Engineered Materials Solutions
Wickeder Group

Conflex Conducting Spring Material Systems

(For Electro-Mechanical Springs and Formed Parts)

2014

CONFLEX CONDUCTING SPRING MATERIAL SYSTEMS

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EMS Conflex conducting spring materials of OFHC copper and steel are engineered to serve applications where solid copper, beryllium copper alloys and phosphor bronze alloys are used in a wide variety of current-carrying spring designs.

A metallurgical materials system is a combination of two or more metals inseparably bonded together to form a new material with properties not otherwise available. This systems approach to materials design results in one or more of the following advantages: reduced material costs, improved performance, simplified manufacturing process, and/or conservation of critical materials.

The synergistic properties achieved by the application of Conflex systems for current-carrying springs:

- Increased yield through lower density
- Reduced material thickness due to higher modulus of elasticity
- Lower cost
- Greater strength from steel component
- Greater flexibility through custom systems with ideal performance characteristics

(*Engineered Materials Solutions provides customer assistance in varied technical areas. Since EMS does not possess full access to data concerning all of the uses and applications of customers' products, responsibility is assumed by EMS neither for customer product design nor any infringements of patents or rights of others which may result from EMS assistance.)*

DESCRIPTION

Conflex 316: A high-strength current-carrying spring material having conductivity of 16% IACS and cold rolled spring properties superior to any cold rolled copper alloy. It is heat treatable to yield strength of over 20,000 psi and its 16% nominal conductivity is greater than phosphor bronze alloys and most cold rolled beryllium copper alloys. Low density provides more parts per pound and high modulus of elasticity permits the use of thinner strip than with a monometal.

Conflex 326: Similar to Conflex 316 but with 26% nominal conductivity, and heat treatable to a yield strength greater than 215,000 psi. It is roughly equivalent to beryllium copper 25 and 165 alloys.

Conflex 325S: Similar strength and conductivity o Conflex 326, but has weldability. It has 25% nominal conductivity and is work hardenable to over 160,000 psi yield strength in tension (greater in bending).

Conflex 545: As rolled tensile properties are superior to those of phosphor bronze, and its 45% IACS conductivity is equivalent to beryllium copper alloy 10. Its strength in bending is greater than in tension.

Conflex Custom Systems: Conflex material systems can be produced with virtually any desired combination of strength and conductivity, as a custom material.

COMPOSITION

SYSTEM	COMPONENTS BY RATIO	
Conflex 316	OFHC Copper	5%
	1065 Steel	90%
	OFHC Copper	5%
Conflex 326	OFHC Copper	10%
	1065 Steel	80%
	OFHC Copper	10%
Conflex 325S	301 Stainless	35%
	OFHC Copper	30%
	301 Stainless	35%
Conflex 545	OFHC Copper	2 ½%
	6150 Steel	28%
	OFHC Copper	39%
	6150 Steel	28%
	OFHC Copper	2 ½%

TYPICAL APPLICATIONS

Conflex composites have been specified for use in many current carrying spring designs, including: cantilever and simple beam loading flat springs, electrical contact blades, carrier strips, switch members, sliding contact fingers, pressure diaphragms, grounding strips, terminals, fuse clips.

The major product classifications served by Conflex include electrical controls, consumer appliances, automotive components and various electronic applications.

Composite springs are being utilized in designs which have been listed by Underwriters'' Laboratories and Conflex has been approved for use in several military applications.

TYPICAL MECHANICAL PROPERTIES, STRIP .020” THICK

CONFLEX	Condition	Tensile Strength kpsi	0.2% Yield Strength Kpsi	Elogation (% in 2”)	Hardness (Steel)	
					Vickers	Rockwell
316	Annealed	64-86	54-74	25-35	154-186	B81-92
	2 Nos. – Hard	94-120	85-109	6-9	237-277	C20-27
	4 Nos. – Hard	117-143	106-132	4-7	280-324	C27-33
	8 Nos. – Hard	138-168	129-157	2-4	311-369	C31-38
	Q & T (900°F)	150-180	131-159	5-9	364-416	C37-42
	Q & T (700°F)	193-227	174-206	4-7	454-516	C46-50
	Q & T (500°F)	221-259	202-238	3-5	573-647	C54-58
325S	Annealed	69-91	25-45	40-60	183-217	B91-97
	2 Nos. – Hard	102-128	76-98	20-30	300-360	C30-37
	4 Nos. – Hard	129-157	128-146	9-15	360-440	C37-44
	8 Nos. – Hard	148-178	136-166	5-8	455-545	C45-52
326	Annealed	58-78	48-68	25-35	154-186	B81-92
	2 Nos. – Hard	86-110	77-99	6-9	237-277	C20-27
	4 Nos. – Hard	105-131	95-119	4-7	280-324	C27-33
	8 No. – Hard	124-152	116-142	2-4	311-369	C31-38
	Q & T (900°F)	136-164	117-143	5-9	364-416	C37-42
	Q & T (700°F)	174-206	154-186	4-7	454-516	C46-50
	Q & T (500°F)	202-238	183-217	3-5	573-647	C54-58
545	Annealed	46-66	39-57	30-40	145-175	B78-88
	2 Nos. – Hard	79-101	70-93	7-10	234-273	C20-26
	4 Nos. – Hard	89-113	84-109	5-8	264-309	C25-31
	8 Nos. – Hard	97-122	92-117	3-5	297-341	C30-35
	Q & T (900°F)	102-128	88-112	6-10	373-427	C38-43
	Q & T (700°F)	126-154	107-133	5-8	454-516	C46-50
	Q & T (500°F)	145-175	121-149	4-6	534-606	C51-56

1. Cold-Rolled Temper Designations:

   Annealed = 0% Cold Reduction

   2 Nos. Hard = 21% Cold Reduction (Half Hard)

   4 Nos. Hard = 37% Cold Reduction (FullHard)

   8 Nos. Hard = 60% Cold Reduction (Spring Temper)

2. Intermediate Cold-Rolled Tempers also supplied.

3. Q & T (900°F) designates quenching and tempering heat treatment: figure in parentheses indicates tempering temperature. Conflex 316, 326, and 545 materials are not supplied as heat treated strip; heat treatment when necessary, is performed after parts fabrication.

4. The mechanical property data given above are typical values and are suitable for general engineering use only. Due to variations in composition and manufacturing process, they should not be used for specification purposes.

EMS Conflex materials systems are specifically engineered for conducting springs and formed parts used in electro-mechanical application such as switches, clips, terminals and various types of current-carrying blades. Conflex materials are not alloys, but systems of metals bonded inseparably together to provide a unique combination of elasticity, strength and electrical conductivity.

BONDING

The Conflex material systems consist of OFHC Copper and 1065 steel, 6150 steel or 301 stainless steel bonded together in a composite structure engineered to achieve specific performance objectives. Cladding is performed without the use of any intermediate adhesive, solder, or brazing material.

BONDED METALS OR ALLOYS

Both alloys and the Conflex metals systems seek to answer a basic manufacturing need for a material having the strength of steel and the electrical conductivity of copper. By the very nature, alloys such as beryllium copper & phosphor bronze represent a compromise solution in which mechanical strength must be sacrificed for conductivity, or vice versa, Conflex multimetal systems, by contrast, permit greater design flexibility through variations in the placement and ratios of the component metals. In the metals system each component metal retains all its distinctive properties, making I possible to provide unique combinations of strength, elasticity and electrical conductivity.

CONDUCTING SPRING COMPARISON

MATERIAL	Modulus of Elasticity (psi x 10^6)	Density (lb/in^3)
CONFLEX 316	23-26	.287
CONFLEX 326	20-23	.291
CONFLEX 325s	24-27	.300
CONFLEX 545	24-27	.301
OFHC COPPER	17	.322
BERYLLIUM COPPER 10	19	.316
BERYLLIUM COPPER 25	18	.298
BERYLLIUM COPPER 165	18	.298
PHOSPHOR BRONZE A	16	.320
PHOSPHOR BRONZE C	16	.317

ELASTICITY

All the Conflex material systems have a higher modulus of elasticity than copper or the current-carrying spring alloys. This permits use of thinner stock to achieve a given spring rate or provides a greater spring rate with identical stock gauge.

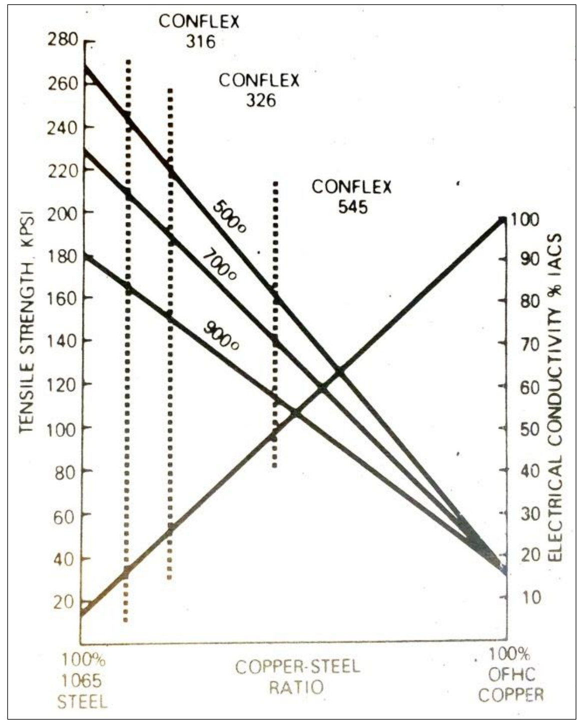
DENSITY

The lower density of Conflex materials systems as compared with copper and most current-carrying spring alloys means that the use of Conflex will result in more parts from a given weight of material. This density advantage combined with a higher modulus of elasticity can provide cost savings up to 75%.

STRENGTH/CONDUCTIVITY

An infinite variety of strength and conductivity combinations are possible with Conflex material systems, depending upon the placement ratios of the component metals. Steels used in Conflex mulitmetals can be heat treated or cold worked to ultra-high strength levels. Four standard Conflex material systems meet the performance characteristics of most applications, and custom systems are available to meet other design requirements.

ULTIMATE TENSILE STRENGTH AND ELECTRICAL CONDUCTIVITY OF Cu/1065 STEEL LAMINATES
(Q & T indicated temperatures)



CUSTOM SYSTEMS

Engineered Materials Solutions systems approach to metallurgical materials permits the highest degree of metals specification. It provides a way of combining the unique characteristics of two or more monometals or alloys into a metals system having mechanical, physical or surface properties designed to meet specific applications requirements. One metal's limitation can be offset by another's strength in such a way that the user benefits not only in performance, but also in cost. Metals systems frequently replace high-cost metal or alloys with lower cost metals, as functional requirements permit. In the case of Conflex current-carrying spring materials, it is possible to specify virtually any combination of strength, elasticity, and electrical conductivity. In addition, selective cladding of stainless steel or other alloys can provide special properties such as corrosion resistance, weldability, high temperature performance, and other desirable characteristics.

ECONOMIC COMPARISON

MATERIAL BASIS OF COMPARISON 5000 lbs. .010” X 1” 20% scrap rate	APPROXIMATE COST SAVINGS (%) USING CONFLEX (ADJUSTED FOR DENSITY DIFFERENCE)			
	CONFLEX TYPE			
	316	326	325S	545
BERYLLIUM COPPER 10	65	61	20	18
BERYLLIUM COPPER 25	62	57	18	16
BERYLLIUM COPPER 165	63	58	20	18

For further information write or call:

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