physical properties of the ELKONITE® materials make them particularly suitable as the die inserts and facings for volume projection welding, flash and butt welding,

electrical upsetting, electroforging and mash welding applications.

ELKONITE® material is also used successfully as facing on spot welding electrodes where heat balance or mechanical wear resistance are required. The initial premium cost of ELKONITE® material is offset by lower production cost per weld due to long die life and less electrode dressing time. The high stability of ELKONITE® material insures uniform heating and prevents misalignment, resulting in a higher quality weld.

**Typical Physical and Mechanical Properties of CMW® Refractory Based Materials**

CMW GRADE	Type of Material	Class #	R.W.M.A. Group B Material	Hardness Rockwell	Electrical Conductivity %I.A.C.S.	Ultimate Tensile Strength, psi	Cross Breaking Strength psi
ELKONITE® 1W3	Tungsten-Copper	10	10.74450	77 B	53	63,000	110,000
ELKONITE® 3W3	Tungsten-Copper		—	90 B	50	75,000	130,000
ELKONITE® 5W3	Tungsten-Copper		—	95 B	48	85,000	140,000
ELKONITE® 10W3	Tungsten-Copper	11	11.74400	98 B	45	90,000	150,000
ELKONITE® 30W3	Tungsten-Copper	12	12.74350	103 B	41	98,000	170,000
ELKONITE® 3W53	Tungsten-Copper Alloy		—	105 B	30	120,000	180,000
ELKONITE® 10W53*	Tungsten-Copper Alloy		—	109 B	28	160,000	200,000
ELKONITE® TC5	Tungsten Carbide-Copper		—	94 B	45	70,000	140,000
ELKONITE® TC10	Tungsten Carbide-Copper		—	100 B	42	75,000	160,000
ELKONITE® TC20	Tungsten Carbide-Copper		—	37 C	30	85,000	180,000
ELKONITE® TC53*	Tungsten Carbide-Copper Alloy		—	47 C	18	150,000	220,000
ELKON® 100W	Tungsten	13	13.74300	39 C	30	150,000	200,000
ELKON® 100M	Molybdenum	14	14.42300	90 B	30	80,000	120,000
ANVILOY® 1150**	Tungsten-Nickel-Iron-Molybdenum		—	34 C	13	140,000	280,000

Note: All properties shown are TYPICAL and should not be used for specifications  
 \* Properties are in fully heat treated condition  
 \*\* Hardness is 56 HRA at 1475 °F (800°C)

**TYPICAL USES**

ELKONITE® 1W3 and 3W3 alloys are generally used for flash and butt welding die inserts where higher electrical and thermal conductivity is necessary and where a degree of malleability is desirable. These materials are also used for spot welding (as a radius faced electrode) low conductivity ferrous metals such as stainless steel.

ELKONITE® 5W3 and TC5 alloys are normally used for light duty projection welding dies where welding pressures are not extreme.

ELKONITE® 10W3 alloy is used for electrode and die inserts in most flash and butt welding dies and for projection welding dies where welding pressures are moderate. It is also used for light electrical upsetting, electroforging dies and seam welder bushing inserts.

ELKONITE® 30W3 and TC10 alloys are recommended for volume projection welding dies where the pressures involved are relatively high. Electrical upsetting of non-ferrous metals and low carbon steel is usually accomplished by the use of such ELKONITE® materials as die facings. Cross-wire welding of large, diameter wire and rod is accomplished with such ELKONITE® materials.

ELKONITE® 3W53 and 10W53 are heat treatable grades of ELKONITE® materials supplied in the fully heat treated condition. If silver brazed to a die backing, such ELKONITE® materials should be heat treated after brazing. These harder grades are used primarily for electroforging and electrical upsetting dies, where temperatures and pressures are comparatively high.

ELKONITE® TC20 and TC53 materials are extremely hard and wear resistant. ELKONITE® TC20 material, while somewhat difficult to machine, may be machined using carbide tipped tools. ELKONITE® TC53 material is a heat treatable grade of such high hardness that machining operations are impractical and the material must be ground. Such ELKONITE® materials are customarily used for special applications of electrical upsetting and electroforging.

ELKON® 100W is extremely hard and its ductility is relatively low. It cannot be machined but may be ground to the required shape. It does not alloy appreciably with nonferrous materials and is used for cross-wire welding of metals such as copper and brass. It is also used for electro brazing electrode material and for some electrical upsetting operations.

ELKON® 100M is used principally for electro brazing electrode material and for cross-wire welding of nonferrous metals. It is not as hard as ELKON® 100W material and may be machined or drilled to fit the parts to be joined. A typical application of this material, as an electrode, is the welding or brazing of braided or solid copper conductors to ferrous or nonferrous terminals, lugs or fittings.

ANVILOY® 1150 material is used in electro brazing applications where heat balance is important. The ANVILOY® 1150 material also has good anti-sticking qualities and good high temperature abrasion and hardness properties. The oxidation resistance of both materials is excellent up to 1100°F.