Thermocouple Wire Specifications

ANSI Color Code for Thermocouple and Thermocouple Extension Wire

ANSI Type	Wire Alloys	Thermocouple Wire Color		T/C Extension Wire Color		
		Polarity	Individual	Overall	Individual	Overall
T	Copper Constantan	+TP -TN	Blue Red	Brown	Blue Red	Blue
J	Iron Constantan	+JP -JN	White Red	Brown	White Red	Black
E	Chromel Constantan	+EP -EN	Purple Red	Brown	Purple Red	Purple
K	Chromel Alumel	+KP -KN	Yellow Red	Brown	Yellow Red	Yellow
R	Platinum 13% Rhodium Platinum	+RP -RN			Black Red	Green
S	Platinum 10% Rhodium Platinum	+SP -SN			Black Red	Green
B	Platinum 30% Rhodium Platinum 6% Rhodium	+BP -BN			Grey Red	Grey

Bare Thermocouple Wire Approximate Weight feet/lb

Wire Ga B & S	Wire Size Dia.	Type J		Type K		Type T		Type E	
		Iron +JP	Constantan -JN	Chromel +KP	Alumel -KN	Copper +TP	Constantan -TN	Chromel +EP	Constantan -EN
6	.162	14.2	12.6	13	13	12.6	12.6	13	12.6
7	.144	18.0							
8	.128	22.8	20.2	21	21	19.8	20.2	21	20.2
14	.064	91.2	80.9	83	83	80.5	80.9	83	80.9
16	.050	144.0	127	130	130	128	127	130	127
18	.040	233.0	207	212	212	203	207	212	207
20	.032	365.0	324	331	331	324	324	331	324
24	.020	925.0	821	838	838	820	821	838	821
26	.015	1478.0	1312	1340	1340	1299	1312	1340	1312
28	.012	2353.0	2089	2130	2130	2062	2089	2130	2089
30	.010	3736.0	3316	3370	3370	3294	3316	3370	3316
36	.005	14940.0	13260	13500	13500	13250	13260	13500	13260

Nominal Thermocouple Resistance Ohms per Double Foot @ 68°F (20°C)

Wire Ga B & S	Wire Size Dia.	ANSI Types						
		J	K	T	E	S	R	B
6	.162	.014	.023	.012	.027	.007	.007	.008
*7	.144	.021						
8	.128	.022	.036	.019	.044	.010	.010	.013
14	.064	.089	.147	.074	.176	.044	.044	.054
16	.050	.141	.232	.117	.277	.069	.069	.086
18	.040	.229	.377	.190	.450	.112	.113	.139
20	.032	.357	.588	.297	.702	.175	.178	.218
24	.020	.905	1.488	.754	1.778	.449	.453	.550
26	.015	1.441	2.450	1.200	2.840	.701	.708	.875
28	.012	2.297	3.590	1.920	4.330	1.062	1.073	1.392
30	.010	3.650	6.020	2.940	7.190	1.794	1.813	2.213
36	.005	14.660	24.080	12.220	28.800	7.150	7.226	8.897

** Double feet 7 Ga Type J= 7 Ga Iron/8 Ga Constantan*

American Wire Gauge (AWG)	Size Dia. Inches
7/0	—
6/0	0.5800
5/0	0.5165
4/0	0.4600
3/0	0.4096
2/0	0.3648
1/0	0.3249
1	0.2893
2	0.2576
3	0.2294
4	0.2043
5	0.1819
6	0.1620
7	0.1443
8	0.1285
9	0.1144
10	0.1019
11	0.0907
12	0.0808
13	0.0720
14	0.0641
15	0.0571
16	0.0508
17	0.0453
18	0.0403
19	0.0359
20	0.0320
21	0.0285
22	0.0253
23	0.0226
24	0.0201
25	0.0179
26	0.0159
27	0.0142
28	0.0126
29	0.0113
30	0.0100
31	0.00893
32	0.00795
33	0.00708
34	0.00630
35	0.00561
36	0.00500
37	0.00445
38	0.00396
39	0.00353
40	0.00314
41	0.00280
42	0.00249
43	0.00222
44	0.00198
45	0.00176
46	0.00157
47	0.00140
48	0.00124
49	0.00111
50	0.00099

Thermocouple Wire Specifications

Thermocouple Wire Specifications *(continued)*

Selection and Use of Thermocouple and Thermocouple Extension Wire

Thermocouple wire can be fabricated into accurate and dependable thermocouples by joining the thermoelements together at the sensing end. Thermocouple wire or thermocouple extension wire must be used to extend thermocouples to indication or control instrumentation. The conditions of measurement determine the type of thermocouple wire and insulation to be used. Temperature range, environment, protection, insulation requirements, response, and service life should be considered. The following parameters serve as a guide to the selection of wire. For a basic application study, refer to Maelin literature "Applying the Systems Concept to Thermocouple Installations," an ISA reprint.

Temperature Limits for Thermocouple Wire

Temperature limits for standard thermocouples that are protected with a closed end protecting tube are shown. These limits are suggested for continuous temperature sensing where insulation is not a factor. For unprotected thermocouples where fast response is required, these limits should be reduced for equivalent service life.

Upper Temperature Limits for Thermocouples

Thermocouple Type	*ANSI TYPE SYMBOL*	*WIRE GAUGE (AWG)*				
		8 Gal	*14 Gal*	*20 Gal*	*24 Gal*	*30 Gal*
Copper-Constantan	T		370°C (700°F)	260°C (500°F)	200°C (400°F)	150°C (300°F)
*Iron-Constantan	J	760°C (1400°F)	600°C (1100°F)	500°C (900°F)	370°C (700°F)	320°C (600°F)
Chromel™-Constantan	E	870°C (1600°F)	650°C (1200°F)	550°C (1000°F)	430°C (800°F)	430°C (800°F)
Chromel™-Alumel™	K	1260°C (2300°F)	1100°C (2000°F)	1000°C (1800°F)	870°C (1600°F)	760°C (1400°F)
Nicrosil-Nisil	N	1260°C (2300°F)	1100°C (2000°F)	1000°C (1800°F)	870°C (1600°F)	760°C (1400°F)
Platinum—10% Rhodium	S				1480°C (2700°F)	
Platinum—13% Rhodium	R				1480°C (2700°F)	
Platinum—30% vs. 6% Rhodium	B				1700°C (3100°F)	
Tungsten—26% Rhenium	WR				2300°C (4200°F)	
Tungsten—3% vs. 25% Rhenium	W3				2300°C (4200°F)	
Tungsten—5% vs. 26% Rhenium	W5				2300°C (4200°F)	

** Magnetic* *™Trade Mark Hoskins Mfg. Co.* *= Not ANSI Symbol*

Insulation Characteristics

Insu. Code	*Insulation Description Individual/Overall*	*Continuous Use Temperature Limits*	*Single Exposure Temperature Limit*	*Moisture Resistance*	*Abrasion Resistance*
601 603	PVC/PVC PVC Rip Cord	-20 to +221°F -29 to +105°C	221°F 105°C	Excellent "	Good "
605	Polyvinyl/Polyvinyl Twisted & Shielded	-20 to +176°F -29 to 80°C	176°F 80°C	Excellent "	Good "
606	Nylon/Nylon	350°F	—	Fair	Excellent
607 608	Teflon on Singles (FEP) Teflon/Teflon (FEP ext.)	400°F 204°C	600°F 316°C	Excellent "	Excellent "
609	Teflon/Teflon TFE Tape	-90 to 500°F -68 to 260°C	600°F 316°C	Excellent "	Very Good "
610	Teflon/Teflon FEP Twisted & Shielded	400°F 204°C	600°F 316°C	Excellent "	Excellent "
611	TFE, Synthetic Fiber/ Synthetic Fiber	500°F 260°C	700°F 371°C	Good "	Good "
612	FEP, Fiberglass/ Fiberglass	400°F 204°C	600°F 316°C	Good "	Good "
618	Ceramic Fiber/ Ceramic Fiber	2600°F 1430°C	2600°F 1430°C	Fair "	Fair "
620	Vitreous Silica Fiber/ Vitreous Silica Fiber	1600°F 871°C	2000°F 1093°C	Fair "	Fair "
622	High Temp. Glass/ High Temp. Glass	1300°F 704°C	1600°F 871°C	Fair "	Fair "
623	High Temp. Fiberglass Twisted	1300°F 704°C	1300°F 704°C	Fair "	Fair "
628	Fiberglass/Fiberglass	900°F 482°C	1000°F 538°C	Good to 400°F (204°C)	Fair "
S	SS Overbraid	—	—	—	Excellent