CBX CUPRON®

Type analysis

Single figures are nominal except where noted.

Copper	53.00 %	**Nickel**	44.00 %	**Manganese**	3.00 %

Forms manufactured

Ribbon	**Wire**

Description

CBX Cupron, which is produced gas free, has a practically constant resistance over a wide temperature range. It overcomes two significant disadvantages of conventional Constantan—the relatively high difference in the temperature coefficient of resistance (TCR) between the low and high temperature range and the generation of gas when Constantan is placed in contact with glass, enamel, or ceramic type materials. By overcoming these deficiencies, it has been used in resistors that are vitreous enameled, glass or ceramic coated, or even bare.

CBX Cupron has been supplied as fine wire and ribbon for precision resistors because of its low TCR and its stability of resistance. It has also been used in resistors, rheostats, or shunts for use in power controls up to a maximum temperature of 538°F (281°C). It has commonly been used in AC components.

Key Properties:

- Exceptionally stable
- Corrosion resistance
- Resistivity increases during heat treatment
- Resistant to precipitation hardening

Applications:

- Power metal strip resistors
- Round wire resistors
- Power metal current sensors

> CBX CUPRON

Care must be taken in termination of CBX Cupron when it is joined to copper because of the high thermal EMF generated. This requires both terminals to be at the same temperature for DC resistors.

The temperature coefficient of resistance of CBX Cupron is ± 25 ppm per degree C between -67° and 221°F (-55° and 105°C). The resistance curve is more linear with temperature than for Constantan alloys. Instead of a nominal difference of 20 ppm per degree centigrade between the cold range (-67° to 77°F [-55° to 25°C]) and the hot range (77° to 221°F [25° to 105°C]), the differential is reduced by a factor of approximately two.

Physical properties

PROPERTY	At or From	English Units	Metric Units
SPECIFIC GRAVITY	—	8.89	8.89
DENSITY	—	0.3210 lb/in^3	8885 kg/m^3
MEAN SPECIFIC HEAT	68°F (20°C)	0.09400 Btu/lb/°F	393 J/kg·K
MEAN COEFFICIENT OF THERMAL EXPANSION	68 to 212°F (20 to 100°C)	8.28 x 10^{-6} length/length/°F	14.904 length/length/°C
THERMAL CONDUCTIVITY		147.1 Btu/in/hr/ft^2/°F	21.2 W/m·K
ELECTRICAL RESISTIVITY	77°F	294.0 ohm-cir-mil/ft	49 microohm·cm
MELTING RANGE	—	2280°F	1249°C
THERMAL EMF VS. COPPER	32 to 212°F (0 to 100°C)	-0.021 mV/°F	
THERMAL EMF VS. PLATINUM 67	32 to 212°F (0 to 100°C)	-0.017 mV/°F	

Magnetic properties

There are two Cupron alloys with a low resistance change at temperatures around ambient. CBX Cupron is a patented alloy melted and manufactured to obtain a positive resistance change in the hot region (77° to 221°F [25° to 105°C]). CB Cupron by contrast has a negative resistance change in this region.

CBX Cupron has a smaller difference in temperature coefficient of resistance between the cold and hot region than conventional CB Cupron (Constantan). Typical difference in TCR of CBX Cupron between -67° to 77°F (-55° to 25°C) and 77° to 221°F (25° to 105°C) is about one-half that of conventional Constantan alloys.

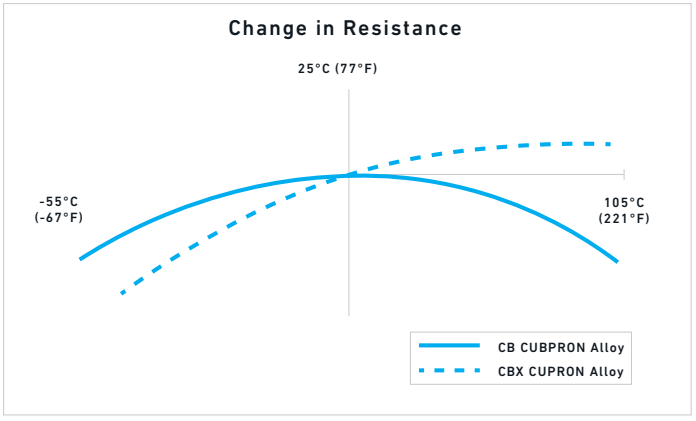
MAGNETIC ATTRACTION	None

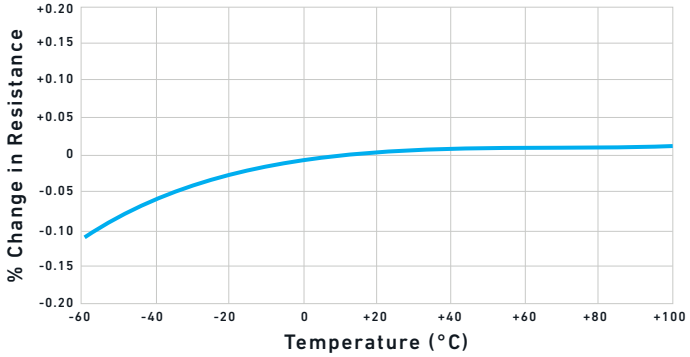
> CBX CUPRON

Other information

Applicable specifications	ASTM B267 Class 5A

GRAPHICAL REPRESENTATION CURVES OF RESISTANCE VS. CB CUPRON ALLOY CHANGE FROM -67° TO 221°F (-55° TO 105°C)





> CBX CUPRON

CURRENT TEMPERATURE CHARACTERISTICS OF STRAIGHT WIRE							.712
B&S	DIAMETER, IN	212°F (100°C)	392°F (200°C)	572°F (300°C)	572°F (400°C)	932°F (500°C)	1112°F (600°C)
1	.289	58.0	110.2	168.7	230.2	289.6	346.2
2	.258	49.7	94.1	144.3	195.0	243.8	292.6
3	.229	42.4	79.5	120.9	163.8	204.8	244.8
4	.204	36.2	67.3	102.4	137.5	171.6	204.8
5	.182	31.0	57.3	86.8	117.0	144.3	173.6
6	.162	26.6	48.8	73.1	97.5	121.9	145.3
7	.144	22.7	41.2	61.4	82.4	101.4	121.9
8	.128	19.5	35.1	51.7	68.8	85.8	102.4
9	.114	16.6	29.7	48.7	58.0	71.5	85.8
10	.102	14.1	25.2	37.1	48.8	69.0	72.1
11	.091	12.1	21.4	31.2	41.05	50.5	60.4
12	.081	10.3	18.0	26.1	34.3	42.1	50.7
13	.072	9.26	15.3	22.0	28.8	35.3	41.9
14	.064	7.51	12.9	18.5	24.1	29.5	35.1
15	.057	6.44	10.9	15.6	20.3	24.8	29.5
16	.051	5.51	9.40	13.4	17.2	21.1	25.0
17	.045	4.80	8.05	11.4	14.8	17.9	21.5
18	.040	4.21	7.00	9.9	12.8	15.5	18.4
19	.036	3.75	6.16	8.68	11.2	13.6	16.0
20	.032	3.30	5.36	7.51	9.65	11.6	13.8
21	.0285	2.90	4.70	6.53	8.39	10.1	12.0
22	.0253	2.56	4.08	4.62	7.21	8.68	10.2
23	.0226	2.26	3.57	4.90	6.26	7.56	8.92
24	.0201	1.98	3.12	4.25	5.41	6.53	7.70
25	.0179	1.74	2.71	3.69	4.67	5.62	6.61
26	.0159	1.53	2.36	3.19	4.01	4.86	5.69
27	.0142	1.35	2.06	2.77	3.49	4.19	4.95
28	.0126	1.18	1.78	2.38	3.00	3.60	4.91
29	.0113	1.04	1.57	2.10	2.63	3.14	3.71
30	.0100	.922	1.37	1.90	2.24	2.68	3.14
31	.0089	.805	1.18	1.54	1.93	2.31	2.69
32	.0080	.714	1.03	1.36	1.68	2.00	2.35
33	.0071	.626	.905	1.17	1.45	1.74	2.10
34	.0063	.538	.788	1.00	1.25	1.49	1.75
35	.0056	.486	.683	.878	1.08	1.29	1.50
36	.0050	.429	.600	.761	.939	1.11	1.30
37	.0045	.380	.529	.669	.819	.975	1.14
38	.0040	.334	.451	.577	.712	.848	.985
39	.0035	.290	.394	.493	.601	.717	.834
40	.0031	.254	.341	.423	.517	.614	.712

Amperes necessary to raise to a given temperature, a straight wire in air.

RESISTIVITY EQUALS 294 OHMS PER CIRCULAR MIL FT AT 77°F (25°C) DENSITY EQUALS 0.321 LB/IN³
TEMPERATURE COEFFICIENT PRACTICALLY NIL

B&S	DIAMETER, IN	OHMS PER FT AT 77˚F (25˚C)	OHMS PER LB BARE WIRE	FT PER LB	LBS PER 1000 FT
000	.410	.0017	.003	1.97	508.6
00	.365	.0022	.005	2.48	403.1
0	.325	.0028	.009	3.13	319.6
1	.289	.0035	.014	3.96	252.7
2	.258	.0044	.022	4.97	201.4
3	.229	.0056	.035	6.30	158.7
4	.204	.0071	.056	7.94	125.9
5	.182	.0089	.089	9.98	100.2
6	.162	.0112	.141	12.59	79.4
7	.144	.0142	.226	15.94	62.7
8	.128	.0179	.362	20.17	49.6
9	.114	.0226	.575	25.43	39.3
10	.102	.0283	.898	31.77	31.5
11	.091	.0355	1.42	39.92	25.1
12	.081	.0448	2.26	50.38	19.8
13	.072	.0567	3.62	63.76	15.7
14	.064	.0718	5.79	80.70	12.4
15	.057	.0905	9.21	101.74	9.83
16	.051	.1130	14.36	127.08	7.87
17	.045	.1452	23.70	163.23	6.13
18	.040	.1838	37.96	206.59	4.84
19	.036	.2269	57.86	255.05	3.92
20	.032	.2871	92.68	322.79	3.10
21	.0285	.3620	147.3	406.94	2.46
22	.0253	.4593	237.2	516.40	1.94
23	.0226	.5756	372.5	647.15	1.55
24	.0201	.7277	595.4	818.15	1.22
25	.0179	.9176	946.6	1,031.62	.969
26	.0159	1.163	1,520.5	1,307.46	.765
27	.0142	1.458	2,390.1	1,639.26	.610
28	.0126	1.852	3,855.6	2,082.01	0.480
29	.0113	2.302	5,960.2	2,588.61	0.386
30	.0100	2.940	9,717.9	3,305.4	0.303
31	.0089	3.712	15,488.6	4,173.0	0.240
32	.0080	4.594	23,725.3	5,164.7	0.194
33	.0071	5.832	38,241.8	6,557.0	.153
34	.0063	7.407	61,689.2	8,328.0	.120
35	.0056	9.375	98,814.1	10,540.2	.095
36	.0050	11.76	155,486.0	13,221.6	.076
37	.0045	14.52	236,985.1	16,323.0	.061
38	.0040	18.38	379,604.4	20,658.7	.048
39	.0035	24.00	647,588.3	26,982.8	.037
40	.0031	30.59	1,052,263.2	34,395.4	.029
	.00275	38.88	1,699,183.9	43,707.8	.023
	.0025	47.04	2,487,775.2	52,886.4	.019
	.00225	58.07	3,791,762.2	65,291.8	.015
	.0020	73.50	6,073,669.9	82,635.0	.0121
	.00175	96.00	10,361,413	107,931.4	.0093

> CBX CUPRON

RESISTANCE OF RIBBON (FLAT WIRE) IN OHMS/FT AT 77°F (25°C)

THICKNESS		WIDTH IN INCHES						
B&S	INCHES	*1/64 .0156*	*1/32 .0312*	*1/16 .0625*	*1/8 .125*	*3/16 .1875*	*1/4 .250*	*3/8 .375*
10	.102							
11	.091							
12	.081							.0081
13	.072							.0091
14	.064							.0102
15	.057							.0115
16	.051							.0128
17	.045						.0218	.0146
18	.040						.0246	.0164
19	.036						.0273	.0182
20	.032		.246	.123	.0614	.0410	.0307	.0205
21	.0285		.276	.138	.0690	.0460	.0345	.0230
22	.0253		.311	.155	.0777	.0518	.0389	.0259
23	.0226		.349	.174	.0870	.0545	.0409	.0290
24	.0201		.392	.196	.0978	.0613	.0460	.0326
25	.0179		.440	.220	.1098	.0688	.0516	.0366
26	.0159		.495	.247	.1236	.0775	.0581	.0412
27	.0142		.555	.277	.1384	.0868	.0651	.0461
28	.0126		.625	.312	.1560	.0978	.0733	.0520
29	.0113		.697	.348	.1740	.1090	.0818	.0580
30	.0100	1.575	.788	.393	.1966	.1232	.0924	.0655
31	.0089	1.770	.885	.442	.2209	.1384	.1038	.0736
32	.0080	1.969	.985	.491	.2783	.1540	.1155	.0819
33	.0071	2.219	1.109	.554	.3136	.1735	.1301	.0923
34	.0063	2.500	1.250	.624	.3534	.1956	.1467	.1040
35	.0056	2.813	1.407	.702	.3976	.2200	.1650	.1170
36	.0050	3.151	1.575	.786	.4453	.2464	.1848	.1311
37	.0045	3.501	1.750	.874	.4948	.2738	.2053	.1456
38	.0040	3.938	1.969	1.113	.5566	.3080	.2310	.1638
39	.0035	4.501	2.250	1.272	.6361	.3520	.2640	.1872
40	.0031	5.082	2.541	1.436	.7182	.3974	.2981	.2114
	.00275	5.728	2.864	1.619	.8096	.4480	.3360	.2383
	.0025	6.301	3.151	1.781	.8906	.4928	.3696	.2621
	.00225	7.001	3.965	1.979	.9896	.5476	.4107	.2913
	.0020	7.876	4.460	2.227	1.1133	.6160	.4620	.3277
	.00175	9.002	5.097	2.545	1.2723	.7040	.5820	.3745
	.0015	10.502	5.947	2.969	1.4843	.8213	.6160	.4369
	.00125	12.602	7.136	3.562	1.7812	.9856	.7392	.5243
	.0010	17.841	8.920	4.453	2.2265	1.2320	.9240	.6553

Resistances to the left of the red line are calculated based on width to thickness ratio (< 15:1, CSA is considered 6% less than a true rectangle; > 15:1, CSA is considered 17% less than true rectangle). Resistance values below the solid black line are for sizes with a width to thickness ratio > 15:1.

Resistance values to the right of the red line are calculated for square edged strip (true rectangle)

> CBX CUPRON

FEET PER POUND OF RIBBON (FLAT WIRE)

THICKNESS		WIDTH IN INCHES						
B&S	INCHES	*1/64 .0156*	*1/32 .0312*	*1/16 .0625*	*1/8 .125*	*3/16 .1875*	*1/4 .250*	*3/8 .375*
10	.102							
11	.091							
12	.081							**8.5**
13	.072							**9.6**
14	.064							**10.8**
15	.057							**12.1**
16	.051							**13.6**
17	.045						24.6	**15.4**
18	.040						27.6	**17.3**
19	.036						30.7	**19.2**
20	.032		**276**	**138**	**69.0**	46.0	34.5	**21.6**
21	.0285		**310**	**155**	**77.5**	51.7	38.8	**24.3**
22	.0253		**349**	**175**	**87.3**	58.2	43.7	**27.3**
23	.0226		**391**	**196**	**97.8**	61.3	45.9	**30.6**
24	.0201		**440**	**220**	**109.9**	68.9	51.7	**34.6**
25	.0179		**494**	**247**	**123.4**	77.4	58.0	**38.7**
26	.0159		**556**	**278**	**139.0**	87.1	65.3	**43.5**
27	.0142		**622**	**311**	**155.6**	97.5	73.1	**48.8**
28	.0126		**702**	**351**	**175.4**	109.9	82.4	
29	.0113		**782**	**391**	**195.5**	122.5		
30	.0100	1768	**884**	**442**	**221.0**	138.5		
31	.0089	1986	**993**	**497**	**248.3**	155.6		
32	.0080	2210	**1105**	**552**	**312.8**	173.1		
33	.0071	2490	**1245**	**622**	**352.5**	195.0		
34	.0063	2806	**1403**	**702**	**397.2**	219.8		
35	.0056	3157	**1578**	**789**	**446.9**			
36	.0050	3535	**1768**	**884**	**500.5**			
37	.0045	3928	**1964**	**982**	**556.1**			
38	.0040	4419	**2210**	**1251**	**625.6**			
39	.0035	5051	**2525**	**1430**	**715.0**			
40	.0031	5702	**2581**	**1615**	**807.2**			
	.00275	6428	**3214**	**1820**	**910.0**			
	.0025	7071	**3535**	**2002**	**1001.0**			
	.00225	7856	**3928**	**2224**	**1112.2**			
	.0020	8838	**5005**	**2502**	**1251.2**			
	.00175	10101	**5720**					
	.0015	11785	**6673**					
	.00125	14141	**8008**					
	.0010	20019	**10010**		.			

R

For additional information, please contact your nearest sales office:
electrification@cartech.com | 610 208 2000

The information and data presented herein are typical or average values and are not a guarantee of maximum or minimum values. Applications specifically suggested for material described herein are made solely for the purpose of illustration to enable the reader to make their own evaluation and are not intended as warranties, either express or implied, of fitness for these or other purposes. There is no representation that the recipient of this literature will receive updated editions as they become available.