SERV-RITE® Wire and Cable

Thermocouple and Thermocouple Extension Wire

Manufactured to Exacting Specifications

Since 1914, SERV-RITE® thermocouple wire and thermocouple extension wire have been known for premium performance and reliability. All stock and custom wire is manufactured in our plant where careful selection of materials, manufacturing equipment and quality controls assure superior uniformity.

This section presents popular available and custom wire. Watlow can custom manufacture wire using alloys and insulation types to meet your specific application demands.

All SERV-RITE thermocouple wire and thermocouple extension wire is manufactured under rigid quality controls. Watlow's wire products are manufactured following ISO 9001 standards. In addition, all EMF vs. temperature calibration procedures follow one or more of the following standards:

- ASTM E 207
- ASTM E 220
- AMS 2750

All testing has NIST traceability. Unless otherwise specified, all SERV-RITE thermocouple wire and extension wire are supplied to meet standard tolerances of ASTM E 230. Special tolerances are also available.

Performance Capabilities

- Compliance with recognized agency tolerances
- Insulation temperature ranges from -200 to 1290°C (-328 to 2350°F)
- Tolerances from ±0.5°C or ±0.4 percent
- NIST calibration certificates

Features and Benefits

Usability

- Flexible Type E, J, K, N and T thermocouple wire can be used for virtually all applications

Compensation extension wire

- Permits fine tuning of temperature measuring circuits

Solid or stranded wire

- Meets specific application requirements

Wide selection of insulation types

- Meet temperature, chemical, moisture and abrasion resistance objectives

Color coding

- Available to comply with United States, United Kingdom, German, Japanese and IEC standards

Metallic overbraids and wraps

- Enhance abrasion resistance

UL® listed PLTC wire and cable

- For applications needing agency compliance

Stock RTD lead wire

- Meets virtually all industrial RTD applications

*Not an ASTM E 230 symbol.

UL® is a registered trademark of Underwriter's Laboratories, Inc.

STOCKED FOR SAME DAY SHIPMENT

- **All stock constructions available in 100, 250, 500 and 1,000 foot spools.**

Stock Wire Products By Calibration

Part Number	Limits	Construction/ Description	Max. Rec. Opr. Temp °C	(°F)
B20-5-304	Std.	Brd.Gls./Brd.Gls.	538	(1000*)
E20-1-304	Std.	Brd.Gls./Brd.Gls.	538	(1000)
E20-1-507	Std.	FEP/FEP	260	(500)
E20-5-502	Std.	PVC/PVC	105	(221)
E20-5-510	Std.	PVC/TWS/PVC	105	(221)
J16-5-313	Std.	Brd. Gls./Brd. Gls.	538	(1000*)
J16-5-502	Std.	PVC/PVC	105	(221)
J16-5-509	Std.	FEP/TWS/FEP	260	(500)
J16-5-510	Std.	PVC/TWS/PVC	105	(221)
J16-5-510-UL®	Std.	PVC/TWS/PVC	105	(221)
J16-7-515	Std.	ETFE/TWS/ETFE	199	(390)
J20-1-304	Std.	Brd.Gls./Brd.Gls.	538	(1000)
J20-2-304	Spc.	Brd.Gls./Brd.Gls.	538	(1000)
J20-2-314	Spc.	Brd. HT Gls./TW	871	(1600)
J20-1-321	Std.	Brd. HT Gls./Brd. HT Gls.	871	(1600)
J20-2-321	Spc.	Brd. HT Gls./Brd. HT Gls.	871	(1600)
J20-1-507	Std.	FEP/FEP	260	(500)
J20-2-507	Spc.	FEP/FEP	260	(500)
J20-1-508	Std.	Tp.TFE/Tp. TFE	316	(600)
J20-2-508	Spc.	Tp.TFE/Tp. TFE	316	(600)
J20-1-509	Std.	FEP/TWS/FEP	260	(500)
J20-1-512	Std.	Tp. P-mide/Tp. P-mide	427	(800)
J20-1-S-304	Std.	Brd.Gls./Brd.Gls.	538	(1000)
J20-2-513	Spc.	Tp. P-mide/Tp. P-mide	427	(800)
J20-3-304	Std.	Brd. Gls./Brd. Gls.	538	(1000)
J20-3-507	Std.	FEP/FEP	260	(500)
J20-3-512	Std.	Tp. P-mide/Tp. P-mide	427	(800)
J20-3-S-304	Std.	Brd. Gls./Brd. Gls./SS Brd.	538	(1000)
J20-5-502	Std.	PVC/PVC	105	(221)
J20-5-507	Std.	FEP/FEP	260	(500)
J20-5-509	Std.	FEP/TWS/FEP	260	(500)
J20-5-510	Std.	PVC/TWS/PVC	105	(221)
J20-5-510-UL®	Std.	PVC/TWS/PVC	105	(221)
J20-5-1004	Std.	PVC/TWS pr./PVC Cbl.	105	(221)
J20-5-1008	Std.	PVC/TWS pr./PVC Cbl.	105	(221)
J20-7-502	Std.	PVC/PVC	105	(221)
J20-7-510	Std.	PVC/TWS/PVC	105	(221)
J24-1-304	Std.	Brd.Gls./Brd.Gls.	538	(1000)
J24-2-304	Spc.	Brd.Gls./Brd.Gls.	538	(1000)
J24-1-505	Std.	PVC/Ripcord	105	(221)
J24-2-505	Spc.	PVC/Ripcord	105	(221)
J24-1-507	Std.	FEP/FEP	260	(500)
J24-2-507	Spc.	FEP/FEP	260	(500)
J24-1-508	Std.	Tp.TFE/Tp. TFE	316	(600)
J24-2-508	Spc.	Tp.TFE/Tp. TFE	316	(600)
J24-2-511	Spc.	Tp. P-mide/TW	427	(800)
J24-3-304	Std.	Brd. Gls./Brd. Gls.	538	(1000)
J24-3-507	Std.	FEP/FEP	260	(500)
J24-3-516	Std.	PFA/PFA	288	(550)
J28-1-305	Std.	Wrp. Dbl. Gls./Brd. Gls.	538	(1000)
J28-2-305	Spc.	Wrp. Dbl. Gls./Brd. Gls.	538	(1000)
J30-1-305	Std.	Wrp. Dbl. Gls./Brd. Gls.	538	(1000)
J30-2-305	Spc.	Wrp. Dbl. Gls./Brd. Gls.	538	(1000)
J30-2-308-002	Spc.	Dbl. Wrp. Cot./Brd. Cot.	88	(190)
J30-2-506	Spc.	FEP/FEP	260	(500)
K16-5-155	Std.	Brd. Gls./Brd. Stx.	343	(650*)
K16-5-157	Std.	Tp. TFE, Brd. Gls./Brd.Stx	343	(650*)
K16-5-313	Std.	Brd. Gls./Brd. Gls.	538	(1000*)
K16-5-502	Std.	PVC/PVC	105	(221)
K16-5-509	Std.	FEP/TWS/FEP	260	(500)
K16-5-510	Std.	PVC/TWS/PVC	105	(221)
K16-5-510-UL®	Std.	PVC/TWS/PVC	105	(221)
K16-7-155	Std.	Brd.Gls./Brd. Stx.	343	(650*)
K16-7-515	Std.	ETFE/TWS/ETFE	199	(390)
K18-7-503	Std.	PVC/Cotton/PVC	105	(221)
K20-1-301	Std.	Brd. Sil./Brd. Sil	1093	(2000)
K20-2-301	Spc.	Brd. Sil./Brd. Sil	1093	(2000)
K20-1-304	Std.	Brd.Gls./Brd.Gls.	538	(1000)
K20-2-304	Spc.	Brd.Gls./Brd.Gls.	538	(1000)
K20-2-314	Spc.	Brd. HT Gls./TW	871	(1600)
K20-1-321	Std.	Brd. HT Gls./Brd. HT Gls.	871	(1600)
K20-2-321	Spc.	Brd. HT Gls./Brd. HT Gls.	871	(1600)
K20-1-350	Std.	Brd. C.Fbr./Brd. C.Fbr.	1427	(2600)
K20-2-350	Spc.	Brd. C.Fbr./Brd. C.Fbr.	1427	(2600)
K20-1-355	Std.	Brd. C.Fbr./Brd. C.Fbr.	1427	(2600)
K20-2-355	Spc.	Brd. C.Fbr./Brd. C.Fbr.	1427	(2600)
K20-1-365	Std.	Brd. Sil./Brd. Sil.	1093	(2000)
K20-2-365	Spc.	Brd. Sil./Brd. Sil.	1093	(2000)
K20-1-507	Std.	FEP/FEP	260	(500)
K20-2-507	Spc.	FEP/FEP	260	(500)
K20-1-508	Std.	Tp.TFE/Tp. TFE	316	(600)
K20-2-508	Spc.	Tp.TFE/Tp. TFE	316	(600)
K20-1-509	Std.	FEP/TWS/FEP	260	(500)
K20-2-509	Spc.	FEP/TWS/FEP	260	(500)
K20-1-S-304	Std.	Brd.Gls./Brd.Gls.	538	(1000)
K20-2-513	Spc.	Tp. P-mide/Tp. P-mide	427	(800)
K20-1-517	Std.	PFA/TWS/PFA	288	(550)
K20-3-304	Std.	Brd. Gls./Brd. Gls.	538	(1000)
K20-3-507	Std.	FEP/FEP	260	(500)
K20-3-512	Std.	Tp. P-mide/Tp. P-mide	427	(800)
K20-3-S-304	Std.	Brd. Gls./Brd. Gls./SS Brd.	538	(1000)
K20-5-502	Std.	PVC/PVC	105	(221)
K20-5-507	Std.	FEP/FEP	260	(500)

CONTINUED

*** Note:** Recommended operating temperature limited to the extension grade alloy recommended temperature of 204°C (400°F).

STOCKED FOR SAME DAY SHIPMENT

- **All stock constructions available in 100, 250, 500 and 1,000 foot spools.**

SERV-RITE Wire and Cable

Stock Wire Products By Calibration (con't)

Part Number	Limits	Construction/ Description	Max. Rec. Opr. Temp °C	Max. Rec. Opr. Temp (°F)
K20-5-509	Std.	FEP/TWS/FEP	260	(500)
K20-5-510	Std.	PVC/TWS/PVC	105	(221)
K20-5-510-UL®	Std.	PVC/TWS/PVC	105	(221)
K20-5-1004	Std.	PVC/TWS pr./PVC Cbl.	105	(221)
K20-5-1008	Std.	PVC/TWS pr./PVC Cbl.	105	(221)
K20-7-502	Std.	PVC/PVC	105	(221)
K20-7-510	Std.	PVC/TWS/PVC	105	(221)
K24-1-304	Std.	Brd.Gls./Brd.Gls.	538	(1000)
K24-2-304	Spc.	Brd.Gls./Brd.Gls.	538	(1000)
K24-1-505	Std.	PVC/Ripcord	105	(221)
K24-2-505	Spc.	PVC/Ripcord	105	(221)
K24-1-507	Std.	FEP/FEP	260	(500)
K24-2-507	Spc.	FEP/FEP	260	(500)
K24-1-508	Std.	Tp.TFE/Tp. TFE	316	(600)
K24-2-508	Spc.	Tp.TFE/Tp. TFE	316	(600)
K24-2-306	Spc.	Brd.Gls./Brd.Gls.	538	(1000)
K24-2-513	Spc.	Tp. P-mide/Tp. P-mide	427	(800)
K24-2-516	Spc.	PFA/PFA	288	(550)
K24-3-304	Std.	Brd. Gls./Brd. Gls.	538	(1000)
K24-3-507	Std.	FEP/FEP	260	(500)
K28-2-305	Spc.	Wrp. Dbl. Gls./Brd. Gls.	538	(1000)
K30-1-305	Std.	Wrp. Dbl. Gls./Brd. Gls.	538	(1000)
K30-2-305	Spc.	Wrp. Dbl. Gls./Brd. Gls.	538	(1000)
K30-2-506	Spc.	FEP/FEP	260	(500)
S16-5-157	Std.	Tp. TFE, Brd. Gls./Brd.Stx	343	(650*)
S20-5-304	Std.	Brd.Gls./Brd.Gls.	538	(1000)
S20-5-502	Std.	PVC/PVC	105	(221)
S20-5-507	Std.	FEP/FEP	260	(500)
S20-5-510	Std.	PVC/TWS/PVC	105	(221)
T16-5-510	Std.	PVC/TWS/PVC	105	(221)
T20-1-304	Std.	Brd.Gls./Brd.Gls.	538	(1000)
T20-1-507	Std.	FEP/FEP	260	(500)
T20-2-507	Spc.	FEP/FEP	260	(500)
T20-2-508	Spc.	Tp.TFE/Tp. TFE	316	(600)
T20-1-509	Std.	FEP/TWS/FEP	260	(500)
T20-3-507	Std.	FEP/FEP	260	(500)
T20-5-502	Std.	PVC/PVC	105	(221)
T20-5-510	Std.	PVC/TWS/PVC	105	(221)
T20-5-1004	Std.	PVC/TWS pr./PVC Cbl.	105	(221)
T20-5-1008	Std.	PVC/TWS pr./PVC Cbl.	105	(221)
T20-7-502	Std.	PVC/PVC	105	(221)
T24-1-304	Std.	Brd. Gls./Brd. Gls.	538	(1000)
T24-1-505	Std.	PVC/Ripcord	105	(221)
T24-2-505	Spc.	PVC/Ripcord	105	(221)
T24-2-507	Spc.	FEP/FEP	260	(500)
T24-1-508	Std.	Tp.TFE/Tp. TFE	316	(600)
T24-2-508	Spc.	Tp.TFE/Tp. TFE	316	(600)
T30-2-506	Spc.	FEP/FEP	260	(500)

RTD Lead Wire

Part Number	Construction/Description	Max. Rec. Opr. Temp °C	Max. Rec. Opr. Temp (°F)
RT3-22-4-701	PVC/TW/PVC	105	(221)
RT3-22-8-704	FEP/TW/FEP	260	(500)
RT3-24-8-705	Brd. Gls./TW/Brd. Gls.	538	(1000)

*** Note:** Recommended operating temperature limited to the extension grade alloy recommended temperature of 204°C (400°F).

Legend:

Brd. = Braided
Gls. = Fiberglass
TWS. = Twisted and shielded
HT = High temperature
Tp. = Taped
P-mide = Polyimide
Cbl. = Cable
TW. = Twisted
Wrp. = Wrapped
Dbl. = Double
Cot. = Cotton
Stx. = SERV TEX synthetic braid
C.Fbr = Ceramic fiber
Sil. = Vitreous silica
pr. = Pair
Std. = Standard
Spc = Special

STOCKED FOR SAME DAY SHIPMENT

- **All stock constructions available in 100, 250, 500 and 1,000 foot spools.**

Stock Wire Products By Temperature

Thermocouple Wire Max. Op. Temp. °C	(°F)	Insulation	Part Number	Limits of Error	Description	Physical Properties: Abrasion Resistance	Moisture Resistance	Chemical Resistance	Page No.
1427	(2600)	Ceramic	K20-1-350	Standard	Brd. C. Fbr./Brd. C. Fbr. (heavy build)	Good	Fair	Good	191
			K20-1-355	Standard	Brd. C. Fbr./Brd. C. Fbr.	Good	Fair	Good	191
			K20-2-350	Special	Brd.C. Fbr./Brd. C. Fbr. (heavy build)	Good	Fair	Good	191
			K20-2-355	Special	Brd. C. Fbr./Brd. C. Fbr.	Good	Fair	Good	191
1093	(2000)	Vitreous Silica	K20-1-301	Standard	Brd. Sil./Brd.Sil. (heavy build)	Fair	Fair	Good	186
			K20-1-365	Standard	Brd. Sil./Brd.Sil.	Fair	Fair	Good	186
			K20-2-301	Special	Brd. Sil/Brd.Sil. (heavy build)	Fair	Fair	Good	186
			K20-2-365	Special	Brd. Sil./Brd.Sil.	Fair	Fair	Good	186
871	(1600)	High Temp. Fiberglass	J20-1-321	Standard	Brd. HT Gls./Brd. HT Gls.	Good	Good	Good	190
			J20-2-314	Special	Brd. HT Gls./TW	Good	Good	Good	189
			J20-2-321	Special	Brd. HT Gls./Brd. HT Gls.	Good	Good	Good	190
			K20-1-321	Standard	Brd. HT Gls./Brd. HT Gls.	Good	Good	Good	190
			K20-2-314	Special	Brd. HT Gls./TW	Good	Good	Good	189
			K20-2-321	Special	Brd. HT Gls./Brd. HT Gls.	Good	Good	Good	190
538	(1000)	Standard Fiberglass	B20-5-304*	Standard	Brd. Gls./Brd. Gls.	Fair	Good	Good	187
			E20-1-304	Standard	Brd. Gls./Brd. Gls.	Fair	Good	Good	187
			J16-5-313	Standard	Brd. Gls./Brd. Gls.	Good	Good	Good	N/A
			J20-1-304	Standard	Brd. Gls./Brd. Gls.	Fair	Good	Good	187
			J20-1-S-304	Standard	Brd. Gls./Brd. Gls.	Fair	Good	Good	187
			J20-2-304	Special	Brd. Gls./Brd. Gls.	Fair	Good	Good	187
			J20-3-304	Standard	Brd. Gls./Brd. Gls.	Fair	Good	Good	187
			J20-3-S-304	Standard	Brd. Gls./Brd. Gls./SS Brd.	Fair	Good	Good	187
			J24-1-304	Standard	Brd. Gls./Brd. Gls.	Fair	Good	Good	187
			J24-2-304	Special	Brd. Gls./Brd. Gls.	Fair	Good	Good	187
			J24-3-304	Standard	Brd. Gls./Brd. Gls.	Fair	Good	Good	187
			J28-1-305	Standard	Wrp. Dbl. Gls./Brd. Gls.	Fair	Good	Good	188
			J28-2-305	Special	Wrp. Dbl. Gls./Brd. Gls.	Fair	Good	Good	188
			J30-1-305	Standard	Wrp. Dbl. Gls./Brd. Gls.	Fair	Good	Good	188
			J30-2-305	Special	Wrp. Dbl. Gls./Brd. Gls.	Fair	Good	Good	188
			K16-5-313*	Standard	Brd. Gls./Brd. Gls.	Good	Good	Good	N/A
			K20-1-304	Standard	Brd. Gls./Brd. Gls.	Fair	Good	Good	187
			K20-1-S-304	Standard	Brd. Gls./Brd. Gls.	Fair	Good	Good	187
			K20-2-304	Special	Brd. Gls./Brd. Gls.	Fair	Good	Good	187
			K20-3-304	Standard	Brd. Gls./Brd. Gls.	Fair	Good	Good	187
			K20-3-S-304	Standard	Brd. Gls./Brd. Gls./SS Brd.	Fair	Good	Good	187
			K24-1-304	Standard	Brd. Gls./Brd. Gls.	Fair	Good	Good	187
			K24-2-304	Special	Brd. Gls./Brd. Gls.	Fair	Good	Good	187
			K24-2-306	Special	Brd. Gls./Brd. Gls.	Fair	Good	Good	N/A
			K24-3-304	Standard	Brd. Gls./Brd. Gls.	Fair	Good	Good	187

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***Note:** Recommended operating temperature limited to the extension grade alloy recommended temperature of 204°C (400°F).

STOCKED FOR SAME DAY SHIPMENT

- **All stock constructions available in 100, 250, 500 and 1,000 foot spools.**

SERV-RITE Wire and Cable

Stock Wire Products By Temperature

Thermocouple Wire Max. Op. Temp. °C	(°F)	Insulation	Part Number	Limits of Error	Description	Physical Properties: Abrasion Resistance	Moisture Resistance	Chemical Resistance	Page No.
538	(1000)	Standard Fiberglass	K28-2-305	Special	Wrp. Dbl. Gls./Brd. Gls.	Fair	Good	Good	188
			K30-1-305	Standard	Wrp. Dbl. Gls./Brd. Gls.	Fair	Good	Good	188
			K30-2-305	Special	Wrp. Dbl. Gls./Brd. Gls.	Fair	Good	Good	188
			S20-5-304*	Standard	Brd. Gls./Brd. Gls.	Fair	Good	Good	187
			T20-1-304	Standard	Brd. Gls./Brd. Gls.	Fair	Good	Good	187
			T24-1-304	Standard	Brd. Gls./Brd. Gls.	Fair	Good	Good	187
427	(800)	Polyimide Tape	J20-1-512	Standard	Tp. P-mide/Tp. P-mide	Excellent	Excellent	Excellent	204
			J20-2-513	Special	Dbl. Tp. P-mide/Dbl. Tp. P-mide	Excellent	Excellent	Excellent	205
			J20-3-512	Standard	Tp. P-mide/Tp. P-mide	Excellent	Excellent	Excellent	204
			J24-2-511	Special	Tp. P-mide/TW	Excellent	Excellent	Excellent	203
			K20-2-513	Special	Dbl. Tp. P-mide/Dbl. Tp. P-mide	Excellent	Excellent	Excellent	205
			K20-3-512	Standard	Tp. P-mide/Tp. P-mide	Excellent	Excellent	Excellent	204
			K24-2-513	Special	Tp. P-mide/Tp. P-mide	Excellent	Excellent	Excellent	205
343	(650)	SERV TEX	K16-5-155*	Standard	Brd. Gls./Brd. Stx.	Good	Good	Good	184
			K16-5-157*	Standard	Tp. TFE/Brd. Gls./Brd. Stx.	Good	Good	Good	185
			K16-7-155*	Standard	Brd. Gls./Brd. Stx.	Good	Good	Good	184
			S16-5-157*	Standard	Tp. TFE/Brd. Gls./Brd. Stx.	Good	Good	Good	185
316	(600)	TFE Tape	J20-1-508	Standard	Tp. TFE/Tp. TFE	Good	Excellent	Excellent	198
			J20-2-508	Special	Tp. TFE/Tp. TFE	Good	Excellent	Excellent	198
			J24-1-508	Standard	Tp. TFE/Tp. TFE	Good	Excellent	Excellent	198
			J24-2-508	Special	Tp. TFE/Tp. TFE	Good	Excellent	Excellent	198
			K20-1-508	Standard	Tp. TFE/Tp. TFE	Good	Excellent	Excellent	198
			K20-2-508	Special	Tp. TFE/Tp. TFE	Good	Excellent	Excellent	198
			K24-1-508	Standard	Tp. TFE/Tp. TFE	Good	Excellent	Excellent	198
			K24-2-508	Special	Tp. TFE/Tp. TFE	Good	Excellent	Excellent	198
			T20-2-508	Special	Tp. TFE/Tp. TFE	Good	Excellent	Excellent	198
			T24-1-508	Standard	Tp. TFE/Tp. TFE	Good	Excellent	Excellent	198
			T24-2-508	Special	Tp. TFE/Tp. TFE	Good	Excellent	Excellent	198
288	(550)	PFA	J24-3-516	Standard	PFA/PFA	Good	Excellent	Excellent	206
			K20-1-517	Standard	PFA/TWS/PFA	Good	Excellent	Excellent	N/A
			K24-2-516	Special	PFA/PFA	Good	Excellent	Excellent	206
260	(500)	FEP	E20-1-507	Standard	FEP/FEP	Excellent	Excellent	Excellent	196
			J16-5-509	Standard	FEP/TWS/FEP	Excellent	Excellent	Excellent	199
			J20-1-507	Standard	FEP/FEP	Excellent	Excellent	Excellent	196
			J20-1-509	Standard	FEP/TWS/FEP	Excellent	Excellent	Excellent	199
			J20-2-507	Special	FEP/FEP	Excellent	Excellent	Excellent	196
			J20-3-507	Standard	FEP/FEP	Excellent	Excellent	Excellent	196
			J20-5-507	Standard	FEP/FEP	Excellent	Excellent	Excellent	196
			J20-5-509	Standard	FEP/TWS/FEP	Excellent	Excellent	Excellent	199
			J24-1-507	Standard	FEP/FEP	Excellent	Excellent	Excellent	196

CONTINUED

***Note:** Recommended operating temperature limited to the extension grade alloy recommended temperature of 204°C (400°F).

STOCKED FOR SAME DAY SHIPMENT

- **All stock constructions available in 100, 250, 500 and 1,000 foot spools.**

Stock Wire Products By Temperature

Thermocouple Wire Max. Op. Temp. °C	(°F)	Insulation	Part Number	Limits of Error	Description	Physical Properties: Abrasion Resistance	Moisture Resistance	Chemical Resistance	Page No.
260	(500)	FEP	J24-2-507	Special	FEP/FEP	Excellent	Excellent	Excellent	196
			J24-3-507	Standard	FEP/FEP	Excellent	Excellent	Excellent	196
			J30-2-506	Special	FEP/FEP	Excellent	Excellent	Excellent	195
			K16-5-509	Standard	FEP/TWS/FEP	Excellent	Excellent	Excellent	199
			K20-1-507	Standard	FEP/FEP	Excellent	Excellent	Excellent	196
			K20-1-509	Standard	FEP/TWS/FEP	Excellent	Excellent	Excellent	199
			K20-2-507	Special	FEP/FEP	Excellent	Excellent	Excellent	196
			K20-2-509	Special	FEP/TWS/FEP	Excellent	Excellent	Excellent	199
			K20-3-507	Standard	FEP/FEP	Excellent	Excellent	Excellent	196
			K20-5-507	Standard	FEP/FEP	Excellent	Excellent	Excellent	196
			K20-5-509	Standard	FEP/TWS/FEP	Excellent	Excellent	Excellent	199
			K24-1-507	Standard	FEP/FEP	Excellent	Excellent	Excellent	196
			K24-2-507	Special	FEP/FEP	Excellent	Excellent	Excellent	196
			K24-3-507	Standard	FEP/FEP	Excellent	Excellent	Excellent	196
			K30-2-506	Special	FEP/FEP	Excellent	Excellent	Excellent	195
			S20-5-507	Standard	FEP/FEP	Excellent	Excellent	Excellent	196
			T20-1-507	Standard	FEP/FEP	Excellent	Excellent	Excellent	196
			T20-1-509	Standard	FEP/TWS/FEP	Excellent	Excellent	Excellent	199
			T20-2-507	Special	FEP/FEP	Excellent	Excellent	Excellent	196
			T20-3-507	Standard	FEP/FEP	Excellent	Excellent	Excellent	196
			T24-2-507	Special	FEP/FEP	Excellent	Excellent	Excellent	196
			T30-2-506	Special	FEP/FEP	Excellent	Excellent	Excellent	195
199	(390)	ETFE	J16-7-515	Standard	ETFE/TWS/ETFE	Excellent	Excellent	Excellent	N/A
			K16-7-515	Standard	ETFE/TWS/ETFE	Excellent	Excellent	Excellent	N/A
105	(221)	PVC	E20-5-502	Standard	PVC/PVC	Good	Excellent	Good	192
			E20-5-510	Standard	PVC/TWS/PVC	Good	Excellent	Good	201
			J16-5-502	Standard	PVC/PVC	Good	Excellent	Good	192
			J16-5-510	Standard	PVC/TWS/PVC	Good	Excellent	Good	201
			J16-5-510-UL	Standard	PVC/TWS/PVC	Good	Excellent	Good	202
			J20-5-1004	Standard	PVC/TWS pr./PVC Cbl.	Good	Excellent	Good	209
			J20-5-1008	Standard	PVC/TWS pr./PVC Cbl.	Good	Excellent	Good	209
			J20-5-502	Standard	PVC/PVC	Good	Excellent	Good	192
			J20-5-510	Standard	PVC/TWS/PVC	Good	Excellent	Good	201
			J20-5-510-UL	Standard	PVC/TWS/PVC	Good	Excellent	Good	202
			J20-7-502	Standard	PVC/PVC	Good	Excellent	Good	192
			J20-7-510	Standard	PVC/TWS/PVC	Good	Excellent	Good	201
			J24-1-505	Standard	PVC/Ripcord	Good	Excellent	Good	194
			J24-2-505	Special	PVC/Ripcord	Good	Excellent	Good	194

CONTINUED

***Note:** Recommended operating temperature limited to the extension grade alloy recommended temperature of 204°C (400°F).

STOCKED FOR SAME DAY SHIPMENT

- **All stock constructions available in 100, 250, 500 and 1,000 foot spools.**

SERV-RITE Wire and Cable

Stock Wire Products By Temperature

Thermocouple Wire Max. Op. Temp. °C	(°F)	Insulation	Part Number	Limits of Error	Description	Physical Properties: Abrasion Resistance	Moisture Resistance	Chemical Resistance	Page No.
105	(221)	PVC	K16-5-502	Standard	PVC/PVC	Good	Excellent	Good	192
			K16-5-510	Standard	PVC/TWS/PVC	Good	Excellent	Good	201
			K16-5-510-UL	Standard	PVC/TWS/PVC	Good	Excellent	Good	202
			K20-5-1004	Standard	PVC/TWS pr./PVC Cbl.	Good	Excellent	Good	209
			K20-5-1008	Standard	PVC/TWS pr./PVC Cbl.	Good	Excellent	Good	209
			K20-5-502	Standard	PVC/PVC	Good	Excellent	Good	192
			K20-5-510	Standard	PVC/TWS/PVC	Good	Excellent	Good	201
			K20-5-510-UL	Standard	PVC/TWS/PVC	Good	Excellent	Good	202
			K20-7-502	Standard	PVC/PVC	Good	Excellent	Good	192
			K20-7-510	Standard	PVC/TWS/PVC	Good	Excellent	Good	201
			K24-1-505	Standard	PVC/Ripcord	Good	Excellent	Good	194
			K24-2-505	Special	PVC/Ripcord	Good	Excellent	Good	194
			S20-5-502	Standard	PVC/PVC	Good	Excellent	Good	192
			S20-5-510	Standard	PVC/TWS/PVC	Good	Excellent	Good	201
			T16-5-510	Standard	PVC/TWS/PVC	Good	Excellent	Good	201
			T20-5-1004	Standard	PVC/TWS pr./PVC Cbl.	Good	Excellent	Good	209
			T20-5-1008	Standard	PVC/TWS pr./PVC Cbl.	Good	Excellent	Good	209
			T20-5-502	Standard	PVC/PVC	Good	Excellent	Good	192
			T20-5-510	Standard	PVC/TWS/PVC	Good	Excellent	Good	201
			T20-7-502	Standard	PVC/PVC	Good	Excellent	Good	192
			T24-1-505	Standard	PVC/Ripcord	Good	Excellent	Good	194
			T24-2-505	Special	PVC/Ripcord	Good	Excellent	Good	194
88	(190)	Cotton	J30-2-308-002	Special	Dbl. Wrp. Cot./Brd. Cot.	Fair	Fair	Poor	N/A
RTD Lead Wire									
538	(1000)	Standard Fiberglass	RT3-24-8-705	N/A	Brd. Gls./TW/Brd. Gls.	Fair	Good	Good	210
260	(500)	FEP	RT3-22-8-704	N/A	FEP/TW/FEP	Excellent	Excellent	Excellent	210
105	(221)	PVC	RT3-22-4-701	N/A	PVC/TW/PVC	Good	Excellent	Good	210

***Note:** Recommended operating temperature limited to the extension grade alloy recommended temperature of 204°C (400°F).

Legend:

Brd. = Braided
Gls. = Fiberglass
TWS. = Twisted and shielded
HT = High temperature
Tp. = Taped
P-mide = Polyimide
Cbl. = Cable
TW. = Twisted
Wrp. = Wrapped
Dbl. = Double
Cot. = Cotton
Stx. = SERV TEX synthetic braid
C.Fbr = Ceramic fiber
Sil. = Vitreous silica
pr. = Pair
Std. = Standard
Spc. = Special

How to Order

When ordering SERV-RITE thermocouple and extension wire, remember to include the following information:

Calibration

- B, C*, E, J, K, N, R, S or T

Gauge size

- AWG gauge

Solid or stranded conductors

- Stranded conductors will be seven strand constructions. If your requirements need other configurations, please consult the factory.

Thermocouple or extension grade

- Determine whether this will be used for the actual sensor or just to “extend” the signal at lower temperatures.

Standard or special limits of error

- This will determine the accuracy of your sensor. Limits of error is determined by testing at a predefined Watlow standard test point. To guarantee limits of error at other temperature points please contact the factory to arrange special testing.

Insulation on singles and duplex

- These are usually the same material which is chosen for the environment in which the sensor will be used. If special designs are required, consult factory for details.

Color coding

- Unless specified, all color coding will be to ASTM E 230 standards.

Spool lengths

- Spool lengths should be specified as to your requirements. Watlow tries to maintain a policy of shipping 1,000 foot spools. However, if not specified, random lengths may be shipped. If you have special packaging requirements, please consult factory.

Variation in quantity

- Watlow follows the industry standard of shipping and invoicing at plus or minus ten percent of any ordered item. If your requirements dictate anything other than plus or minus ten percent, consult factory as there may be additional charges.

Overbraid options

- If an overbraid is required, the options are presented below.

Overbraid selection code

- **S**–Stainless Steel Wire Braid

  C–Tinned Copper Wire Braid

  W–Flat Stainless Steel Spiral Wrap

  N–Alloy 600 Wire Braid

  Each SERIES page lists these options. Special requirements and testing are available at additional cost. Consult factory for details. These include:

Shielding

- Some constructions are available with shielding possibilities.

Calibration Tests

- If calibration is required, please specify the temperatures.

Certificate of Compliance

- These may be provided to various specifications. When ordering, please provide specification requirements.

Special Requirements

- Please consult the factory for any requirements not covered above.

Availability

Stock constructions: Many constructions available for same day shipment

Stock constructions with options: Shipment generally in five working days or less

Stock constructions requiring calibration or other laboratory services: Shipment generally in five working days or less

Made-to-order: Consult factory for details

*Not an ASTM E 230 symbol

SERV-RITE Wire and Cable

Thermocouple Wire and Thermocouple Extension Wire

Technical Data

How to Select Wire to Suit Your Requirements

The following information will acquaint you with some of the nomenclature involved with thermocouple wire and thermocouple extension wire. By spending a few minutes reading this information orders can be placed quickly and accurately.

Thermocouple Wire or Thermocouple Extension Wire

There are some significant differences between the wire used to actually measure temperature and the wire used to carry the millivoltage signal to an instrument.

The most obvious difference is the color-code used to identify the wire itself. In most cases, thermocouple grade wire is identified by its overall brown color. The exceptions in the SERV-RITE wire product line are the very high temperature yarns such as those used in the SERIES 301 and 350. Of course, the overall color code is not used when there is no overall covering as in SERV-RITE wire SERIES 505, 511 and 314.

The working differences between the two wires is that the thermocouple "extension" wire is not calibrated above 204°C (400°F). The temperature rating of the insulations used on some extension grade wire exceeds this 204°C (400°F) temperature. This is to allow the wire to survive occasional contact with hot parts or furnace walls.

The following explains the meanings of the terms used in the tables of this section.

Single Conductor Insulation

This item identifies the type of insulation used on the individual thermoelements. Certain part numbers use a combination of insulations. When there is a combination, the insulations are listed in their order of application.

Duplex Conductor Insulation

This item lists the overall insulation when one is used. Some constructions which have no overall insulation use this area to describe the duplexing method—i.e. twisting, "ripcord", etc.

Temperature Rating

Most constructions are rated for both continuous use and for single reading applications. The continuous use temperature is considered to be the highest temperature at which that particular construction will survive indefinitely. The single reading temperature has been determined by actual tests. Each insulation system will perform differently when exposed to this temperature. Generally, the construction will perform at this temperature and produce an accurate reading. However, after exposure to this temperature, the wire will exhibit less flexibility and/or abrasion resistance. Because of this, it is unlikely that the wire could be removed from the application and then replaced after exposure to the "single reading temperature."

SERV-RITE Wire and Cable

Thermocouple Wire and Thermocouple Extension Wire

Technical Data

How to Select Wire to Suit Your Requirements

ASTM E 230 Color Code

Generally, SERV-RITE wire has color codes wherever possible. The exceptions are the high temperature yarn constructions such as the SERIES 301 and 350. Color coding of the SERIES 511 and 512 is accomplished by including a colored thread or "tracer" under the tape.

Physical Properties

Abrasion Resistance is rated fair, good, or excellent and is based on the wall thickness of the construction and how well it survives with other insulations of similar thicknesses. The 511 SERIES receives an excellent rating because the thin wall of polyimide tape will survive better than almost any other insulation applied in the same wall thickness. The "absolute" abrasion resistance of a construction will depend not only on the type of insulation but on thickness at which it is applied.

Moisture Resistance ratings are given for the wire in the "as received" condition. In the case of fiberglass insulated wire, the moisture resistance is achieved by the use of impregnations or spirally applied tapes called moisture barriers. The impregnations and/or tapes will burn off at temperatures below the upper useful operating temperatures of the fiberglass. The thermoplastic insulations (PVC and the fluoroplastics) and the polyimide insulated constructions will maintain their moisture resistance up to their "continuous" temperature rating.

Chemical Resistance ratings are given as they relate to most common chemicals. These ratings apply to the insulation types and not necessarily to the type of impregnation used. Consult factory for specific applications.

UL® Listed PLTC Wire And Cable

Watlow offers UL® listed SERV-RITE thermocouple and extension wire and cable for PLTC (Power Limited Tray Cable) applications. The following insulation SERIES have these approvals:

- 502
- 507
- 509
- 510
- 900
- 1000

All these insulation SERIES have the following physical characteristics:

- UL® listed Type PLTC—300 Volt
- Passes IEEE 383 70,000 BTU/Hr flame test
- Passes VW-1 flame test
- UL® listed under Subject 13
- Non-propagating
- Flame retardant
- UV light resistant

Metallic Overbraids and Wraps

Although standard SERV-RITE wire products are designed to yield a high degree of abrasion resistance, it is sometimes necessary to add an additional metallic covering to further enhance this property. The following are the available overbraids and wraps.

Stainless Steel Wire Braid (S)

This, the most popular of the over-braids, uses 300 series stainless steel and is available on virtually all standard SERV-RITE wire offerings. It is an economical method of extending the life of thermocouple and extension wire. Several of our standard wire items are available from stock with a stainless overbraid. Non-stock items are available on a special order basis.

Alloy 600 Wire Braid (N)

Most commonly specified on high temperature SERV-RITE wire yarn insulations, the Inconel® braid offers a higher operating temperature than the series 300 stainless steel overbraid. When this braid is specified on SERV-RITE SERIES 350, the performance of the material is only surpassed by metal-sheathed cables. Consult factory for availability on specific wire items.

Tinned Copper Wire Overbraid (C)

When there is a possibility of electrical interference in the area of the thermocouple installation, it may be necessary to shield the wire from electrical "noise." Several of our standard products use aluminized tapes as an intrinsic shield. However, when shielding is needed on other constructions, a tinned copper shield can be specified on special order.

Stainless Steel Spiral Wrap (W)

Certain constructions are available with a spirally applied stainless steel wrap. The wrap yields a tough mechanical coating that survives well in most outdoor applications. Consult factory for the availability on specific catalog items. To add a metallic overbraid or wrap, insert the letter designator as follows:

Inconel® is a registered trademark of Special Metals Corporation.

SERV-RITE Wire and Cable

Thermocouple Wire and Thermocouple Extension Wire

Technical Data

How to Select Wire Code Number

1	2	3		4		5		6	7	8		9	10	11
			-		-		-				-			

1. ASTM E 230 Calibration[1]

B N
E S
J T
K

2-3. AWG

14 to 36

4. Conductor Type/Tolerance[2]

1 = Thermocouple grade, solid wire, standard tolerance
2 = Thermocouple grade, solid wire, special tolerance
3 = Thermocouple grade, stranded wire, standard tolerance
4 = Thermocouple grade, stranded wire, special tolerance
5 = Extension grade, solid wire, standard tolerance
6 = Extension grade, solid wire, special tolerance
7 = Extension grade, stranded wire, standard tolerance
8 = Extension grade, stranded wire, special tolerance

5. Metallic Overbraids (optional)

S = Stainless steel
N = Alloy 600
C = Tinned copper

6-8. Insulation Series

Refer to Insulation chart below.

9-11. Color Code

Blank = ASTM E 230 (formally ANSI MC96.1)
BSC = BS 1843
DIN = DIN 43710
JIS = JIS C 1610-1981
IEC = IEC 584-3

[1] Color coding will be to ASTM E 230 standards, unless specified.

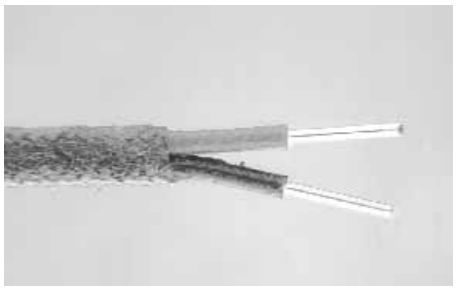
[2] Stranded conductors will be seven strand constructions. Consult factory for other configurations.

Made-to-order

If you are unable to locate the stock SERV-RITE wire product that meets your unique application, Watlow can manufacture the exact wire product that does. With short lead times, Watlow can make-to-order any combination of wire type and insulation with metallic overbraids, wraps or shielding, in designated standards. Simply review “How to Order,” on page 180 of this section, define your requirements and call your Watlow representative to place your order and confirm specifications.

Thermocouple Wire

SERV TEX Insulated Extension Wire SERIES 155



The SERIES 155 is a tough wire especially suited to applications involving momentary contact with molten metals, hot surfaces as found in heat treating, steel, aluminum plants, glass ceramic and brick manufacturing.

The conductors are insulated with braided fiberglass and then impregnated with a resin. Insulated conductors are then laid parallel and a SERV TEX braid is woven over them and a final impregnation is applied.

Continuous Use Temp.	Single Use Temp.
290˚C (550˚F)	340˚C (650˚F)
Resin retained to 204°C (400°F)	

Resistance Properties		
Moisture	Chemical	Abrasion
Good	Good	Good

Popular Constructions

Grade	AWG	Wire Type	Limits of Error	Type K	Type J	Type S
Extension	16	Solid	Standard	**K16-5-155**	J16-5-155	S16-5-155
		Stranded	Standard	**K16-7-155**	J16-7-155	S16-7-155

Note: **Bolded** products are stocked and shipped in 100, 250, 500 and 1000 foot spools.

Available Constructions

1	2	3	4	5	6	7
			-	-	1	5	5

1. ASTM E 230 Calibrations

E K S
J N T

2-3. AWG

20	16	14
20 stranded (7/28)	16 stranded (7/24)	14 stranded (7/22)

4. Conductor Type/Tolerance

5 = Extension grade, solid wire, standard tolerance
6 = Extension grade, solid wire, special tolerance
7 = Extension grade, stranded wire, standard tolerance
8 = Extension grade, stranded wire, special tolerance

Note: Minimum order sizes apply for non-stock constructions.

Performance Capabilities

- Continuous temperature rating: 290°C (550°F)
- SERV TEX heavy braided jacket
- Fiberglass braided insulation
- Available with optional metallic overbraid for additional abrasion resistance

Applications

- Heat treating
- Molten metal
- Foundry

Wire Specifications

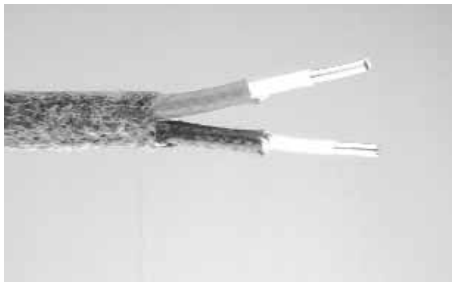
AWG	Nominal Conductor Size		Nominal Insulation Thickness				Nominal Overall Size		Approximate Shipping Weight	
			Conductor		Overall					
	in.	(mm)	in.	(mm)	in.	(mm)	in.	(mm)	lbs/1000 ft	(kg/km)
20	0.032	(0.813)	0.015	(0.381)	0.030	(0.762)	0.136 x 0.178	(3.45 x 4.52)	15	(22.4)
20 S* (7/28)	0.038	(0.965)	0.015	(0.381)	0.030	(0.762)	0.144 x 0.196	(3.66 x 4.98)	16	(23.8)
16	0.051	(1.290)	0.015	(0.381)	0.030	(0.762)	0.158 x 0.226	(4.01 x 5.74)	29	(43.2)
16 S* (7/24)	0.060	(1.524)	0.015	(0.381)	0.030	(0.762)	0.170 x 0.244	(4.32 x 6.20)	31	(46.2)
14	0.064	(1.628)	0.015	(0.381)	0.030	(0.762)	0.180 x 0.252	(4.57 x 6.40)	40	(59.6)
14 S* (7/22)	0.076	(1.930)	0.015	(0.381)	0.030	(0.762)	0.205 x 0.270	(5.21 x 6.86)	46	(68.5)

* “S” denotes stranded wire: e.g., “20 S (7/28)” is seven strands of 28 gauge wire to make a 20 gauge stranded conductor.

SERV-RITE Wire and Cable

Thermocouple Wire

SERV TEX and TFE Tape Extension Wire SERIES 157



The SERIES 157 is an improved version of SERIES 155. The SERIES 157 uses tape over the conductors to improve moisture resistance.

The SERIES 157 conductors are first wrapped with a TFE tape, braided with fiberglass, and then impregnated with a resin. The insulated single conductors are then laid parallel and braided with SERV TEX yarn. The final coat is a resin impregnation.

Continuous Use Temp.	Single Use Temp.
290˚C (550˚F)	340˚C (650˚F)
Resin retained to 204°C (400°F)	

Resistance Properties		
Moisture	Chemical	Abrasion
Good	Good	Good

Popular Constructions

Grade	AWG	Wire Type	Limits of Error	Type K	Type J	Type S
Extension	16	Solid	Standard	**K16-5-157**	J16-5-157	**S16-5-157**
		Stranded	Standard	K16-7-157	J16-7-157	S16-7-157

Note: **Bolded** products are stocked and shipped in 100, 250, 500 and 1000 foot spools.

Available Constructions

1	2	3	4	5	6	7
			-	-	1	5	7

1. ASTM E 230 Calibrations

E K S
J N T

2-3. AWG

20	16	14
20 stranded (7/28)	16 stranded (7/24)	14 stranded (7/22)

4. Conductor Type/Tolerance

5 = Extension grade, solid wire, standard tolerance
6 = Extension grade, solid wire, special tolerance
7 = Extension grade, stranded wire, standard tolerance
8 = Extension grade, stranded wire, special tolerance

Note: Minimum order sizes apply for non-stock constructions.

Performance Capabilities

- Continuous temperature rating 290°C (550°F)
- SERV TEX heavy braided jacket
- Fiberglass braided insulation
- TFE taped conductors
- Available with optional metallic overbraid for additional abrasion resistance

Applications

- Heat treating
- Molten metal
- Foundry

Wire Specifications

AWG	Nominal Conductor Size		Nominal Insulation Thickness				Nominal Overall Size		Approximate Shipping Weight	
			Conductor		Overall					
	in.	(mm)	in.	(mm)	in.	(mm)	in.	(mm)	lbs/1000 ft	(kg/km)
20	0.032	(0.813)	0.020	(0.508)	0.030	(0.762)	0.146 x 0.192	(3.71 x 4.87)	16	(23.8)
20 S* (7/28)	0.038	(0.965)	0.020	(0.508)	0.030	(0.762)	0.154 x 0.210	(3.91 x 5.33)	17	(25.3)
16	0.051	(1.290)	0.020	(0.508)	0.030	(0.762)	0.168 x 0.240	(4.27 x 6.10)	30	(44.7)
16 S* (7/24)	0.060	(1.524)	0.020	(0.508)	0.030	(0.762)	0.180 x 0.258	(4.57 x 6.55)	32	(47.7)
14	0.064	(1.628)	0.020	(0.508)	0.030	(0.762)	0.190 x 0.266	(4.57 x 6.76)	42	(62.6)
14 S* (7/22)	0.076	(1.930)	0.020	(0.508)	0.030	(0.762)	0.225 x 0.302	(5.72 x 7.67)	48	(71.5)

* “S” denotes stranded wire: e.g., “20 S (7/28)” is seven strands of 28 gauge wire to make a 20 gauge stranded conductor.

Thermocouple Wire

High Temperature Vitreous Silica Braided Thermocouple Wire SERIES 301 and 365

Both the SERIES 301 and 365 use vitreous silica yarn as the insulation on both the conductors and duplex. This yarn retains its flexibility after exposure to high temperatures.

The vitreous silica yarn's greater purity performs better at high temperatures than other fibrous glass products. Testing has indicated that "contamination" will compromise this material's upper use temperature. For this reason, our standard offering is supplied without color coding or impregnations. The 365 construction is a cost-effective, medium insulation build of the popular heavy duty 301 construction.

For higher temperatures consider SERIES 350 (see page 191).

Continuous Use Temp.	Single Use Temp.
980˚C (1800˚F)	1093˚C (2000˚F)

Resistance Properties		
Moisture	**Chemical**	**Abrasion**
Fair	Good	Fair

Popular Constructions

Grade	AWG	Wire Type	Insulation	Limits of Error	Type K
Thermocouple	20	Solid	Heavy	Standard	**K20-1-301**
				Special	**K20-2-301**
			Medium	Standard	**K20-1-365**
				Special	**K20-2-365**

Note: **Bolded** products are stocked and shipped in 100, 250, 500 and 1000 foot spools.

Available Constructions

1 2 3 4 5 6 7
- -

1. ASTM E 230 Calibrations
E K
J N

2-3. AWG
20
16

4. Conductor Type/Tolerance
1 = Thermocouple grade, solid wire, standard tolerance
2 = Thermocouple grade, solid wire, special tolerance

5-7. Insulation Type
301 = Heavy build
365 = Medium build

Note: Minimum order sizes apply for non-stock constructions.

Performance Capabilities

- Continuous temperature rating 982°C (1800°F)
- Vitreous silica braided yarn insulation
- Available with optional metallic overbraid for additional abrasion resistance

Applications

- Heat treating
- Oven and furnace
- Survey and load

Wire Specifications - SERIES 301 and SERIES 365

AWG	Nominal Conductor Size		Nominal Insulation Thickness				Nominal Overall Size		Approximate Shipping Weight	
			Conductor		Overall					
	in.	(mm)	in.	(mm)	in.	(mm)	in.	(mm)	lbs/1000 ft	(kg/km)
20①	0.032	(0.813)	0.018	(0.457)	0.015	(0.381)	0.098 x 0.154	(2.49 x 3.91)	15	(22.4)
18①	0.040	(1.020)	0.018	(0.457)	0.015	(0.381)	0.110 x 0.180	(2.79 x 4.57)	19	(28.3)
16①	0.051	(1.290)	0.016	(0.406)	0.015	(0.381)	0.118 x 0.198	(3.00 x 5.03)	25	(37.3)
20②	0.032	(0.813)	0.015	(0.381)	0.012	(0.305)	0.090 x 0.140	(2.29 x 3.56)	13	(19.4)

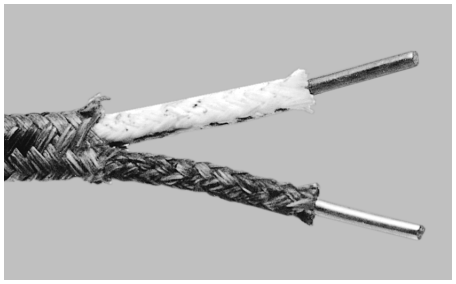
①SERIES 301
②SERIES 365

* Lack of binders or impregnations may cause insulation to "flower" when stripped.

SERV-RITE Wire and Cable

Thermocouple Wire

Fiberglass Braided Thermocouple and Extension Wire SERIES 304



The uniform quality and availability of the SERIES 304 make it the ideal wire for general applications requiring moderate abrasion and moisture resistance, wide temperature capabilities and economy.

Each conductor is covered with a color coded glass braid. This braid is impregnated to enhance abrasion resistance and reduce fraying. The insulated single conductors are laid parallel and covered with another layer of woven glass. A final impregnation is then applied to the glass.

For higher temperatures, consider SERIES 321 (see page 190).

Continuous Use Temp.	Single Use Temp.
480˚C (900˚F)	540˚C (1000˚F)
Resin retained to 204°C (400°F)	

Resistance Properties		
Moisture	Chemical	Abrasion
Good	Good	Fair

Popular Constructions

Grade	AWG	Wire Type	Limits of Error	Type K	Type J	Type T
Thermocouple	20	Solid	Standard	**K20-1-304***	**J20-1-304***	**T20-1-304**
			Special	**K20-2-304**	**J20-2-304**	T20-2-304
		Stranded	Standard	**K20-3-304***	**J20-3-304***	T20-3-304
	24	Solid	Standard	**K24-1-304**	**J24-1-304**	**T24-1-304**
			Special	**K24-2-304**	**J24-2-304**	T24-2-304
		Stranded	Standard	**K24-3-304**	**J24-3-304**	

Grade	AWG	Wire Type	Limits of Error	Type E	Type B
Thermocouple	20	Solid	Standard	**E20-1-304**	
			Special	E20-2-304	
		Stranded	Standard	E20-3-304	
Extension	20	Solid	Standard		**B20-5-304**
	24	Solid	Standard		

Note: **Bolded** products are stocked and shipped in 100, 250, 500 and 1000 foot spools.
*These constructions stocked with a **stainless steel overbraid** (order overbraid by adding "-S" in front of construction type (i.e. K20-1-S-304).

Available Constructions

1	2	3	4	5	6	7
			-	-3	0	4

1. ASTM E 230 Calibrations

B	J	N	T
E	K	S	

2-3. AWG

30	24	20
28	24 stranded (7/32)	20 stranded (7/28)

4. Conductor Type/Tolerance

1 = Thermocouple grade, solid wire, standard tolerance
2 = Thermocouple grade, solid wire, special tolerance
3 = Thermocouple grade, stranded wire, standard tolerance
4 = Thermocouple grade, stranded wire, special tolerance
5 = Extension grade, solid wire, standard tolerance
6 = Extension grade, solid wire, special tolerance
7 = Extension grade, stranded wire, standard tolerance
8 = Extension grade, stranded wire, special tolerance

Note: Minimum order sizes apply for non-stock constructions.

Performance Capabilities

- Continuous temperature rating 482°C (900°F)
- Fiberglass braided yarn insulation
- Available with optional metallic overbraid for additional abrasion resistance

Applications

- Heat treating
- Oven
- General use

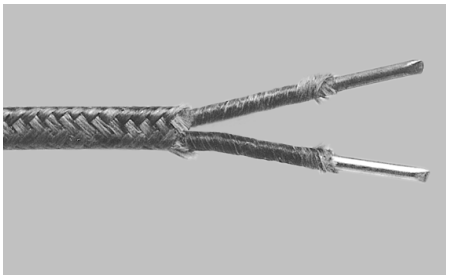
Wire Specifications

AWG	Nominal Conductor Size in.	(mm)	Nominal Insulation Thickness Conductor in.	(mm)	Overall in.	(mm)	Nominal Overall Size in.	(mm)	Approximate Shipping Weight lbs/1000 ft	(kg/km)
30	0.010	(0.254)	0.007	(0.178)	0.008	(0.203)	0.043 x 0.064	(1.09 x 1.63)	3	(4.5)
28	0.013	(0.320)	0.007	(0.178)	0.008	(0.203)	0.043 x 0.070	(1.09 x 1.78)	3	(4.5)
24	0.020	(1.508)	0.005	(0.127)	0.006	(0.152)	0.045 x 0.072	(1.14 x 1.83)	7	(10.4)
24 S* (7/32)	0.024	(1.610)	0.005	(0.127)	0.006	(0.152)	0.048 x 0.080	(1.22 x 2.03)	8	(11.9)
20	0.032	(1.813)	0.005	(0.127)	0.006	(0.152)	0.056 x 0.096	(1.42 x 2.44)	9	(13.4)
20 S* (7/28)	0.038	(1.965)	0.006	(0.152)	0.006	(0.152)	0.064 x 0.112	(1.63 x 2.84)	10	(14.9)

* "S" denotes stranded wire: e.g., "20 S (7/28)" is seven strands of 28 gauge wire to make a 20 gauge stranded conductor.

Thermocouple Wire

Fiberglass Wrapped Thermocouple and Extension Wire SERIES 305



SERIES 305 is specifically constructed for light duty applications where size is a critical factor. The single conductors are insulated using a specialized yarn wrapped on the conductors in layers. This yarn is then impregnated to add abrasion resistance and enhance electrical properties. The insulated single conductors are then laid parallel and covered with a layer of braided glass. A final impregnation is applied to the braid.

For higher temperature applications, use SERIES 321 (see page 190).

Continuous Use Temp.	Single Use Temp.
480˚C (900˚F)	540˚C (1000˚F)
Resin retained to 204°C (400°F)	

Resistance Properties		
Moisture	Chemical	Abrasion
Good	Good	Fair

Popular Constructions

Grade	AWG	Wire Type	Limits of Error	Type K	Type J
Thermocouple	24	Solid	Standard	K24-1-305	J24-1-305
			Special	K24-2-305	J24-2-305
	28	Solid	Standard	K28-1-305	**J28-1-305**
			Special	**K28-2-305**	**J28-2-305**
	30	Solid	Standard	**K30-1-305**	**J30-1-305**
			Special	**K30-2-305**	**J30-2-305**

Note: **Bolded** products are stocked and shipped in 100, 250, 500 and 1000 foot spools.

Available Constructions

1	2	3	4	5	6	7
			-	-	3	0	5

1. ASTM E 230 Calibrations

B J N T
E K S

2-3. AWG

30 24 20
28 24 stranded (7/32) 20 stranded (7/28)

4. Conductor Type/Tolerance

1 = Thermocouple grade, solid wire, standard tolerance
2 = Thermocouple grade, solid wire, special tolerance
3 = Thermocouple grade, stranded wire, standard tolerance
4 = Thermocouple grade, stranded wire, special tolerance
5 = Extension grade, solid wire, standard tolerance
6 = Extension grade, solid wire, special tolerance
7 = Extension grade, stranded wire, standard tolerance
8 = Extension grade, stranded wire, special tolerance

Note: Minimum order sizes apply for non-stock constructions.

Performance Capabilities

- Continuous temperature rating 482°C (900°F)
- Fiberglass braided yarn insulation
- Yarn wrapped conductors for superior coverage on small gauge wires
- Available with optional metallic overbraid for additional abrasion resistance

Applications

- Heat treating
- Oven
- General use

Wire Specifications

AWG	Nominal Conductor Size		Nominal Insulation Thickness				Nominal Overall Size		Approximate Shipping Weight	
			Conductor		Overall					
	in.	(mm)	in.	(mm)	in.	(mm)	in.	(mm)	lbs/1000 ft	(kg/km)
30	0.010	(0.254)	0.005	(0.127)	0.008	(0.203)	0.036 x 0.056	(0.914 x 1.42)	3	(4.5)
28	0.013	(0.320)	0.005	(0.127)	0.008	(0.203)	0.040 x 0.062	(1.02 x 1.57)	3	(4.5)
24	0.020	(0.508)	0.005	(0.127)	0.006	(0.152)	0.042 x 0.072	(1.07 x 1.83)	7	(10.4)
24 S* (7/32)	0.024	(0.610)	0.005	(0.127)	0.006	(0.152)	0.048 x 0.080	(1.22 x 2.03)	8	(11.9)
20	0.032	(0.813)	0.005	(0.127)	0.006	(0.152)	0.054 x 0.096	(1.37 x 2.44)	9	(13.4)
20 S* (7/28)	0.038	(0.965)	0.005	(0.127)	0.006	(0.152)	0.060 x 0.108	(1.52 x 2.74)	10	(14.9)

* “S” denotes stranded wire: e.g., “24 S (7/32)” is seven strands of 32 gauge wire to make a 24 gauge stranded conductor.

SERV-RITE Wire and Cable

Thermocouple Wire

High Temperature Fiberglass Twisted Thermocouple Wire SERIES 314

The SERIES 314 is an economical construction for general, high temperature applications. The braided high temperature yarn is applied in a unique manner that allows SERIES 314 to be competitively priced with other fiberglass constructions. It produces a finished wire that performs at temperatures to 870°C (1600°F).

The conductors are insulated with braided high strength fiberglass and impregnated to improve abrasion resistance. The impregnation is tinted to impart color coding to primary insulations. The insulated single conductors are then twisted together to yield a construction flexible enough for most any application.

Continuous Use Temp.	Single Use Temp.
705˚C (1300˚F)	870˚C (1600˚F)
Resin retained to 204°C (400°F)	

Resistance Properties		
Moisture	Chemical	Abrasion
Good	Good	Good

Popular Constructions

Grade	AWG	Wire Type	Limits of Error	Type K	Type J
Thermocouple	20	Solid	Standard	K20-1-314	J20-1-314
			Special	**K20-2-314**	**J20-2-314**
	24	Solid	Standard	K24-1-314	J24-1-314
			Special	K24-2-314	J24-2-314

Note: **Bolded** products are stocked and shipped in 100, 250, 500 and 1000 foot spools.

Available Constructions

1	2	3	4	5	6	7
			-	-	3	1	4

1. ASTM E 230 Calibrations

E K T
J N

2-3. AWG

24 16
20

4. Conductor Type/Tolerance

1 = Thermocouple grade, solid wire, standard tolerance
2 = Thermocouple grade, solid wire, special tolerance
3 = Thermocouple grade, stranded wire, standard tolerance
4 = Thermocouple grade, stranded wire, special tolerance

Note: Minimum order sizes apply for non-stock constructions.

Performance Capabilities

- Continuous temperature rating 705°C (1300°F)
- Fiberglass braided yarn insulation
- Twisted design has no jacket
- Available with optional metallic overbraid for additional abrasion resistance

Applications

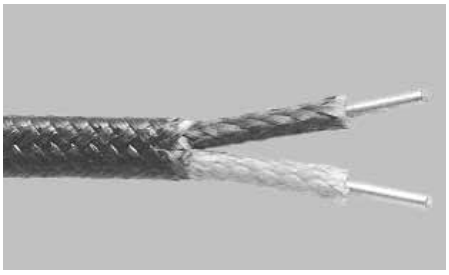
- Heat treating
- Aluminum stress relieving
- Steel annealing

Wire Specifications

AWG	Nominal Conductor Size in.	(mm)	Nominal Conductor Insulation Thickness in.	(mm)	Nominal Overall Size in.	(mm)	Approximate Shipping Weight lbs/1000 ft	(kg/km)
24	0.020	(0.508)	0.015	(0.381)	0.100	(2.54)	6	(8.9)
20	0.032	(0.965)	0.015	(0.381)	0.124	(3.15)	10	(14.9)
18	0.040	(1.02)	0.018	(0.457)	0.152	(3.56)	16	(23.8)
16	0.051	(1.29)	0.018	(0.457)	0.174	(4.42)	21	(31.3)
14	0.064	(1.63)	0.018	(0.457)	0.200	(5.08)	32	(47.7)

Thermocouple Wire

High Temperature Braided Fiberglass Thermocouple Wire SERIES 321



The addition of color coding and impregnation to the high temperature fiberglass make this the logical next step for systems which have exceeded the temperature capabilities of standard glass insulated series.

Each conductor is covered with a color coded, high temperature fiberglass braid. This braid is then impregnated to enhance abrasion resistance and reduce fraying. The insulated conductors are laid parallel and covered with another braid of high temperature fiberglass and impregnation.

Continuous Use Temp.	Single Use Temp.
705˚C (1300˚F)	870˚C (1600˚F)
Resin retained to 204°C (400°F)	

Resistance Properties		
Moisture	Chemical	Abrasion
Good	Good	Good

Popular Constructions

Grade	AWG	Wire Type	Limits of Error	Type K	Type J
Thermocouple	20	Solid	Standard	**K20-1-321**	**J20-1-321**
			Special	**K20-2-321**	**J20-2-321**
	24	Solid	Standard	K24-1-321	J24-1-321
			Special	K24-2-321	J24-2-321

Note: **Bolded** products are stocked and shipped in 100, 250, 500 and 1000 foot spools.

Available Constructions

1 2 3 4 5 6 7
_ _ _ - _ - 3 2 1

1. ASTM E 230 Calibrations
E K T
J N

2-3. AWG
24 16
20 14

4. Conductor Type/Tolerance
1 = Thermocouple grade, solid wire, standard tolerance
2 = Thermocouple grade, solid wire, special tolerance
3 = Thermocouple grade, stranded wire, standard tolerance
4 = Thermocouple grade, stranded wire, special tolerance

Note: Minimum order sizes apply for non-stock constructions.

Performance Capabilities

- Continuous temperature rating 705°C (1300°F)
- Heavy fiberglass braided yarn insulation
- Twisted design has no jacket
- Available with optional metallic overbraid for additional abrasion resistance

Applications

- Heat treating
- Aluminum and steel

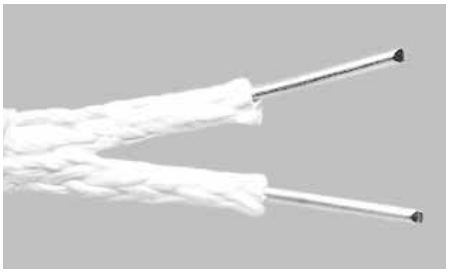
Wire Specifications

AWG	Nominal Conductor Size		Nominal Insulation Thickness				Nominal Overall Size		Approximate Shipping Weight	
			Conductor		Overall					
	in.	(mm)	in.	(mm)	in.	(mm)	in.	(mm)	lbs/1000 ft	(kg/km)
24	0.020	(0.508)	0.015	(0.381)	0.010	(0.254)	0.072 x 0.120	(1.83 x 3.05)	10	(14.9)
20	0.032	(0.965)	0.015	(0.381)	0.010	(0.254)	0.082 x 0.140	(2.08 x 3.56)	13	(19.4)
18	0.040	(1.02)	0.015	(0.381)	0.010	(0.254)	0.090 x 0.156	(2.29 x 3.96)	18	(26.8)
16	0.051	(1.29)	0.015	(0.381)	0.010	(0.254)	0.100 x 0.174	(2.54 x 4.42)	25	(37.3)
14	0.064	(1.63)	0.015	(0.381)	0.010	(0.254)	0.114 x 0.200	(2.90 x 5.08)	34	(50.7)

SERV-RITE Wire and Cable

Thermocouple Wire

High Temperature Ceramic Fiber Thermocouple Wire SERIES 350 and 355



The SERIES 350 uses the ultimate high-temperature flexible insulating system. The ceramic fiber yarn's upper temperature limit often exceeds the melting point of the material it's insulating. When an application requires flexible insulation, while pushing Type K or Type N to their extreme limits, ceramic fiber insulation is the only choice.

Watlow supplies standard SERIES 350 without color coding or impregnations.* This minimizes contaminating the pure ceramic fiber yarn. Laboratory testing indicates the impregnation can decrease the upper use temperature by as much as 540°C (1000°F).

The 355 construction is a cost-effective, medium insulation build of the popular 350 heavy duty construction.

If application temperatures exceed SERIES 350 construction, specify XACTPAK® mineral-insulated, metal-sheathed cable.

Popular Constructions

Grade	AWG	Wire Type	Insulation	Limits of Error	Type K
Thermocouple	20	Solid	Heavy	Standard	**K20-1-350**
				Special	**K20-2-350**
			Medium	Standard	**K20-1-355**
				Special	**K20-2-355**

Note: **Bolded** products are stocked and shipped in 100, 250, 500 and 1000 foot spools.

Available Constructions

1 2 3 4 5 6 7

- -

1. ASTM E 230 Calibrations

E K

J N

2-3. AWG

24 16

20 14

4. Conductor Type/Tolerance

1 = Thermocouple grade, solid wire, standard tolerance

2 = Thermocouple grade, solid wire, special tolerance

3 = Thermocouple grade, stranded wire, standard tolerance

4 = Thermocouple grade, stranded wire, special tolerance

5-7. Insulation Type

350 = Heavy build

355 = Medium build

Note: Minimum order sizes apply for non-stock constructions.

Performance Capabilities

- Continuous temperature rating 1205°C (2200°F)
- Ceramic fiber braided yarn insulation
- Available with optional metallic overbraid for additional abrasion resistance

Continuous Use Temp.	Single Use Temp.
1205˚C (2200˚F)	1430˚C (2600˚F)

Resistance Properties		
Moisture	**Chemical**	**Abrasion**
Fair	Good	Good

Applications

- Heat treating
- Oven and furnace survey
- Load thermocouple

Wire Specifications - SERIES 350 and SERIES 355

AWG	Nominal Conductor Size		Nominal Insulation Thickness				Nominal Overall Size		Approximate Shipping Weight	
			Conductor		Overall					
	in.	(mm)	in.	(mm)	in.	(mm)	in.	(mm)	lbs/1000 ft	(kg/km)
24①	0.020	(0.508)	0.016	(0.406)	0.016	(0.406)	0.088 x 0.132	(2.24 x 3.35)	13	(19.4)
20①	0.032	(0.965)	0.016	(0.406)	0.016	(0.406)	0.100 x 0.154	(2.54 x 3.91)	16	(23.8)
16①	0.051	(1.29)	0.016	(0.406)	0.016	(0.406)	0.119 x 0.192	(3.02 x 4.88)	32	(47.7)
14①	0.064	(1.63)	0.016	(0.406)	0.016	(0.406)	0.132 x 0.218	(3.35 x 5.54)	44	(65.6)
24②	0.020	(0.508)	0.012	(0.305)	0.016	(0.406)	0.078 x 0.116	(1.98 x 2.95)	13	(19.4)
20②	0.032	(0.965)	0.012	(0.305)	0.016	(0.406)	0.090 x 0.138	(2.29 x 3.50)	16	(23.8)
16②	0.051	(1.29)	0.012	(0.305)	0.016	(0.406)	0.111 x 0.176	(2.82 x 4.47)	32	(47.7)

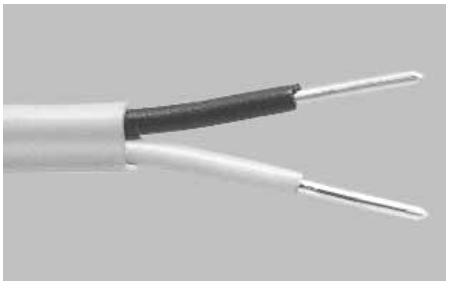
①SERIES 350

②SERIES 355

* Because this insulation has no binders or impregnations, it may "flower" when stripped.

Thermocouple Wire

PVC Insulated Extension Wire SERIES 502



SERIES 502 is an economical wire that's also available in UL® listings for PLTC (Power Limited Tray Cable) applications.

The primary and duplex insulation is PVC. It yields a construction that's inexpensive while performing continuously at temperatures to 105°C (220°F).

SERIES 502 is often used in conduit and wiring trays where its flexibility allows for easy installation. The SERIES 502 can be easily stripped using hand tools or mechanical methods.

The SERIES 502 is also available as a UL® PLTC construction (see page 193).

Continuous Use Temp.	Single Use Temp.
105˚C (220˚F)	105˚C (220˚F)

Resistance Properties		
Moisture	Chemical	Abrasion
Excellent	Excellent	Excellent

Popular Constructions

Grade	AWG	Wire Type	Limits of Error	Type K	Type J	Type T
Extension	16	Solid	Standard	**K16-5-502**	**J16-5-502**	
		Stranded	Standard	K16-7-502	J16-7-502	
	20	Solid	Standard	**K20-5-502**	**J20-5-502**	**T20-5-502**
		Stranded	Standard	**K20-7-502**	**J20-7-502**	**T20-7-502**
	24	Solid	Standard	K24-5-502	J24-5-502	T24-5-502
		Stranded	Standard	K24-7-502	J24-7-502	T24-7-502

Grade	AWG	Wire Type	Limits of Error	Type E	Type S
Extension	20	Solid	Standard	**E20-5-502**	**S20-5-502**

Note: **Bolded** products are stocked and shipped in 100, 250, 500 and 1000 foot spools.

Available Constructions

1	2	3	4	5	6	7
			-	-	5	0	2

1. ASTM E 230 Calibrations

B	E	K	S
C	J	N	T

2-3. AWG

24	20	16	14
24 stranded (7/28)	20 stranded (7/28)	16 stranded (7/24)	14 stranded (7/22)

4. Conductor Type/Tolerance

5 = Extension grade, solid wire, standard tolerance
6 = Extension grade, solid wire, special tolerance
7 = Extension grade, stranded wire, standard tolerance
8 = Extension grade, stranded wire, special tolerance

Note: Minimum order sizes apply for non-stock constructions.

Performance Capabilities

- Continuous temperature rating 105°C (220°F)
- Flexible PVC plastic insulation
- Available with optional metallic overbraid for additional abrasion resistance

Applications

- General use extension wire

Wire Specifications

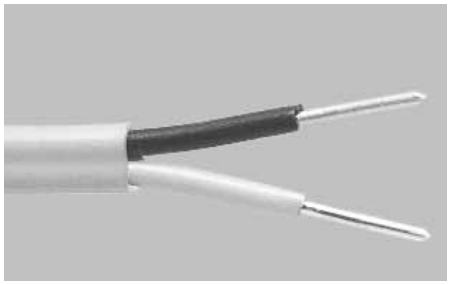
AWG	Nominal Conductor Size		Nominal Insulation Thickness				Nominal Overall Size		Approximate Shipping Weight	
			Conductor		Overall					
	in.	(mm)	in.	(mm)	in.	(mm)	in.	(mm)	lbs/1000 ft	(kg/km)
24	0.020	(0.508)	0.015	(0.381)	0.015	(0.381)	0.080 x 0.130	(2.03 x 3.30)	10	(14.9)
24 S* (7/32)	0.024	(0.610)	0.015	(0.381)	0.015	(0.381)	0.084 x 0.138	(2.13 x 3.51)	11	(16.4)
20	0.032	(0.813)	0.015	(0.381)	0.015	(0.381)	0.092 x 0.154	(2.34 x 3.91)	14	(20.9)
20 S* (7/28)	0.038	(0.965)	0.015	(0.381)	0.015	(0.381)	0.098 x 0.166	(2.49 x 4.22)	16	(23.8)
18	0.040	(1.02)	0.020	(0.508)	0.020	(0.508)	0.120 x 0.200	(3.05 x 5.08)	21	(31.3)
18 S* (7/26)	0.048	(1.22)	0.020	(0.508)	0.020	(0.508)	0.128 x 0.216	(3.25 x 5.49)	23	(34.3)
16	0.051	(1.29)	0.020	(0.508)	0.020	(0.508)	0.131 x 0.222	(3.33 x 5.64)	28	(41.7)
16 S* (7/24)	0.060	(1.52)	0.020	(0.508)	0.020	(0.508)	0.140 x 0.240	(3.56 x 6.10)	30	(44.7)
14	0.064	(1.628)	0.020	(0.508)	0.025	(0.635)	0.144 x 0.248	(3.66 x 6.30)	44	(65.6)
14 S* (7/22)	0.076	(1.930)	0.020	(0.508)	0.025	(0.635)	0.166 x 0.282	(4.22 x 7.16)	48	(71.5)

* "S" denotes stranded wire: e.g., "24 S (7/32)" is seven strands of 32 gauge wire to make a 24 gauge stranded conductor.

SERV-RITE Wire and Cable

Thermocouple Wire

PVC Insulated Extension Wire SERIES 502 UL®



UL® SERIES 502 is an economical wire available in UL® listings for Power Limited Tray Cable (PLTC) applications.

The primary and duplex insulation is PVC. It yields a construction that's in-expensive while performing continuously at temperatures to 105°C (220°F).

UL® SERIES 502 is often used in conduit and wiring trays where its flexibility allows for easy installation. The UL® SERIES 502 can be easily stripped using hand tools or mechanical methods.

Continuous Use Temp.	Single Use Temp.
105˚C (220˚F)	105˚C (220˚F)

Resistance Properties		
Moisture	Chemical	Abrasion
Excellent	Good	Good

Popular Constructions

Grade	AWG	Wire Type	Limits of Error	Type K	Type J	Type T
Extension	16	Solid	Standard	K16-5-502-UL®	J16-5-502-UL®	
		Stranded	Standard	K16-7-502-UL®	J16-7-502-UL®	
	20	Solid	Standard	K20-5-502-UL®	J20-5-502-UL®	T20-5-502-UL®
		Stranded	Standard	K20-7-502-UL®	J20-7-502-UL®	T20-7-502-UL®

Available Constructions

1	2	3	4	5	6	7	8	9
			-	-	5	0	2	-U	L

1. ASTM E 230 Calibrations

E K S
J N T

2-3. AWG

20 16
20 stranded (7/28) 16 stranded (7/28)

4. Conductor Type/Tolerance

5 = Extension grade, solid wire, standard tolerance
6 = Extension grade, solid wire, special tolerance
7 = Extension grade, stranded wire, standard tolerance
8 = Extension grade, stranded wire, special tolerance

Note: Minimum order sizes apply for non-stock constructions.

Performance Capabilities

- Continuous temperature rating 105°C (220°F)
- Flexible PVC plastic insulation
- UL® listed 300V PLTC
- Listed under UL® Subject 13, File Number E116321
- Passes IEEE 383 70,000 BTU/hour flame test
- Passes VW-1 flame test
- Non-propagating
- UV light resistant
- Available with optional metallic overbraid for additional abrasion resistance

Applications

- General Use extension wire

Wire Specifications

AWG	Nominal Conductor Size		Nominal Insulation Thickness				Nominal Overall Size		Approximate Shipping Weight	
			Conductor		Overall					
	in.	(mm)	in.	(mm)	in.	(mm)	in.	(mm)	lbs/1000 ft	(kg/km)
20	0.032	(0.813)	0.015	(0.381)	0.035	(0.889)	0.132 x 0.194	(3.35 x 4.93)	23	(34.3)
20 S* (7/28)	0.038	(0.965)	0.015	(0.381)	0.035	(0.889)	0.138 x 0.206	(3.50 x 5.23)	25	(37.3)
18	0.040	(1.02)	0.020	(0.508)	0.035	(0.889)	0.158 x 0.230	(3.81 x 5.48)	31	(46.2)
18 S* (7/26)	0.048	(1.22)	0.020	(0.508)	0.035	(0.889)	0.158 x 0.246	(4.01 x 6.25)	32	(47.7)
16	0.051	(1.29)	0.020	(0.508)	0.035	(0.889)	0.161 x 0.252	(4.09 x 6.40)	38	(56.6)
16 S* (7/24)	0.060	(1.52)	0.020	(0.508)	0.035	(0.889)	0.170 x 0.270	(4.32 x 6.86)	40	(59.6)

* "S" denotes stranded wire: e.g., "20 S (7/28)" is seven strands of 28 gauge wire to make a 20 gauge stranded conductor.

Thermocouple Wire

PVC Insulated "RIPCORD" SERIES 505

The SERIES 505 is the most economical wire produced. Unlike some competitive "ripcord" type constructions which use only a stripe to establish polarity, SERIES 505 single conductors are fully color coded. The conductors are individually insulated with the proper colored PVC and fused into "ripcord" using a proprietary process.

The insulated conductors can be easily separated by hand once the bond between conductors has been slit. As with other PVC insulated products, SERIES 505 lends itself well to both manual and mechanical stripping methods.

Continuous Use Temp.	Single Use Temp.
105˚C (220˚F)	105˚C (220˚F)

Resistance Properties		
Moisture	Chemical	Abrasion
Excellent	Good	Good

Popular Constructions

Grade	AWG	Wire Type	Limits of Error	Type K	Type J	Type T
Thermocouple	24	Solid	Standard	**K24-1-505**	**J24-1-505**	**T24-1-505**
			Special	**K24-2-505**	**J24-2-505**	**T24-2-505**

Note: **Bolded** products are stocked and shipped in 100, 250, 500 and 1000 foot spools.

Available Constructions

1	2	3	4	5	6	7
			-	-	5	0	5

1. ASTM E 230 Calibrations

B	E	K	S
C	J	N	T

2-3. AWG

26	24	20
	24 stranded (7/32)	20 stranded (7/28)

4. Conductor Type/Tolerance

1 = Thermocouple grade, solid wire, standard tolerance
2 = Thermocouple grade, solid wire, special tolerance
3 = Thermocouple grade, stranded wire, standard tolerance
4 = Thermocouple grade, stranded wire, special tolerance

Note: Minimum order sizes apply for non-stock constructions.

Performance Capabilities

- Continuous temperature rating 105°C (220°F)
- Flexible PVC plastic insulation
- "Ripcord" peelable construction
- Available with optional metallic overbraid for additional abrasion resistance

Applications

- Laboratory
- Test stand
- Automotive

Wire Specifications

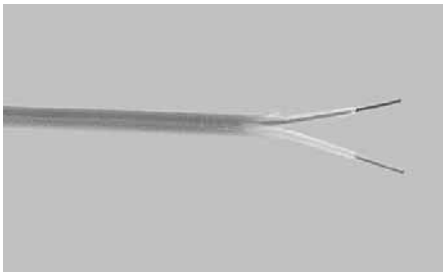
AWG	Nominal Conductor Size in.	(mm)	Nominal Conductor Insulation Thickness in.	(mm)	Nominal Overall Size in.	(mm)	Approximate Shipping Weight lbs/1000 ft	(kg/km)
26	0.016	(0.406)	0.015	(0.381)	0.046 x 0.088	(1.17 x 2.24)	4	(6.0)
24	0.020	(0.508)	0.015	(0.381)	0.050 x 0.096	(1.27 x 2.44)	5	(7.5)
24 S* (7/32)	0.024	(0.610)	0.015	(0.381)	0.054 x 0.104	(1.37 x 2.64)	6	(8.9)
20	0.032	(0.813)	0.015	(0.381)	0.062 x 0.120	(1.57 x 3.05)	10	(14.9)
20 S* (7/28)	0.038	(0.965)	0.015	(0.381)	0.068 x 0.132	(1.73 x 3.35)	11	(16.4)

* "S" denotes stranded wire: e.g., "24 S (7/32)" is seven strands of 32 gauge wire to make a 24 gauge stranded conductor.

SERV-RITE Wire and Cable

Thermocouple Wire

Small Gauge FEP Insulated SERIES 506



The SERIES 506 is the smallest standard insulated wire construction. The thin FEP wall on both primary and duplex insulation yields a construction that can operate safely at temperatures far beyond common PVC and nylon insulations.

The SERIES 506 is fully color coded for ease of installation. Its small size allows use in high density circuits. Response time is minimized by small diameter conductors. SERIES 506 is available only in gauge sizes of #26 and smaller. For gauge sizes larger than #26 specify SERIES 507 (see page 196).

Continuous Use Temp.	Single Use Temp.
204˚C (400˚F)	260˚C (500˚F)

Resistance Properties		
Moisture	Chemical	Abrasion
Excellent	Excellent	Excellent

Popular Constructions

Grade	AWG	Wire Type	Limits of Error	Type K	Type J	Type T
Thermocouple	28	Solid	Special	K28-2-506	J28-2-506	T28-2-506
	30	Solid	Special	**K30-2-506**	**J30-2-506**	**T30-2-506**
	36	Solid	Special	K36-2-506	J36-2-506	T36-2-506

Note: **Bolded** products are stocked and shipped in 100, 250, 500 and 1000 foot spools.

Available Constructions

1	2	3	4	5	6	7
			-	- 5	0	6

1. ASTM E 230 Calibrations

E K S
J N T

2-3. AWG

36 30 28

4. Conductor Type/Tolerance

1 = Thermocouple grade, solid wire, standard tolerance
2 = Thermocouple grade, solid wire, special tolerance
3 = Thermocouple grade, stranded wire, standard tolerance
4 = Thermocouple grade, stranded wire, special tolerance

Note: Minimum order sizes apply for non-stock constructions.

Performance Capabilities

- Continuous temperature rating 204°C (400°F)
- Flexible FEP plastic insulation
- Thin insulation wall for a compact construction
- Available with optional metallic overbraid for additional abrasion resistance

Applications

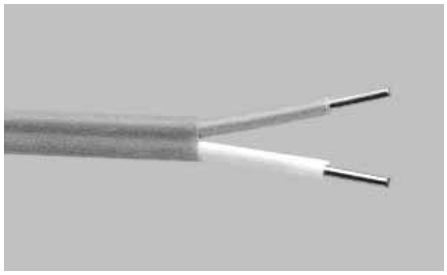
- Laboratory
- Test stand
- Industrial equipment testing

Wire Specifications

AWG	Nominal Conductor Size		Nominal Insulation Thickness				Nominal Overall Size		Approximate Shipping Weight	
			Conductor		Overall					
	in.	(mm)	in.	(mm)	in.	(mm)	in.	(mm)	lbs/1000 ft	(kg/km)
36	0.005	(0.127)	0.005	(0.127)	0.005	(0.127)	0.025 x 0.040	(0.635 x 1.02)	2	(3.0)
32	0.008	(0.203)	0.005	(0.127)	0.005	(0.127)	0.028 x 0.046	(0.711 x 1.17)	2	(3.0)
30	0.010	(0.254)	0.005	(0.127)	0.005	(0.127)	0.030 x 0.050	(0.762 x 1.27)	3	(4.5)
28	0.013	(0.330)	0.005	(0.127)	0.005	(0.127)	0.033 x 0.056	(0.838 x 1.42)	3	(4.5)

Thermocouple Wire

FEP Insulated Thermocouple and Extension Wire SERIES 507



The SERIES 507 is the most economical fluoroplastic insulated wire. SERIES 507 is also available as UL® listed PLTC. Individual conductors are coated with a layer of color coded FEP. The insulated conductors are then parallel duplexed with an additional layer of color coded FEP. The finished construction has a temperature rating of 260°C (500°F). Abrasion, moisture and chemical resistance are far in excess of most other insulations.

This construction is widely used when pulling long lengths of wire through conduit. FEP's low friction coefficient and abrasion resistance make it ideally suited for these applications.

For higher abrasion resistance consider Tefzel® insulated constructions, the SERIES 514.

For higher temperatures specify SERIES 508 (see page 198).

Continuous Use Temp.	Single Use Temp.
204˚C (400˚F)	260˚C (500˚F)

Resistance Properties		
Moisture	Chemical	Abrasion
Excellent	Excellent	Excellent

Tefzel® is a registered trademark of E. I. du Pont de Nemours & Company.

Popular Constructions

Grade	AWG	Wire Type	Limits of Error	Type K	Type J	Type T
Extension	20	Solid	Standard	**K20-5-507**	**J20-5-507**	T20-5-507
Thermocouple	20	Solid	Standard	**K20-1-507**	**J20-1-507**	**T20-1-507**
		Stranded	Standard	**K20-3-507**	**J20-3-507**	**T20-3-507**
		Solid	Special	**K20-2-507**	**J20-2-507**	**T20-2-507**
	24	Solid	Standard	**K24-1-507**	**J24-1-507**	T24-1-507
		Stranded	Standard	**K24-3-507**	**J24-3-507**	T24-3-507
		Solid	Special	**K24-2-507**	**J24-2-507**	**T24-2-507**

Grade	AWG	Wire Type	Limits of Error	Type E	Type S
Extension	20	Solid	Standard	E20-5-507	**S20-5-507**
Thermocouple	20	Solid	Standard	**E20-1-507**	
		Stranded	Standard	E20-3-507	
		Solid	Special	E20-2-507	
Extension	24	Solid	Standard		S24-5-507
Thermocouple	24	Solid	Standard	E24-1-507	
		Stranded	Standard	E24-3-507	
		Solid	Special	E24-2-507	

Note: **Bolded** products are stocked and shipped in 100, 250, 500 and 1000 foot spools.

Available Constructions

1	2	3	4	5	6	7
			-	-	5	0	7

1. ASTM E 230 Calibrations

B	E	K	S
C	J	N	T

2-3. AWG

24	22	20	16
24 stranded (7/32)	22 stranded (7/30)	20 stranded (7/28)	16 stranded (7/24)

4. Conductor Type/Tolerance

1 = Thermocouple grade, solid wire, standard tolerance
2 = Thermocouple grade, solid wire, special tolerance
3 = Thermocouple grade, stranded wire, standard tolerance
4 = Thermocouple grade, stranded wire, special tolerance
5 = Extension grade, solid wire, standard tolerance
6 = Extension grade, solid wire, special tolerance
7 = Extension grade, stranded wire, standard tolerance
8 = Extension grade, stranded wire, special tolerance

Note: Minimum order sizes apply for non-stock constructions.

Performance Capabilities

- Continuous temperature rating 204°C (400°F)
- Flexible FEP plastic insulation
- Available with optional metallic overbraid for additional abrasion resistance

Applications

- General use extension wire

SERV-RITE Wire and Cable

Thermocouple Wire

FEP Insulated Thermocouple and Extension Wire SERIES 507 (con't)

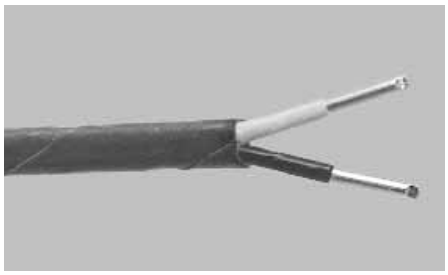
Wire Specifications

AWG	Nominal Conductor Size		Nominal Insulation Thickness				Nominal Overall Size		Approximate Shipping Weight	
			Conductor		Overall					
	in.	(mm)	in.	(mm)	in.	(mm)	in.	(mm)	lbs/1000 ft	(kg/km)
24	0.020	(0.508)	0.008	(0.203)	0.010	(0.254)	0.056 x 0.096	(1.42 x 2.44)	8	(11.9)
24 S* (7/32)	0.024	(0.610)	0.008	(0.203)	0.010	(0.254)	0.060 x 0.104	(1.52 x 2.64)	9	(13.4)
22	0.025	(0.635)	0.008	(0.203)	0.010	(0.254)	0.061 x 0.106	(1.55 x 2.69)	10	(14.9)
22 S* (7/30)	0.030	(0.762)	0.008	(0.203)	0.010	(0.254)	0.066 x 0.116	(1.68 x 2.95)	11	(16.4)
20	0.032	(0.813)	0.008	(0.203)	0.010	(0.254)	0.068 x 0.120	(1.73 x 3.05)	12	(17.9)
20 S* (7/28)	0.038	(0.965)	0.008	(0.203)	0.010	(0.254)	0.074 x 0.132	(1.88 x 3.35)	14	(20.9)
18	0.040	(1.02)	0.008	(0.203)	0.010	(0.254)	0.076 x 0.136	(1.93 x 3.45)	18	(26.8)
18 S* (7/26)	0.048	(1.22)	0.008	(0.203)	0.010	(0.254)	0.084 x 0.152	(2.13 x 3.86)	20	(29.8)
16	0.051	(1.29)	0.008	(0.203)	0.012	(0.305)	0.091 x 0.162	(2.31 x 4.11)	28	(41.7)
16 S* (7/24)	0.060	(1.52)	0.008	(0.203)	0.012	(0.305)	0.100 x 0.186	(2.54 x 4.72)	30	(44.7)

* "S" denotes stranded wire: e.g., "24 S (7/32)" is seven strands of 32 gauge wire to make a 24 gauge stranded conductor.

Thermocouple Wire

TFE Insulated SERIES 508



The primary and duplex insulation of SERIES 508 is fused TFE tape. The tape is spirally applied to the conductor and heated. This process, called sintering, forms the tape into a homogeneous layer. When sintered, the tape exhibits all of the advantages of extruded TFE insulation, while eliminating the concentricity problems associated with TFE extrusions.

The SERIES 508 is fully color coded and capable of continuous operation in excess of 260°C (500°F). Because the fusing process causes the duplex tape to fuse with the primary insulation, SERIES 508 is not recommended for applications where it's necessary to remove the outer tape while leaving the primary insulation intact.

Continuous Use Temp.	Single Use Temp.
260˚C (500˚F)	315˚C (600˚F)

Resistance Properties		
Moisture	Chemical	Abrasion
Excellent	Excellent	Good

Popular Constructions

Grade	AWG	Wire Type	Limits of Error	Type K	Type J	Type T
Thermocouple	20	Solid	Standard	**K20-1-508**	**J20-1-508**	T20-1-508
		Stranded	Standard	K20-3-508	J20-3-508	T20-3-508
		Solid	Special	**K20-2-508**	**J20-2-508**	**T20-2-508**
	24	Solid	Standard	**K24-1-508**	**J24-1-508**	**T24-1-508**
		Stranded	Standard	K24-3-508	J24-3-508	T24-3-508
		Solid	Special	**K24-2-508**	**J24-2-508**	**T24-2-508**

Grade	AWG	Wire Type	Limits of Error	Type E
Thermocouple	20	Solid	Standard	E20-1-508
		Stranded	Standard	E20-3-508
		Solid	Special	E20-2-508
	24	Solid	Standard	E24-1-508
		Stranded	Standard	E24-3-508
		Solid	Special	E24-2-508

Note: **Bolded** products are stocked and shipped in 100, 250, 500 and 1000 foot spools.

Available Constructions

1	2	3	4	5	6	7
			-	-	5	0	8

1. ASTM E 230 Calibrations

B	E	K	S
C	J	N	T

2-3. AWG

26	24	20	16
	24 stranded (7/32)	20 stranded (7/28)	16 stranded (7/24)

4. Conductor Type/Tolerance

1 = Thermocouple grade, solid wire, standard tolerance
2 = Thermocouple grade, solid wire, special tolerance
3 = Thermocouple grade, stranded wire, standard tolerance
4 = Thermocouple grade, stranded wire, special tolerance

Note: Minimum order sizes apply for non-stock constructions.

Performance Capabilities

- Continuous temperature rating 260°C (500°F)
- Fused TFE tape insulation
- Available with optional metallic overbraid for additional abrasion resistance

Applications

- Aircraft
- Petroleum processing

Wire Specifications

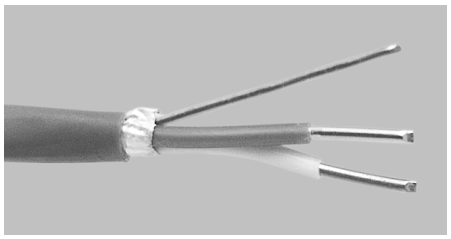
AWG	Nominal Conductor Size		Nominal Insulation Thickness				Nominal Overall Size		Approximate Shipping Weight	
			Conductor		Overall					
	in.	(mm)	in.	(mm)	in.	(mm)	in.	(mm)	lbs/1000 ft	(kg/km)
26	0.016	(0.406)	0.006	(0.152)	0.008	(0.203)	0.044 x 0.072	(1.12 x 1.83)	4	(6.0)
24	0.020	(0.508)	0.006	(0.152)	0.008	(0.203)	0.047 x 0.077	(1.19 x 1.95)	5	(7.5)
24 S* (7/32)	0.024	(0.610)	0.006	(0.152)	0.008	(0.203)	0.049 x 0.084	(1.24 x 2.13)	6	(8.9)
20	0.032	(0.813)	0.006	(0.152)	0.008	(0.203)	0.061 x 0.106	(1.55 x 2.69)	11	(16.4)
20 S* (7/28)	0.038	(0.965)	0.006	(0.152)	0.008	(0.203)	0.064 x 0.112	(1.63 x 2.84)	12	(17.9)
18	0.040	(1.02)	0.006	(0.152)	0.008	(0.203)	0.068 x 0.120	(1.73 x 3.05)	16	(23.8)
18 S* (7/26)	0.048	(1.22)	0.006	(0.152)	0.008	(0.203)	0.076 x 0.136	(1.93 x 3.45)	18	(26.8)
16	0.051	(1.29)	0.010	(0.254)	0.008	(0.203)	0.087 x 0.158	(2.21 x 4.01)	25	(37.3)
16 S* (7/24)	0.060	(1.52)	0.010	(0.254))	0.008	(0.203)	0.096 x 0.176	(2.44 x 4.47)	27	(40.2)

* "S" denotes stranded wire: e.g., "24 S (7/32)" is seven strands of 32 gauge wire to make a 24 gauge stranded conductor.

SERV-RITE Wire and Cable

Thermocouple Wire

FEP Insulated and Shielded Thermocouple and Extension Wire SERIES 509



The SERIES 509 was developed especially for use with microprocessor based systems. SERIES 509 (see page 200) is also available as UL® listed PLTC.

The conductors are insulated with color coded FEP. They are then twisted with a copper drain wire. An aluminized polyester tape is wrapped around the conductors and drain wire. Finally, FEP is applied.

The finished construction can withstand temperatures in excess of 204°C (400°F). Twisted conductors minimize EMI and the taped shield eliminates most problems associated with AC "noise."

Continuous Use Temp.	Single Use Temp.
204˚C (400˚F)	260˚C (500˚F)

Resistance Properties		
Moisture	Chemical	Abrasion
Excellent	Excellent	Excellent

Popular Constructions

Grade	AWG	Wire Type	Limits of Error	Type K	Type J	Type T
Extension	16	Solid	Standard	**K16-5-509**	**J16-5-509**	
		Stranded	Standard	K16-7-509	J16-7-509	
	20	Solid	Standard	**K20-5-509**	**J20-5-509**	T20-5-509
		Stranded	Standard	K20-7-509	J20-7-509	T20-7-509
Thermocouple	20	Solid	Standard	**K20-1-509**	**J20-1-509**	**T20-1-509**
		Solid	Special	**K20-2-509**	J20-2-509	T20-2-509
	24	Solid	Standard	K24-1-509	J24-1-509	T24-1-509
		Stranded	Standard	K24-3-509	J24-3-509	T24-3-509

Grade	AWG	Wire Type	Limits of Error	Type E	Type S
Extension	20	Solid	Standard	E20-5-509	S20-5-509

Note: **Bolded** products are stocked and shipped in 100, 250, 500 and 1000 foot spools.

Available Constructions

1	2	3	4	5	6	7
			-	-5	0	9

1. ASTM E 230 Calibrations

B J N T
E K S

2-3. AWG

24	20	16
24 stranded (7/32)	20 stranded (7/28)	16 stranded (7/24)

4. Conductor Type/Tolerance

1 = Thermocouple grade, solid wire, standard tolerance
2 = Thermocouple grade, solid wire, special tolerance
3 = Thermocouple grade, stranded wire, standard tolerance
4 = Thermocouple grade, stranded wire, special tolerance
5 = Extension grade, solid wire, standard tolerance
6 = Extension grade, solid wire, special tolerance
7 = Extension grade, stranded wire, standard tolerance
8 = Extension grade, stranded wire, special tolerance

Note: Minimum order sizes apply for non-stock constructions.

Performance Capabilities

- Continuous temperature rating 204°C (400°F)
- Flexible FEP plastic insulation
- Twisted and shielded construction to reduce electrical noise interference
- Available with optional metallic overbraid for additional abrasion resistance

Applications

- General use extension wire

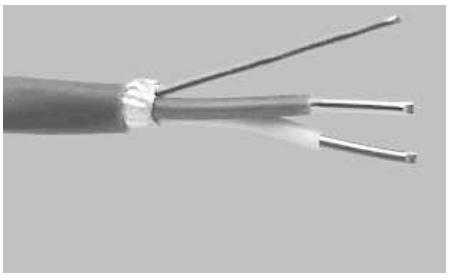
Wire Specifications

AWG	Nominal Conductor Size		Nominal Insulation Thickness				Nominal Overall Size		Approximate Shipping Weight	
			Conductor		Overall					
	in.	(mm)	in.	(mm)	in.	(mm)	in.	(mm)	lbs/1000 ft	(kg/km)
24	0.020	(0.508)	0.008	(0.203)	0.012	(0.305)	0.104	(2.64)	12	(17.9)
24 S* (7/32)	0.024	(0.610)	0.008	(0.203)	0.012	(0.305)	0.112	(2.84)	13	(19.4)
20	0.032	(0.813)	0.008	(0.203)	0.012	(0.305)	0.128	(3.25)	18	(26.8)
20 S* (7/28)	0.038	(0.965)	0.008	(0.203)	0.012	(0.305)	0.140	(3.56)	20	(29.8)
18	0.040	(1.02)	0.008	(0.203)	0.015	(0.381)	0.152	(3.86)	25	(37.3)
18 S* (7/26)	0.048	(1.22)	0.008	(0.203)	0.015	(0.381)	0.168	(4.27)	27	(40.2)
16	0.051	(1.29)	0.008	(0.203)	0.015	(0.381)	0.174	(4.42)	33	(49.2)
16 S* (7/24)	0.060	(1.52)	0.008	(0.203)	0.015	(0.381)	0.192	(4.88)	35	(52.2)

* "S" denotes stranded wire: e.g., "24 S (7/32)" is seven strands of 32 gauge wire to make a 24 gauge stranded conductor.

Thermocouple Wire

FEP Insulated with Shield and Drain 300V UL® Listed PLTC Extension Cable SERIES 509 UL®



The SERIES 509 UL® is one of a family of constructions developed especially for use with microprocessor based systems. SERIES 509 UL® has UL® listings for Power Limited Tray Cable (PLTC) applications.

The conductors are first insulated with color coded FEP. The conductors are then twisted with a copper drain wire. An aluminized polyester tape is wrapped around the two conductors and drain wire. Finally, an FEP layer is applied over the taped conductors.

The finished construction can withstand temperatures in excess of 204°C (400°F). The twisted conductors minimizes electromagnetic interference and the taped shield eliminates most problems associated with AC "noise" in the sensing circuit.

Popular Constructions

Grade	AWG	Wire Type	Limits of Error	Type K	Type J	Type T
Extension	16	Solid	Standard	K16-5-509-UL®	J16-5-509-UL®	
		Stranded	Standard	K16-7-509-UL®	J16-7-509-UL®	
	20	Solid	Standard	K20-5-509-UL®	J20-5-509-UL®	T20-5-509-UL®
		Stranded	Standard	K20-7-509-UL®	J20-7-509-UL®	T20-7-509-UL®

Available Constructions

1	2	3	4	5	6	7	8	9
			-	-	5	0	9	-U	L

1. ASTM E 230 Calibrations

E K S
J N T

2-3. AWG

20 16
20 stranded (7/28) 16 stranded (7/24)

4. Conductor Type/Tolerance

5 = Extension grade, solid wire, standard tolerance
6 = Extension grade, solid wire, special tolerance
7 = Extension grade, stranded wire, standard tolerance
8 = Extension grade, stranded wire, special tolerance

Note: Minimum order sizes apply for non-stock constructions.

Performance Capabilities

- UL® listed 300V PLTC
- Listed under UL® Subject 13, File Number E116321
- Passes IEEE 383 70,000 BTU/hour flame test
- Passes VW-1 flame test
- Non-propagating
- UV light resistant
- Continuous temperature rating 204°C (400°F)
- Flexible FEP plastic insulation
- Twisted and shielded construction to reduce electrical noise interference
- Available with optional metallic overbraid for additional abrasion resistance

Continuous Use Temp.	Single Use Temp.
204˚C (400˚F)	260˚C (500˚F)

Resistance Properties		
Moisture	Chemical	Abrasion
Excellent	Excellent	Excellent

Applications

- General use extension wire

Wire Specifications

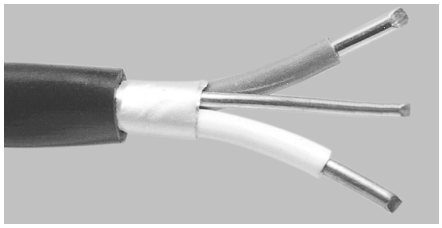
AWG	Nominal Conductor Size		Nominal Insulation Thickness: Conductor		Nominal Insulation Thickness: Overall		Nominal Overall Size		Approximate Shipping Weight	
	in.	(mm)	in.	(mm)	in.	(mm)	in.	(mm)	lbs/1000 ft	(kg/km)
20	0.032	(0.813)	0.008	(0.203)	0.018	(0.457)	0.142	(3.61)	22	(32.8)
20 S* (7/28)	0.038	(0.965)	0.008	(0.203)	0.018	(0.457)	0.158	(3.91)	24	(35.8)
16	0.051	(1.29)	0.008	(0.203)	0.018	(0.457)	0.180	(4.57)	38	(56.6)
16 S* (7/24)	0.060	(1.52)	0.008	(0.203)	0.018	(0.457)	0.198	(5.03)	41	(61.1)

* "S" denotes stranded wire: e.g., "20 S (7/28)" is seven strands of 28 gauge wire to make a 20 gauge stranded conductor.

SERV-RITE Wire and Cable

Thermocouple Wire

PVC Insulated and Shielded Thermocouple and Extension Wire SERIES 510



The SERIES 510 is a PVC insulated, twisted and shielded construction for systems sensitive to induced voltages and "noise." SERIES 510 (see page 202) is also available as UL® listed PLTC.

The conductors are insulated with color coded PVC. The next operation twists the two insulated conductors with a copper drain wire. An aluminized polyester tape is wrapped around the wires to impart 100 percent shielding. Lastly, another layer of PVC is applied.

The twisting eliminates most EMI while the shield tape minimizes AC "noise".

Continuous Use Temp.	Single Use Temp.
105˚C (220˚F)	105˚C (220˚F)

Resistance Properties		
Moisture	Chemical	Abrasion
Excellent	Good	Good

Popular Constructions

Grade	AWG	Wire Type	Limits of Error	Type K	Type J	Type T
Extension	16	Solid	Standard	**K16-5-510**	**J16-5-510**	**T16-5-510**
		Stranded	Standard	K16-7-510	J16-7-510	T16-7-510
	20	Solid	Standard	**K20-5-510**	**J20-5-510**	**T20-5-510**
		Stranded	Standard	**K20-7-510**	**J20-7-510**	T20-7-510
	24	Solid	Standard	K24-5-510	J24-5-510	T24-5-510
		Stranded	Standard	K24-7-510	J24-7-510	T24-7-510

Grade	AWG	Wire Type	Limits of Error	Type E	Type S
Extension	20	Solid	Standard	**E20-5-510**	**S20-5-510**

Note: **Bolded** products are stocked and shipped in 100, 250, 500 and 1000 foot spools.

Available Constructions

1	2	3	4	5	6	7
			-	-	5	1	0

1. ASTM E 230 Calibrations

B J N T
E K S

2-3. AWG

24	20	16	14
24 stranded (7/32)	20 stranded (7/28)	16 stranded (7/24)	14 stranded (7/22)

4. Conductor Type/Tolerance

1 = Thermocouple grade, solid wire, standard tolerance
2 = Thermocouple grade, solid wire, special tolerance
3 = Thermocouple grade, stranded wire, standard tolerance
4 = Thermocouple grade, stranded wire, special tolerance
5 = Extension grade, solid wire, standard tolerance
6 = Extension grade, solid wire, special tolerance
7 = Extension grade, stranded wire, standard tolerance
8 = Extension grade, stranded wire, special tolerance

Note: Minimum order sizes apply for non-stock constructions.

Performance Capabilities

- Continuous temperature rating 105°C (220°F)
- Flexible PVC plastic insulation
- Twisted and shielded construction to reduce electrical noise interference
- Available with optional metallic overbraid for additional abrasion resistance

Applications

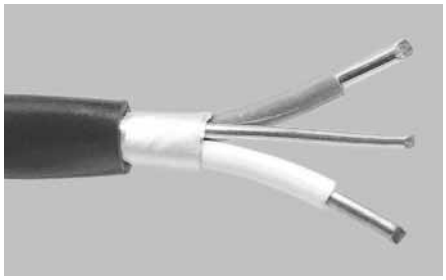
- General use extension wire

Wire Specifications

AWG	Nominal Conductor Size		Nominal Insulation Thickness				Nominal Overall Size		Approximate Shipping Weight	
			Conductor		Overall					
	in.	(mm)	in.	(mm)	in.	(mm)	in.	(mm)	lbs/1000 ft	(kg/km)
24	0.020	(0.508)	0.015	(0.381)	0.020	(0.508)	0.140	(3.56)	13	(19.4)
24 S* (7/32)	0.024	(0.610)	0.015	(0.381)	0.020	(0.508)	0.148	(3.76)	14	(20.9)
20	0.032	(0.813)	0.015	(0.381)	0.020	(0.508)	0.164	(4.17)	22	(32.8)
20 S* (7/28)	0.038	(0.965)	0.015	(0.381)	0.020	(0.508)	0.176	(4.47)	24	(35.8)
18	0.040	(1.02)	0.020	(0.508)	0.020	(0.508)	0.200	(5.08)	30	(44.7)
18 S* (7/26)	0.048	(1.22)	0.020	(0.508)	0.020	(0.508)	0.216	(5.49)	32	(47.7)
16	0.051	(1.29)	0.020	(0.508)	0.020	(0.508)	0.222	(5.64)	39	(58.1)
16 S* (7/24)	0.060	(1.52)	0.020	(0.508)	0.020	(0.508)	0.240	(6.10)	41	(61.1)
14	0.064	(1.63)	0.020	(0.508)	0.025	(0.635)	0.258	(6.55)	55	(82.0)
14 S* (7/22)	0.076	(1.93)	0.020	(0.508)	0.025	(0.635)	0.282	(7.16)	58	(86.4)

* "S" denotes stranded wire: e.g., "24 S (7/32)" is seven strands of 32 gauge wire to make a 24 gauge stranded conductor.

Thermocouple Wire
PVC Insulated and Shielded 300 V UL® Listed PLTC Extension Cable SERIES 510 UL®



The SERIES 510 UL® is UL® listed for Power Limited Tray Cable (PLTC) applications. It's an economical PVC insulated, twisted and shielded construction for microprocessor based systems and others that are sensitive to induced voltages and "noise."

The conductors are first insulated with color coded PVC. The next operation consists of twisting the two insulated conductors with a copper drain wire. An aluminized polyester tape is then wrapped around the wires to impart 100 percent shielding. Lastly, another layer of PVC is applied.

The twisting eliminates most electromagnetic interference while the shield tape minimizes AC "noise" interference.

Popular Constructions

Grade	AWG	Wire Type	Limits of Error	Type K	Type J	Type T
Extension	16	Solid	Standard	**K16-5-510-UL®**	**J16-5-510-UL®**	
		Stranded	Standard	K16-7-510-UL®	J16-7-510-UL®	
	20	Solid	Standard	**K20-5-510-UL®**	**J20-5-510-UL®**	T20-5-510-UL®
		Stranded	Standard	K20-7-510-UL®	J20-7-510-UL®	T20-7-510-UL®

Note: **Bolded** products are stocked and shipped in 100, 250, 500 and 1000 foot spools.

Available Constructions

1	2	3	4	5	6	7	8	9
			-	-	5	1	0	-U	L

1. ASTM E 230 Calibrations

E	K	S
J	N	T

2-3. AWG

20	16
20 stranded (7/28)	16 stranded (7/24)

4. Conductor Type/Tolerance

5 = Extension grade, solid wire, standard tolerance
6 = Extension grade, solid wire, special tolerance
7 = Extension grade, stranded wire, standard tolerance
8 = Extension grade, stranded wire, special tolerance

Note: Minimum order sizes apply for non-stock constructions.

Performance Capabilities

- UL® listed 300V PLTC
- Listed under UL® Subject 13, File Number E116321
- Passes IEEE 383 70,000 BTU/hour flame test
- Passes VW-1 flame test
- Non-propagating
- UV light resistant
- Continuous temperature rating 105°C (220°F)
- Flexible PVC plastic insulation
- Available with optional metallic overbraid for additional abrasion resistance

Continuous Use Temp.	Single Use Temp.
105˚C (220˚F)	105˚C (220˚F)

Resistance Properties		
Moisture	Chemical	Abrasion
Excellent	Good	Good

Applications

- General use extension wire

Wire Specifications

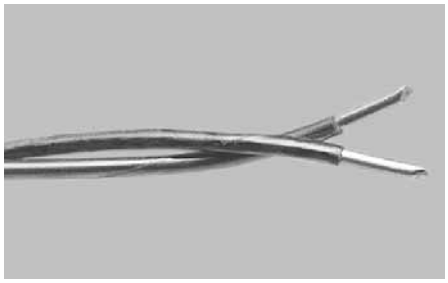
AWG	Nominal Conductor Size		Nominal Insulation Thickness				Nominal Overall Size		Approximate Shipping Weight	
			Conductor		Overall					
	in.	(mm)	in.	(mm)	in.	(mm)	in.	(mm)	lbs/1000 ft	(kg/km)
20	0.032	(0.813)	0.015	(0.381)	0.035	(0.889)	0.198	(5.03)	27	(40.2)
20 S* (7/28)	0.038	(0.965)	0.015	(0.381)	0.035	(0.889)	0.210	(5.33)	29	(43.2)
18	0.040	(1.02)	0.020	(0.508)	0.035	(0.889)	0.234	(5.94)	35	(52.2)
18 S* (7/26)	0.048	(1.22)	0.020	(0.508)	0.035	(0.889)	0.250	(6.35)	37	(55.1)
16	0.051	(1.29)	0.020	(0.508)	0.035	(0.889)	0.256	(6.50)	48	(71.5)
16 S* (7/24)	0.060	(1.52)	0.020	(0.508)	0.035	(0.889)	0.274	(6.96)	51	(76.0)

* "S" denotes stranded wire: e.g., "20 S (7/28)" is seven strands of 28 gauge wire to make a 20 gauge stranded conductor.

SERV-RITE Wire and Cable

Thermocouple Wire

Polyimide Insulated and Twisted SERIES 511



SERIES 511 is the most economical polyimide taped construction. The polyimide film applied to the conductors is considered to be the ultimate "soft" insulation. The tape maintains its strength at temperatures to 315°C (600°F). The FEP laminate serves as a moisture barrier and allows the tape to fused with itself. The finished construction will not unravel when cut.

The SERIES 511 conductors are wrapped with the polyimide tape which is fused to itself. Each conductor is color coded with a colored thread under the tape. The final operation is twisting the insulated conductors into a duplex construction, thereby eliminating the overall duplex insulation and minimizing cost.

Popular Constructions

Grade	AWG	Wire Type	Limits of Error	Type K	Type J
Thermocouple	20	Solid	Standard	K20-1-511	J20-1-511
			Special	K20-2-511	J20-2-511
	24	Solid	Standard	K24-1-511	J24-1-511
			Special	K24-2-511	**J24-2-511**

Note: **Bolded** products are stocked and shipped in 100, 250, 500 and 1000 foot spools.

Available Constructions

1	2	3	4	5	6	7
			-	- 5	1	1

1. ASTM E 230 Calibrations

E K T
J N

2-3. AWG

30 24 20 16
24 stranded (7/32) 20 stranded (7/28)

4. Conductor Type/Tolerance

1 = Thermocouple grade, solid wire, standard tolerance
2 = Thermocouple grade, solid wire, special tolerance
3 = Thermocouple grade, stranded wire, standard tolerance
4 = Thermocouple grade, stranded wire, special tolerance

Note: Minimum order sizes apply for non-stock construction.

Performance Capabilities

- Continuous temperature rating 315°C (600°F)
- Polyimide fused tape insulation
- Twisted design has no outer jacket
- Colored tracer used to indicate calibration type
- Available with optional metallic overbraid for additional abrasion resistance

Applications

- Aerospace
- Petrochemical
- Plastics

*Continuous Use Temp.	*Single Use Temp.
315°C (600°F)	430°C (800°F)

Resistance Properties		
Moisture	Chemical	Abrasion
Excellent	Excellent	Excellent

Wire Specifications

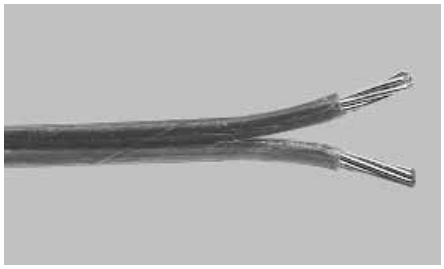
AWG	Nominal Conductor Size in.	(mm)	Nominal Conductor Insulation Thickness in.	(mm)	Nominal Overall Size in	(mm)	Approximate Shipping Weight lbs/1000 ft	(kg/km)
30	0.010	(0.254)	0.004	(0.102)	0.040	(1.02)	3	(4.5)
24	0.020	(0.508)	0.005	(0.127)	0.060	(1.52)	4	(6.0)
24 S** (7/32)	0.024	(0.610)	0.005	(0.127)	0.068	(1.73)	5	(7.5)
20	0.032	(0.813)	0.005	(0.127)	0.084	(2.13)	8	(11.9)
20 S** (7/28)	0.038	(0.965)	0.005	(0.127)	0.094	(2.39)	9	(13.4)
16	0.051	(1.29)	0.005	(0.127)	0.122	(3.10)	19	(28.3)

* FEP laminate melts at approximately 260°C (500°F).

** "S" denotes stranded wire: e.g., "24 S (7/32)" is seven strands of 32 gauge wire to make a 24 gauge stranded conductor.

Thermocouple Wire

Polyimide Insulated SERIES 512



The SERIES 512 is a heavier duty version of SERIES 511 construction, using the same polyimide insulation. Color coding is accomplished using the same colored thread "tracers." However, the SERIES 512 has a duplex insulation of polyimide tape. The extra wall of tape yields a construction with increased abrasion resistance.

For higher temperature requirements, choose one of our fiberglass insulated wires.

For improved abrasion resistance, and easier color identification of conductors, specify SERIES 513 (see page 205) when consulting the factory.

*Continuous Use Temp.	*Single Use Temp.
315˚C (600˚F)	430˚C (800˚F)

Resistance Properties		
Moisture	Chemical	Abrasion
Excellent	Excellent	Excellent

Popular Constructions

Grade	AWG	Wire Type	Limits of Error	Type K	Type J
Thermocouple	20	Solid	Standard	K20-1-512	**J20-1-512**
			Special	K20-2-512	J20-2-512
		Stranded	Standard	**K20-3-512**	**J20-3-512**
	24	Solid	Standard	K24-1-512	J24-1-512
			Special	K24-2-512	J24-2-512

Note: **Bolded** products are stocked and shipped in 100, 250, 500 and 1000 foot spools.

Available Constructions

1	2	3	4	5	6	7
			-	-	5	1	2

1. ASTM E 230 Calibrations

E K T
J N

2-3. AWG

30 24 20 16
24 stranded (7/32) 20 stranded (7/28) 16 stranded (7/24)

4. Conductor Type/Tolerance

1 = Thermocouple grade, solid wire, standard tolerance
2 = Thermocouple grade, solid wire, special tolerance
3 = Thermocouple grade, stranded wire, standard tolerance
4 = Thermocouple grade, stranded wire, special tolerance

Note: Minimum order sizes apply for non-stock constructions.

Performance Capabilities

- Continuous temperature rating 315°C (600°F)
- Polyimide fused tape insulation
- Colored tracer used to indicate calibration type
- Available with optional metallic overbraid for additional abrasion resistance

Applications

- Aerospace
- Petrochemical
- Plastics

Wire Specifications

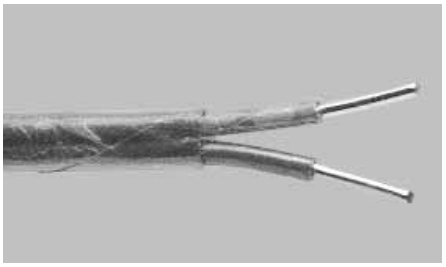
AWG	Nominal Conductor Size		Nominal Insulation Thickness				Nominal Overall Size		Approximate Shipping Weight	
			Conductor		Overall					
	in.	(mm)	in.	(mm)	in.	(mm)	in.	(mm)	lbs/1000 ft	(kg/km)
30	0.010	(0.254)	0.004	(0.102)	0.005	(0.127)	0.026 x 0.044	(0.660 x 1.18)	3	(4.5)
24	0.020	(0.508)	0.005	(0.127)	0.005	(0.127)	0.036 x 0.064	(0.914 x 1.626)	5	(7.5)
24 S** (7/32)	0.024	(0.610)	0.005	(0.127)	0.005	(0.127)	0.043 x 0.066	(1.092 x 1.676)	6	(8.9)
20	0.032	(0.813)	0.005	(0.127)	0.005	(0.127)	0.048 x 0.088	(1.219 x 2.235)	8	(11.9)
20 S** (7/28)	0.038	(0.965)	0.005	(0.127)	0.005	(0.127)	0.056 x 0.098	(1.42 x 2.490)	9	(13.4)
16	0.051	(1.29)	0.005	(0.127)	0.005	(0.127)	0.071 x 0.132	(1.80 x 3.35)	19	(28.3)
16 S** (7/24)	0.060	(1.52)	0.005	(0.127)	0.005	(0.127)	0.084 x 0.148	(2.134 x 3.760)	21	(31.3)

*FEP laminate melts at approximately 260°C (500°F).
** "S" denotes stranded wire: e.g., "24 S (7/32)" is seven strands of 32 gauge wire to make a 24 gauge stranded conductor.

SERV-RITE Wire and Cable

Thermocouple Wire

Double Polyimide Insulated SERIES 513



The SERIES 513 is the ultimate polyimide insulated wire. The multiple polyimide tape layers along with fully color coded conductors make this insulation system the choice for high reliability circuits. Abrasion, moisture and chemical resistance are all enhanced by additional layers of tape and application of polyimide varnish.

The actual construction consists of a double polyimide tape layer applied to each conductor. The tape is fused by heating. Each insulated single conductor is then coated to impart the proper color code. Finally, the insulated conductors are laid parallel and covered by a double, heat fused layer of polyimide tape.

When applications require higher heat resistance, it is necessary to specify fiberglass insulation.

Popular Constructions

Grade	AWG	Wire Type	Limits of Error	Type K	Type J
Thermocouple	20	Solid	Standard	K20-1-513	J20-1-513
			Special	**K20-2-513**	**J20-2-513**
		Stranded	Standard	K20-3-513	J20-3-513
	24	Solid	Standard	K24-1-513	J24-1-513
			Special	**K24-2-513**	J24-2-513
	30	Solid	Special	K30-2-513	J24-2-513

Note: **Bolded** products are stocked and shipped in 100, 250, 500 and 1000 foot spools.

Available Constructions

1	2	3	4	5	6	7
			-	-	5	1	3

1. ASTM E 230 Calibrations

E K T
J N

2-3. AWG

30 24 20
24 stranded (7/32) 20 stranded (7/28)

4. Conductor Type/Tolerance

1 = Thermocouple grade, solid wire, standard tolerance
2 = Thermocouple grade, solid wire, special tolerance
3 = Thermocouple grade, stranded wire, standard tolerance
4 = Thermocouple grade, stranded wire, special tolerance

Note: Minimum order sizes apply for non-stock constructions.

Performance Capabilities

- Continuous temperature rating 315°C (600°F)
- Double polyimide fused tape insulation
- Colored coated conductors used to indicate calibration type

*Continuous Use Temp.	*Single Use Temp.
315˚C (600˚F)	430˚C (800˚F)

Resistance Properties		
Moisture	Chemical	Abrasion
Excellent	Excellent	Excellent

- Available with optional metallic overbraid for additional abrasion resistance

Applications

- Aerospace
- Petrochemical
- Plastics

Wire Specifications

AWG	Nominal Conductor Size		Nominal Insulation Thickness				Nominal Overall Size		Approximate Shipping Weight	
			Conductor		Overall					
	in.	(mm)	in.	(mm)	in.	(mm)	in.	(mm)	lbs/1000 ft	(kg/km)
30	0.010	(0.254)	0.006	(0.152)	0.006	(0.152)	0.038 x 0.058	(0.097 x 1.47)	3	(4.5)
24	0.020	(0.508)	0.006	(0.152)	0.006	(0.152)	0.054 x 0.076	(1.37 x 1.93)	5	(7.5)
24 S** (7/32)	0.024	(0.610)	0.006	(0.152)	0.006	(0.152)	0.056 x 0.084	(1.42 x 2.13)	6	(8.9)
20	0.032	(0.813)	0.006	(0.152)	0.006	(0.152)	0.065 x 0.100	(1.65 x 2.54)	10	(14.9)
20 S** (7/28)	0.038	(0.965)	0.006	(0.152)	0.006	(0.152)	0.070 x 0.112	(1.78 x 2.84)	11	(16.4)

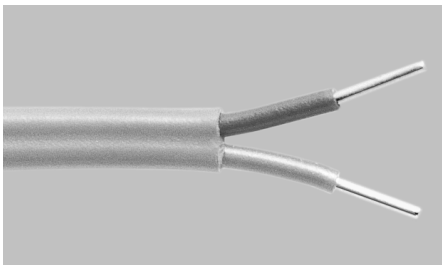
*FEP laminate melts at approximately 260°C (500°F).

** “S” denotes stranded wire: e.g., “24 S (7/32)” is seven strands of 32 gauge wire to make a 24 gauge stranded conductor.

SERV-RITE Wire and Cable

Thermocouple Wire

PFA Insulated Thermocouple and Extension Wire SERIES 516



A relatively new fluoroplastic, PFA, is the insulation on SERIES 516. PFA's temperature rating is only slightly less than TFE. However, PFA can be applied using conventional extrusion techniques. This produces a smooth finish, as opposed to the spiral usually associated with TFE tape constructions. This is important in the food industry where taped constructions present cleaning problems. The smooth surface also allows this construction to be pulled through conduits and cut-outs more easily.

Once each conductor has been coated with a color coded PFA layer, they are laid parallel and again coated with PFA.

Continuous Use Temp.	Single Use Temp.
260˚C (500˚F)	290˚C (550˚F)

Resistance Properties		
Moisture	**Chemical**	**Abrasion**
Excellent	Excellent	Good

Popular Constructions

Grade	AWG	Wire Type	Limits of Error	Type K	Type J	Type T
Thermocouple	20	Solid	Standard	K20-1-516	J20-1-516	T20-1-516
		Solid	Special	K20-2-516	J20-2-516	T20-2-516
		Stranded	Standard	K20-3-516	J20-3-516	T20-3-516
	24	Solid	Standard	K24-1-516	J24-1-516	T20-1-516
		Solid	Special	**K24-2-516**	J24-2-516	T20-2-516
		Stranded	Standard	K24-3-516	**J24-3-516**	T20-3-516

Grade	AWG	Wire Type	Limits of Error	Type E
Thermocouple	20	Solid	Standard	E20-1-516
		Solid	Special	E20-2-516
		Stranded	Standard	E20-3-516
	24	Solid	Standard	E24-1-516
		Solid	Special	E24-2-516
		Stranded	Standard	E24-3-516

Note: **Bolded** products are stocked and shipped in 100, 250, 500 and 1000 foot spools.

Available Constructions

1	2	3	4	5	6	7
			-	-	5	1	6

1. ASTM E 230 Calibrations

B J N T
E K S

2-3. AWG

36	24	20	16
30	24 stranded (7/32)	20 stranded (7/28)	16 stranded (7/24)

4. Conductor Type/Tolerance

1 = Thermocouple grade, solid wire, standard tolerance
2 = Thermocouple grade, solid wire, special tolerance
3 = Thermocouple grade, stranded wire, standard tolerance
4 = Thermocouple grade, stranded wire, special tolerance
5 = Extension grade, solid wire, standard tolerance
6 = Extension grade, solid wire, special tolerance
7 = Extension grade, stranded wire, standard tolerance
8 = Extension grade, stranded wire, special tolerance

Note: Minimum order sizes apply for non-stock constructions.

Performance Capabilities

- Continuous temperature rating 260°C (500°F)
- Flexible TFE plastic insulation
- Available with optional metallic overbraid for additional abrasion resistance

Applications

- General use extension wire

SERV-RITE Wire and Cable

Thermocouple Wire

PFA Insulated Thermocouple and Extension Wire SERIES 516 (con't)

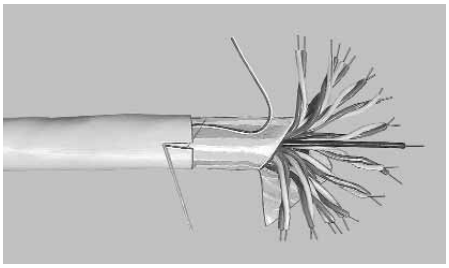
Wire Specifications

AWG	Nominal Conductor Size		Nominal Insulation Thickness				Nominal Overall Size		Approximate Shipping Weight	
			Conductor		Overall					
	in.	(mm)	in.	(mm)	in.	(mm)	in.	(mm)	lbs/1000 ft	(kg/km)
36	0.005	(0.127)	0.003	(0.076)	0.003	(0.076)	0.017 x 0.028	(0.432 x 0.711)	3.0	(2)
30	0.010	(0.254)	0.003	(0.076)	0.003	(0.076)	0.022 x 0.038	(0.559 x 0.965)	4.5	(3)
24	0.020	(0.508)	0.008	(0.203)	0.010	(0.254)	0.056 x 0.092	(1.42 x 2.34)	11.9	(8)
24 S* (7/32)	0.024	(0.610)	0.008	(0.203)	0.010	(0.254)	0.060 x 0.100	(1.52 x 2.54)	13.4	(9)
20	0.032	(0.813)	0.008	(0.203)	0.010	(0.254)	0.068 x 0.116	(1.73 x 2.95)	17.9	(12)
20 S* (7/28)	0.038	(0.965)	0.008	(0.203)	0.010	(0.254)	0.074 x 0.128	(1.88 x 3.25)	20.9	(14)
16	0.051	(1.29)	0.010	(0.254)	0.012	(0.305)	0.095 x 0.166	(2.41 x 4.22)	40.2	(27)
16 S* (7/24)	0.060	(1.52)	0.010	(0.254)	0.012	(0.305)	0.104 x 0.184	(2.64 x 4.67)	43.2	(29)

* "S" denotes stranded wire: e.g., "24 S (7/32)" is seven strands of 32 gauge wire to make a 24 gauge stranded conductor.

Multi-Pair Cable

PVC Insulated Multi- Pair 300 V UL® Listed PLTC Extension Cable SERIES 900 UL® and 900



SERIES 900 UL® is our family of multi-pair cables for UL® PLTC applications. Standard SERIES 900 UL® cables of different pair counts in most calibrations can be shipped quickly.

SERIES 900 UL® and 900 cable starts by insulating conductors with 105°C (220°F) PVC. For identification, one conductor of each pair is numbered and twisted with its counterpart. These "twisted pairs" are cabled with an additional insulated copper wire for communication use. The entire cable is wrapped with clear polyester tape to minimize the chance of short circuits to the cable's shield. An aluminized polyester tape shield is then spirally applied. A copper drain wire and heavy ripcord are longitudinally applied under the final jacket of color coded PVC.

Popular Constructions

Grade	AWG	Wire Type	Limits of Error	Type K	Type J	Type T
Extension (4 pr)	20	Solid	Standard	K20-5-904	J20-5-904	T20-5-904
Extension (8 pr)	20	Solid	Standard	K20-5-908	J20-5-908	T20-5-908
Extension (4 pr)	24	Solid	Standard	K24-5-904	J24-5-904	T24-5-904
Extension (8 pr)	24	Solid	Standard	K24-5-908	J24-5-908	T24-5-908

Popular Constructions UL® Listed

Grade	AWG	Wire Type	Limits of Error	Type K	Type J	Type T
Extension (4 pr)	20	Solid	Standard	K20-5-904-UL®	J20-5-904-UL®	T20-5-904-UL®
Extension (8 pr)	20	Solid	Standard	K20-5-908-UL®	J20-5-908-UL®	T20-5-908-UL®
Extension (4 pr)	24	Solid	Standard	K24-5-904-UL®	J24-5-904-UL®	T24-5-904-UL®
Extension (8 pr)	24	Solid	Standard	K24-5-908-UL®	J24-5-908-UL®	T24-5-908-UL®

Available Constructions

1 2 3 4 5 6 7 8 9
_ _ _ / _ / 9 _ _ /U L

1. ASTM E 230 Calibrations
E K S
J N T

2-3. AWG
24 20 16

4. Conductor Type/Tolerance
5 = Extension grade, solid wire, standard tolerance
6 = Extension grade, solid wire, special tolerance
7 = Extension grade, stranded wire, standard tolerance
8 = Extension grade, stranded wire, special tolerance

5. SERIES 900

6-7. Pair Counts
02 04 06 08 10 12 16 20 24

Note: Minimum order sizes apply for non-stock constructions.

Performance Capabilities

- Continuous temperature rating 105°C (220°F)

Continuous Use Temp.	Single Use Temp.
105°C (220°F)	105°C (220°F)

Resistance Properties		
Moisture	Chemical	Abrasion
Excellent	Good	Good

- Flexible PVC plastic insulation
- Multipair cable with overall shield
- Available in UL® listed 300V PLTC design also
- Available with optional metallic overbraid for additional abrasion resistance

Applications

- General use extension wire

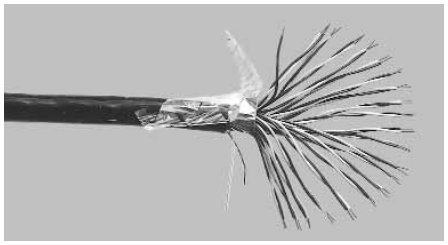
Wire Specifications

No. of Pairs	AWG	Nominal Conductor Size		Nominal Insulation Thickness				Nominal Overall Size		Approximate Shipping Weight	
				Conductor		Overall					
		in.	(mm)	in.	(mm)	in.	(mm)	in.	(mm)	lbs/1000 ft	(kg/km)
2	20	0.032	(0.813)	0.015	(0.381)	0.050	(1.27)	0.290	(7.37)	72	(107.3)
4	20	0.032	(0.813)	0.015	(0.381)	0.050	(1.27)	0.350	(8.89)	94	(140.1)
6	20	0.032	(0.813)	0.015	(0.381)	0.050	(1.27)	0.405	(10.29)	116	(172.8)
8	20	0.032	(0.813)	0.015	(0.381)	0.050	(1.27)	0.440	(11.18)	140	(208.6)
10	20	0.032	(0.813)	0.015	(0.381)	0.050	(1.27)	0.490	(12.45)	164	(244.4)
12	20	0.032	(0.813)	0.015	(0.381)	0.060	(1.52)	0.535	(13.59)	188	(280.1)
16	20	0.032	(0.813)	0.015	(0.381)	0.060	(1.52)	0.610	(15.49)	240	(357.6)
20	20	0.032	(0.813)	0.015	(0.381)	0.060	(1.52)	0.650	(16.51)	292	(435.1)
24	20	0.032	(0.813)	0.015	(0.381)	0.060	(1.52)	0.710	(18.03)	344	(512.6)

SERV-RITE Wire and Cable

Multi-Pair Cable

PVC Insulated Multi-Pair 300 V UL® Listed PLTC Extension Cable with Individual and Overall Shield SERIES 1000 UL® and 1000



SERIES 1000 UL® is our family of individually shielded and isolated multipair cables* for UL® PLTC applications. SERIES 1000 is the non UL® equivalent. SERIES 1000 UL® cables are made by insulating conductors with 105°C (220°F) PVC. For identification, one conductor of each pair is numbered and twisted with its counterpart. The pairs are then spirally wrapped with an aluminized polyester tape and drain wire to isolate them in the cable. This eliminates "noise" that can exist in a circuit. Individual pairs are then cabled with an additional insulated copper wire for communication use. These cables are ideal for data signals.

Continuous Use Temp.	Single Use Temp.
105˚C (220˚F)	105˚C (220˚F)

Resistance Properties		
Moisture	Chemical	Abrasion
Excellent	Good	Good

Popular Constructions

Grade	AWG	Wire Type	Limits of Error	Type K	Type J	Type T
Extension (4 pr)	20	Solid	Standard	**K20-5-1004**	**J20-5-1004**	**T20-5-1004**
Extension (8 pr)	20	Solid	Standard	**K20-5-1008**	**J20-5-1008**	**T20-5-1008**
Extension (4 pr)	24	Solid	Standard	K24-5-1004	J24-5-1004	T24-5-1004
Extension (8 pr)	24	Solid	Standard	K24-5-1008	J24-5-1008	T24-5-1008

Popular Constructions UL® Listed

Grade	AWG	Wire Type	Limits of Error	Type K	Type J	Type T
Extension (4 pr)	20	Solid	Standard	K20-5-1004-UL®	J20-5-1004-UL®	T20-5-1004-UL®
Extension (8 pr)	20	Solid	Standard	K20-5-1008-UL®	J20-5-1008-UL®	T20-5-1008-UL®
Extension (4 pr)	24	Solid	Standard	K24-5-1004-UL®	J24-5-1004-UL®	T24-5-1004-UL®
Extension (8 pr)	24	Solid	Standard	K24-5-1008-UL®	J24-5-1008-UL®	T24-5-1008-UL®

Note: **Bolded** products are stocked and shipped in 100, 250, 500 and 1000 foot spools.

Available Constructions

1	2	3	4	5	6	7	8	9	10
			-	-	1	0		-	U	L

1. ASTM E 230 Calibrations

E K S
J N T

2-3. AWG

24 20 16

4. Conductor Type/Tolerance

5 = Extension grade, solid wire, standard tolerance
6 = Extension grade, solid wire, special tolerance
7 = Extension grade, stranded wire, standard tolerance
8 = Extension grade, stranded wire, special tolerance

5-6. SERIES 1000

7-8. Pair Counts

02 04 06 08 10 12 16 20 24

9-10. UL® Listed

Leave blank for no UL®

Note: Minimum order sizes apply for non-stock constructions.

Performance Capabilities

- Continuous temperature rating 105°C (220°F)
- Flexible PVC plastic insulation
- Multipair cable with individual pair and overall shields
- Available in UL® listed 300V PLTC design
- Available with optional metallic overbraid for additional abrasion resistance

Applications

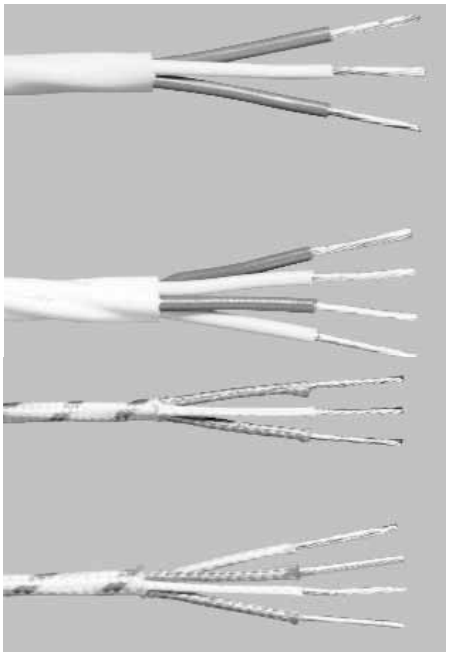
- General use extension wire

Wire Specifications

No. of Pairs	AWG	Nominal Conductor Size		Nominal Insulation Thickness				Nominal Overall Size		Approximate Shipping Weight	
				Conductor		Overall					
		in.	(mm)	in.	(mm)	in.	(mm)	in.	(mm)	lbs/1000 ft	(kg/km)
2	20	0.032	(0.813)	0.015	(0.381)	0.050	(1.27)	0.305	(7.75)	77	(114.7)
4	20	0.032	(0.813)	0.015	(0.381)	0.050	(1.27)	0.385	(9.78)	104	(155.0)
6	20	0.032	(0.813)	0.015	(0.381)	0.050	(1.27)	0.445	(11.30)	131	(195.2)
8	20	0.032	(0.813)	0.015	(0.381)	0.050	(1.27)	0.490	(12.45)	160	(238.4)
10	20	0.032	(0.813)	0.015	(0.381)	0.060	(1.52)	0.560	(14.22)	189	(281.6)
12	20	0.032	(0.813)	0.015	(0.381)	0.060	(1.52)	0.610	(15.49)	218	(324.8)
16	20	0.032	(0.813)	0.015	(0.381)	0.060	(1.52)	0.640	(16.26)	280	(417.2)
20	20	0.032	(0.813)	0.015	(0.381)	0.060	(1.52)	0.710	(18.03)	342	(509.6)
24	20	0.032	(0.813)	0.015	(0.381)	0.060	(1.52)	0.805	(20.45)	404	(602.0)

RTD Lead Wire

SERIES 701, 704 and 705



Watlow's quality, experience and versatility carry over from insulated thermocouple and extension wire to RTD Lead Wire and fiberglass wire.

PVC

Continuous Use Temp.	Single Use Temp.
105˚C (220˚F)	105˚C (220˚F)

Resistance Properties		
Moisture	**Chemical**	**Abrasion**
Excellent	Good	Good

FEP

Continuous Use Temp.	Single Use Temp.
204˚C (400˚F)	260˚C (500˚F)

Resistance Properties		
Moisture	**Chemical**	**Abrasion**
Excellent	Excellent	Excellent

Fiberglass

Continuous Use Temp.	Single Use Temp.
480˚C (900˚F)	540˚C (1000˚F)

Resistance Properties		
Moisture	**Chemical**	**Abrasion**
Good	Good	Fair

Popular Constructions

No. of Conductors	AWG	Wire Type*	Insulation Material		
			PVC (220°F)	FEP (400°F)	Fiberglass (900°F)
2	22	Tinned copper	RT2-22-4-701	RT2-22-4-704	RT2-22-4-705
		Nickel plated copper	RT2-22-8-701	RT2-22-8-704	RT2-22-8-705
	24	Tinned copper	RT2-24-4-701	RT2-24-4-704	RT2-24-4-705
		Nickel plated copper	RT2-24-8-701	RT2-24-8-704	RT2-24-8-705
3	22	Tinned copper	**RT3-22-4-701**	RT3-22-4-704	RT3-22-4-705
		Nickel plated copper	RT3-22-8-701	**RT3-22-8-704**	RT3-22-8-705
	24	Tinned copper	RT3-24-4-701	RT3-24-4-704	RT3-24-4-705
		Nickel plated copper	RT3-24-8-701	RT3-24-8-704	**RT3-24-8-705**
4	22	Tinned copper	RT4-22-4-701	RT4-22-4-704	RT4-22-4-705
		Nickel plated copper	RT4-22-8-701	RT4-22-8-704	RT4-22-8-705
	24	Tinned copper	RT4-24-4-701	RT4-24-4-704	RT4-24-4-705
		Nickel plated copper	RT4-24-8-701	RT4-24-8-704	RT4-24-8-705

Note: **Bolded** products are stocked and shipped in 100, 250, 500 and 1000 foot spools.

Available Constructions

1	2	3	4	5	6	7	8	9
R	T		-		-	-		

3. Number of Conductors
2 3 4

4-5. AWG
24 22 20
18 16

6. Conductor Type/Tolerance
4 = Stranded tinned copper
8 = Stranded nickel plated copper

7-9. Insulation Type
701 = PVC
704 = FEP
705 = Fiberglass

Note: Minimum order sizes apply for non-stock constructions.

Performance Capabilities

- Continuous temperature rating 105 to 480°C (220 to 900°F) depending upon construction
- Available with optional metallic overbraid for additional abrasion resistance

Applications

- General use RTD sensor wire

SERV-RITE Wire and Cable

RTD Lead Wire

SERIES 701, 704 and 705

Wire Specifications - SERIES 701 - PVC

No. of Conductors	AWG	Nominal Conductor Size		Nominal Insulation Thickness				Nominal Overall Size		Approximate Shipping Weight	
				Conductor		Overall					
		in.	(mm)	in.	(mm)	in.	(mm)	in.	(mm)	lbs/1000 ft	(kg/km)
2	22S** (7/30)	0.030	(0.762)	0.015	(0.381)	0.020	(0.508)	0.160	(4.06)	17	(25.3)
	20S** (7/28)	0.038	(0.965)	0.015	(0.381)	0.020	(0.508)	0.176	(4.47)	19	(28.3)
	18S** (7/26)	0.048	(1.22)	0.020	(0.508)	0.025	(0.635)	0.226	(5.74)	22	(32.8)
3	22S** (7/30)	0.030	(0.762)	0.015	(0.381)	0.020	(0.508)	0.172	(4.37)	20	(29.8)
	20S** (7/28)	0.038	(0.965)	0.015	(0.381)	0.020	(0.508)	0.190	(4.83)	25	(37.3)
	18S** (7/26)	0.048	(1.22)	0.020	(0.508)	0.025	(0.635)	0.244	(6.20)	30	(44.7)
4	22S** (7/30)	0.030	(0.762)	0.015	(0.381)	0.020	(0.508)	0.184	(4.67)	23	(34.3)
	20S** (7/28)	0.038	(0.965)	0.015	(0.381)	0.020	(0.508)	0.204	(5.18)	30	(44.7)
	18S** (7/26)	0.048	(1.22)	0.020	(0.508)	0.025	(0.635)	0.262	(6.65)	37	(55.1)

* 24 and 16 gauge constructions also available, consult factory for details.

** "S" denotes stranded wire: e.g., "22 S (7/30)" is seven strands of 30 gauge wire to make a 22 gauge stranded conductor.

Wire Specifications - SERIES 704 - FEP

No. of Conductors	AWG	Nominal Conductor Size		Nominal Insulation Thickness				Nominal Overall Size		Approximate Shipping Weight	
				Conductor		Overall					
		in.	(mm)	in.	(mm)	in.	(mm)	in.	(mm)	lbs/1000 ft	(kg/km)
2	24S* (7/32)	0.024	(0.610)	0.008	(0.203)	0.012	(0.305)	0.118	(3.00)	12	(17.9)
	22S* (7/30)	0.030	(0.762)	0.008	(0.203)	0.012	(0.305)	0.130	(3.30)	14	(20.9)
	20S* (7/28)	0.038	(0.965)	0.008	(0.203)	0.012	(0.305)	0.146	(3.71)	17	(25.3)
3	24S* (7/32)	0.024	(0.610)	0.008	(0.203)	0.012	(0.305)	0.126	(3.20)	16	(23.8)
	22S* (7/30)	0.030	(0.762)	0.008	(0.203)	0.012	(0.305)	0.140	(3.56)	20	(29.8)
	20S* (7/28)	0.038	(0.965)	0.008	(0.203)	0.012	(0.305)	0.158	(4.01)	24	(35.8)
4	24S* (7/32)	0.024	(0.610)	0.008	(0.203)	0.012	(0.305)	0.136	(3.46)	19	(28.3)
	22S* (7/30)	0.030	(0.762)	0.008	(0.203)	0.012	(0.305)	0.150	(3.81)	23	(34.3)
	20S* (7/28)	0.038	(0.965)	0.008	(0.203)	0.012	(0.305)	0.170	(4.32)	27	(40.2)

* "S" denotes stranded wire: e.g., "24 S (7/32)" is seven strands of 32 gauge wire to make a 24 gauge stranded conductor.

Wire Specifications - SERIES 705 - Fiberglass

No. of Conductors	AWG	Nominal Conductor Size		Nominal Insulation Thickness				Nominal Overall Size		Approximate Shipping Weight	
				Conductor		Overall					
		in.	(mm)	in.	(mm)	in.	(mm)	in.	(mm)	kg/km	(lbs/1000 ft)
2	24S* (7/32)	0.024	(0.610)	0.005	(0.127)	0.006	(0.152)	0.080	(2.03)	6	(8.9)
	22S* (7/30)	0.030	(0.762)	0.005	(0.127)	0.006	(0.152)	0.092	(2.34)	7	(10.4)
	20S* (7/28)	0.038	(0.965)	0.006	(0.152)	0.006	(0.152)	0.112	(2.84)	9	(13.4)
3	24S* (7/32)	0.024	(0.610)	0.005	(0.127)	0.006	(0.152)	0.086	(2.18)	8	(11.9)
	22S* (7/30)	0.030	(0.762)	0.005	(0.127)	0.006	(0.152)	0.098	(2.49)	9	(13.4)
	20S* (7/28)	0.038	(0.965)	0.006	(0.152)	0.006	(0.152)	0.120	(3.05)	12	(17.9)
4	24S* (7/32)	0.024	(0.610)	0.005	(0.127)	0.006	(0.152)	0.092	(2.34)	10	(14.9)
	22S* (7/30)	0.030	(0.762)	0.005	(0.127)	0.006	(0.152)	0.106	(2.69)	12	(17.9)
	20S* (7/28)	0.038	(0.965)	0.006	(0.152)	0.006	(0.152)	0.130	(3.30)	16	(23.8)

* "S" denotes stranded wire: e.g., "24 S (7/32)" is seven strands of 32 gauge wire to make a 24 gauge stranded conductor.

SERV-RITE Wire and Cable

Bare Thermocouple Alloy

ASTM E 230
Types J, K, T, E and N

Watlow can provide matched pairs of uninsulated thermocouple alloys for your temperature sensing needs. These are the same quality products used to manufacture our own insulated wire, XACTPAK metal sheathed cable, sensors and specialty components. Many wire products from 2 to 36 AWG may be available for off the shelf shipment in standard or special limits of error.

Consult the factory with your specific requirements for pricing and availability.

Bare Thermocouple Wire—ASTM E 230 Types J and K

AWG	KP[1] Code No.	Feet per lb	KN[1] Code No.	Feet per lb	JP Code No.	Feet per lb	JN Code No.	Feet per lb
2	**1475-2**	5	**1476-2**	5	—	—	—	—
8	**1475-8**	21	**1476-8**	21	**1565-8**	23	**1566-8**	20
14	**1475-14**	83	**1476-14**	83	**1565-14**	91	**1566-14**	80
16	**1475-16**	130	**1476-16**	130	**1565-16**	145	**1566-16**	128
18	**1475-18**	212	**1476-18**	212	**1565-18**	231	**1566-18**	204
20	**1475-20**	331	**1476-20**	331	**1565-20**	365	**1566-20**	332
22	**1475-22**	530	**1476-22**	530	**1565-22**	586	**1566-22**	514
24	**1475-24**	838	**1476-24**	838	**1565-24**	926	**1566-24**	818
26	**1475-26**	1340	**1476-26**	1340	**1565-26**	1476	**1566-26**	1300
28	**1475-28**	2130	**1476-28**	2130	**1565-28**	2360	**1566-28**	2071
30	**1475-30**	3370	**1476-30**	3370	**1565-30**	3740	**1566-30**	3290
36	**1475-36**	13480	**1476-36**	16480	**1565-36**	14950	**1566-36**	13280

[1] KP and KN 2 gauge to 14 gauge products are oxide finished, all other sizes are bright annealed finish.

Bare Thermocouple Wire—ASTM E 230 Types T and E

AWG	EP Code No.	Feet per lb	EN Code No.	Feet per lb	TP Code No.	Feet per lb	TN Code No.	Feet per lb
8	**1474-8**	21	**1624-8**	20	—	—	**1625-8**	20
14	**1474-14**	83	**1624-14**	80	**1665-14**	80	**1625-14**	80
16	**1474-16**	130	**1624-16**	128	**1665-16**	128	**1625-16**	128
18	**1474-18**	212	**1624-18**	204	**1665-18**	204	**1625-18**	204
20	**1474-20**	331	**1624-20**	332	**1665-20**	332	**1625-20**	332
22	**1474-22**	530	**1624-22**	514	**1665-22**	514	**1625-22**	514
24	**1474-24**	838	**1624-24**	818	**1665-24**	818	**1625-24**	818
26	**1474-26**	1340	**1624-26**	1300	**1665-26**	1300	**1625-26**	1300
28	**1474-28**	2130	**1624-28**	2071	**1665-28**	2071	**1625-28**	2071
30	**1474-30**	3370	**1624-30**	3290	**1665-30**	3290	**1625-30**	3290

SERV-RITE Wire and Cable

Bare Thermocouple Alloy

ASTM E 230 Types B, R, and S

ASTM E 230 Type B* (6 Percent / 30 Percent)—Standard Grade

Size of Wire		BP Code No.	Inches Per Troy Oz (Approx.)	BN Code No.	Inches Per Troy Oz (Approx.)
AWG	O.D. (in.)				
24	0.0201	**2330-24**	294	**2306-24**	343
30	0.0100	**2330-30**	1373	**2306-30**	1176

*Type B thermocouples and thermoelements meet ITS-90. BP and BN thermoelements must be ordered as a matched pair.

ASTM E 230 Types R and S—Standard Grade ITS-90**

Size of Wire		RN, SN Code No.	Inches Per Troy Oz (Approx.)	SP Code No.	Inches Per Troy Oz (Approx.)	RP Code No.	Inches Per Troy Oz (Approx.)
AWG	O.D. (in.)						
23	0.0225	**2300-23**	222	**2310-23**	241	**2313-23**	246
24	0.0201	**2300-24**	282	**2310-24**	302	**2313-24**	308
30	0.0100	**2300-30**	1127	**2310-30**	1209	**2313-30**	1234

ASTM E 230 Types R and S—Reference Grade①, ITS-90**

Size of Wire		RN, SN Code No.	Inches Per Troy Oz (Approx.)	SP Code No.	Inches Per Troy Oz (Approx.)	RP Code No.	Inches Per Troy Oz (Approx.)
AWG	O.D. (in.)						
24	0.0201	**2300-24-SP**	282	**2310-24-SP**	302	**2313-24-SP**	308
30	0.0100	**2300-30-SP**	1127	**2310-30-SP**	1209	**2313-30-SP**	1234

① Accuracy 0.10 percent from 600 to 1450°C (1112 to 2642°F).

** Types R and S thermocouples and thermoelements are provided in accordance with ITS-90.

Notes

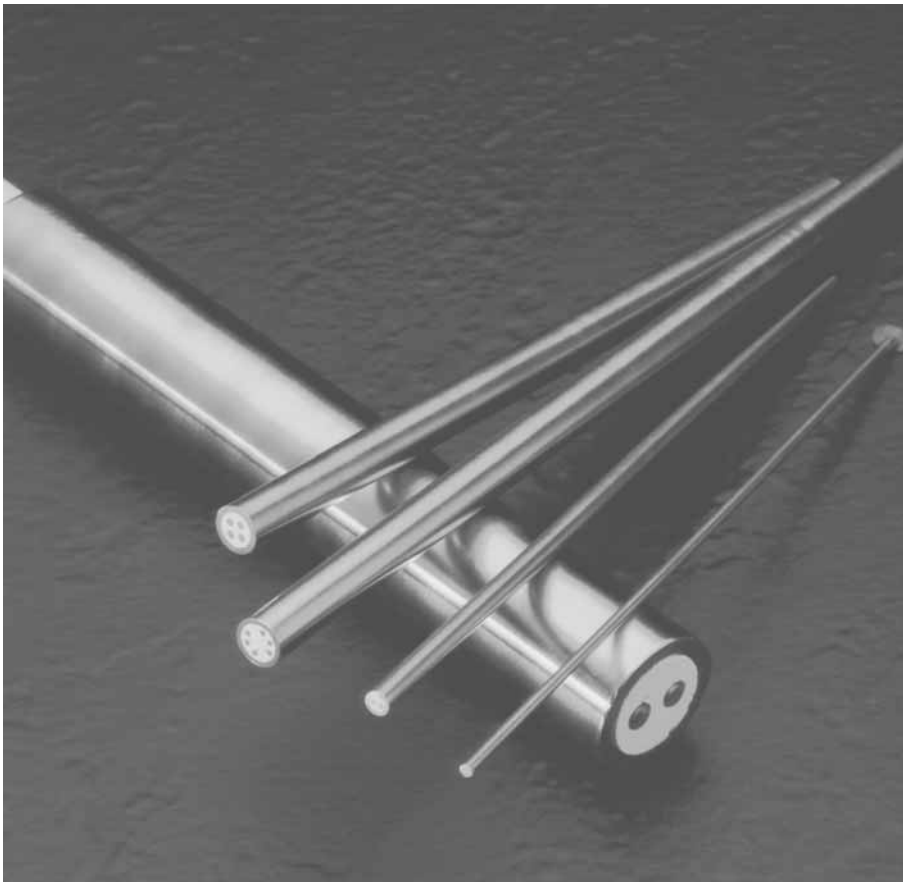
Mineral Insulated Metal-Sheathed Cable

XACTPAK® Cable

Watlow helped pioneer XACTPAK® mineral insulated, metal-sheathed cable. The unique properties of XACTPAK make it ideally suited to solve a wide variety of problem applications.

The outer sheath can be made from any malleable metal in a wide range of diameters, containing single or multiple wires. Easily formed or bent, it can accommodate virtually any configuration. The outer sheath protects thermocouple or thermocouple extension wires from oxidation and hostile environments that would quickly destroy unprotected wire.

The mineral insulations available provide excellent high temperature dielectric strength to ensure signals are carried faithfully to your instrumentation or controls.



Performance Capabilities

- Available in standard and special limits of error accuracy
- Diameters from 0.010 to 0.5 inch (0.25 to 12.7 mm)
- Compliance with recognized agency tolerances and specifications
- Sheath materials available to withstand a wide variety of hostile and corrosive environments
- Calibrated for intended temperature range
- Temperature ranges from 0 to 1480°C (32 to 2700°F)
- Cryogenic cable available upon request

Features and Benefits

Fireproof cable

- Perform where conventional insulated wires burn and degrade

Fast and accurate

- Precisely measures temperature for a fast response

Tight moisture and gas seals

- Resists contamination

High pressure rating

- Allows use in pressure vessels and vacuum applications

Form flexibility

- Adapts to virtually any application

Thermal shock resistance

- Withstands thermal cycling

Compact, durable and corrosion resistant

- Long life performance with minimum constraints on applications

High temperature rating

- Meets demanding application needs

Applications

- Atomic research
- Bearing temperature
- Blast furnaces
- Catalytic reformers
- Diesel engines
- Food and beverage
- Furnaces
- Glass and ceramic
- Heat treating
- Instrument cabling
- Jet engines and test cells
- Kilns
- Laboratory and research
- Medical
- Nuclear reactors
- Power stations and steam generators
- Refineries and oil processing
- Rocket engines
- Semiconductor processing
- Turbines
- Vacuum furnaces

XACTPAK Cable

Technical Data

Quality Control and Testing

To maintain quality and consistency, XACTPAK cable is manufactured under carefully controlled procedures and rigid standards of cleanliness. Quality checks are made at critical points throughout the manufacturing process.

All XACTPAK cable is inspected and tested for sheath condition, insulation density, conductor uniformity, electrical continuity, insulation resistance, calibration conformance and physical dimension. Special testing and certification—including helium leak, homogeneity and metallurgical examination, among others—are available on request.

Quality Assurance

Every coil of XACTPAK cable is thoroughly tested for continuity, insulation resistance, physical dimensions and physical appearance.

Each lot, or batch of XACTPAK contains raw materials (sheath, insulation, wires) from one production lot which eliminates the need to calibrate every thermocouple cut from a coil because of poor homogeneity.

Samples from each lot are calibrated in our modern calibration laboratory by highly skilled technicians. Unlike some manufacturers who calibrate at a few low temperature calibration points, Watlow calibrates throughout the range that the cable is designed for.

For a more complete discussion of Watlow's advanced technological capabilities, refer to the laboratory services section, pages 30 to 35.

Care, Handling and Fabrication of XACTPAK Cable

To maximize the performance advantages made possible by XACTPAK cable's overall premium quality, the following instructions covering its storage, handling and further fabrication should be observed.

Storage

To prevent moisture from being absorbed by its hygroscopic mineral insulation, both ends of each length of XACTPAK cable are sealed at the factory. To further guard against moisture penetration, it is advisable to store XACTPAK material in a dry place.

Moisture

If XACTPAK cable is not adequately sealed, its insulation will absorb moisture. This will lower its electrical resistance and may prove to be troublesome in subsequent welding. Minor moisture penetration can be remedied by using a blow torch to heat the sheath. Apply the flame six to seven inches from the open end and slowly work the flame to and over the end. Reseal the end after it has cooled to about 82°C (180°F). Deep moisture penetration is unlikely, but should it occur the material may be baked at approximately 121°C (250°F) for 24 hours to increase its insulation resistance. If baking does not bring the insulation resistance back to acceptable levels, the material should be discarded.

Mineral Insulated Metal-Sheathed Cable

XACTPAK Cable

Technical Data

Care, Handling and Fabrication of XACTPAK Cable

Continued

Cutting

When pieces are cut from a length of XACTPAK cable, the exposed ends should immediately be squared and sealed. Squaring and sealing will guard against possible contamination and remove any loosened insulation or distorted wire caused by cutting. A light pressure sanding with a 180-grit belt is the easiest method for rough squaring of 0.040 inch or larger diameter XACTPAK cable. Using hard pressure against the sanding belt will cause excessive heat build-up which may "smear" the soft metal over the insulation. After sanding, a clean fine toothed file should be used to dress the squared ends. Each exposed end should then be sealed with XACTSEAL to prevent moisture absorption.

Inexperienced personnel may find 0.032 inch or smaller diameter XACTPAK cable difficult to handle and will probably prefer to have all cutting, stripping and fabricating done at our factory.

Insulation Resistance

XACTPAK mineral insulated, metal-sheathed cable should have a minimum room temperature insulation resistance of 100 megohms when tested at 50V⎓(dc) both wires to sheath and wire to wire.

All ceramics used in XACTPAK cable will decrease in resistance as temperature increases.

Shipping and Packaging

XACTPAK cable is stocked in random lengths from 20 feet to the "Maximum Stock Lengths" listed in the tables on the following pages. We reserve the right to supply random lengths of our choice unless specific cut lengths are specified on your order.

On request, XACTPAK cable can be furnished in other coil dimensions or shipped in straight form when necessary. Longer lengths are available on special order.

Stripping

A hand stripping tool will readily remove the sheath from 0.010 through 0.125 inch diameter XACTPAK cable. However, due to the difficulty of working with 0.032 inch or smaller diameter material, it is recommended that small diameter material be ordered factory stripped. Material larger than 0.125 inch diameter can be stripped on a lathe with a suitable tool bit or lathe-mounted stripping tool. It is also possible to strip larger sizes of XACTPAK cable by using a hacksaw to make a ring cut through the sheath at the desired distance from the end. Hammering the severed portion of sheath at several places will break up the insulation allowing the sheath to be slipped off. After stripping, the exposed conductors should be sandblasted or cleaned with emery cloth. The exposed ends should be resealed immediately after completion of the stripping operation.

Forming

Because XACTPAK cable's sheath is dead soft and bright annealed, it can be formed and shaped to most contours without risk of cracking. As a rule of thumb, the sheath can be formed around a mandrel twice the sheath diameter without damage. In other words, 0.125 inch diameter XACTPAK cable can be wound around a 0.250 inch diameter mandrel.

XACTPAK Cable

Technical Data

Care, Handling and Fabrication of XACTPAK Cable

Continued

Welding

Because of the delicate nature of the work and to avoid possible contamination, it is recommended that the fabrication of "hot" or "measuring" junctions be done at our factory.

If they are attempted in the field, a welding rod of the same material as the sheath should be used, and the welding method should be by inert gas. Flux should not be used as it will contaminate the insulation.

Other weldments, such as to a vessel or pipe, should be made in an inert atmosphere to prevent oxidation of the sheath. When working with XACTPAK cable of 0.040 inch outside diameter or less, extreme caution should be used not to burn through the sheath.

How to Select XACTPAK Cable to Suit Your Requirements

Our mineral insulated metal-sheathed cable section has been designed for ease of use so that the right cable is chosen for each application. The following four items must be considered when selecting XACTPAK mineral insulated metal-sheathed cable:

1. Sheath Material

The sheath serves to isolate and protect the wires and insulation from contamination and mechanical damage. There is no sheath material which is appropriate for all conditions so Watlow offers a wide variety to choose from. Temperature, strength, corrosiveness, service life and cost must be considered when selecting a sheath material.

2. Calibration

Watlow stocks all ASTM recognized thermocouple types along with many that have not been recognized, such as the full line of tungsten rhenium thermocouples. We also manufacture cable with other wire alloys such as nickel, copper, nickel clad copper, 304 SS, Alloy 600 and virtually any malleable metal.

3. Insulation Material

The insulation separates the conductors from each other and the outer sheath. When selecting insulation, temperature rating, environment and cost must be taken into account.

4. Physical Characteristics

The diameter of the sheath and the wall thickness will directly affect the following:

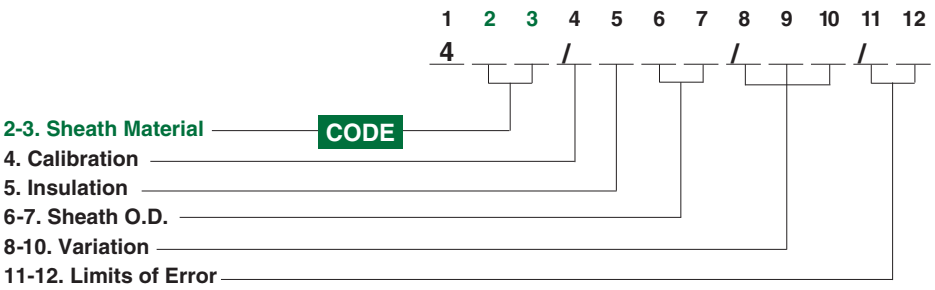
- Time response
- Service life
- Flexibility
- Pressure rating
- Strength

5. Specify Coil Lengths

Random—the factory selects for you (20 foot minimum). Special—specify lengths and tolerance. Cut to length charges and minimum order quantities may apply.

Mineral Insulated Metal-Sheathed Cable

XACTPAK Cable



Sheath Material

The following information is designed to be used as a guide and may not be correct in every application. If in doubt, consult with your Watlow sales engineer or the factory.

Alloy 600

01—Maximum temperature: 1175°C (2150°F). Most widely used thermocouple sheath material. Good high temperature strength, corrosion resistance, resistance to chloride ion stress corrosion cracking and oxidation resistance to high temperatures. Do not use in sulfur bearing environments. Good in nitriding environments.

304 SS

02—Maximum temperature: 900°C (1650°F). Most widely used low temperature sheath material. Extensively used in food, beverage, chemical and other industries where corrosion resistance is required. Subject to damaging carbide precipitation in 480 to 870°C (900 to 1600°F) range. Lowest cost *corrosion resistant* sheath material available.

310 SS

03—Maximum temperature: 1150°C (2100°F). Mechanical and corrosion resistance, similar to but better than 304 SS. Very good heat resistance. This alloy contains 25 percent chromium, 20 percent nickel. Not as ductile as 304 SS.

316 SS

04—Maximum temperature: 900°C (1650°F). Best corrosion resistance of the austenitic stainless steel grades. Widely used in the food and chemical industry. Subject to damaging carbide precipitation in 482 to 870°C (900 to 1600°F) range.

347 SS

05—Maximum temperature: 870°C (1600°F). Similar to 304 SS except nickel niobium stabilized. This alloy is designed to overcome susceptibility to carbide precipitation in the 480 to 870°C (900 to 1600°F) range. Used in aerospace and chemical applications.

446 SS

13—Maximum temperature: 1150°C (2100°F). Ferritic stainless steel which has good resistance to sulfurous atmospheres at high temperatures. Good corrosion resistance to nitric acid, sulfuric acid and most alkalies. 27 percent chromium content gives this alloy the highest heat resistance of any ferritic stainless steel.

321 SS

16—Maximum temperature: 870°C (1600°F). Similar to 304 SS except titanium stabilized for inter-granular corrosion. This alloy is designed to overcome susceptibility to carbon precipitation in the 480 to 870°C (900 to 1600°F) range. Used in aerospace and chemical applications.

Hastelloy® X

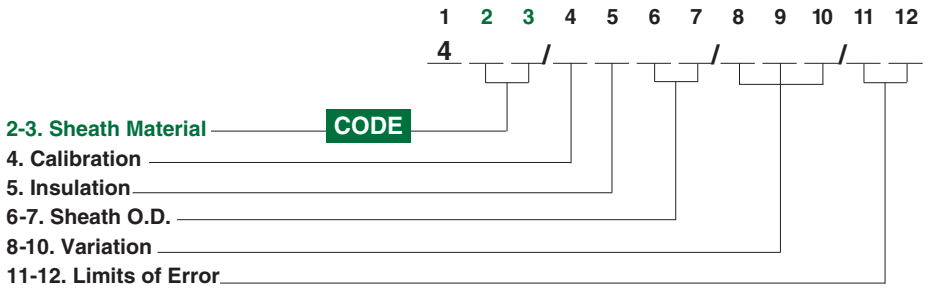
18—Maximum temperature: 1205°C (2200°F). Widely used in aerospace applications. Resistant to oxidizing, reducing and neutral atmospheric conditions. Excellent high temperature strength along with superior oxidation resistance. Resistant to stress corrosion cracking in petrochemical applications.

Inconel® 601

19—Maximum temperature: 1175°C (2150°F) continuous, 1260°C (2300°F) intermittent. Similar to Alloy 600 with the addition of aluminum for outstanding oxidation resistance. Designed for high temperature corrosion resistance. This material is good in carburizing environments, and has good creep rupture strength. *Do not use in vacuum furnaces!* Susceptible to intergranular attack by prolonged heating in 540 to 760°C (1000 to 1400°F) temperature range.

XACTPAK Cable

Sheath Material
Continued



Inconel® 625

25—Maximum temperature: 980°C (1800°F). Used in many aerospace applications. Excellent high temperature strength. Excellent resistance to pitting and crevice corrosion. Unaffected by radiation embrittlement.

Haynes® Alloy 230

32—Maximum temperature: 1150°C (2100°F). This alloy offers excellent high temperature strength, oxidation resistance and long term thermal stability. Used in aerospace applications, chemical process industries and high temperature industrial heating applications. This alloy is recommended for use in nitriding environments.

Haynes® Alloy HR-160

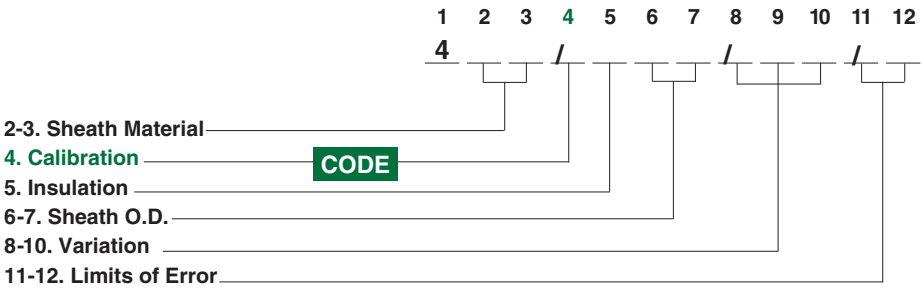
38—Maximum temperature 1175°C (2150°F). Developed to provide superior sulfidation-resistance at high temperatures. This alloy shows good resistance to corrosion in some salt bath applications. Applications include sulfur furnaces, waste incinerators, coke burners, recuperators, cement kilns and high temperature furnaces.

Haynes® Alloy 718

42—Maximum temperature 700°C (1300°F). A precipitation hardendable Inconel® alloy developed for corrosion resistance and excellent weldability. Applications include gas turbine, aerospace, oil and gas production and nuclear.

Mineral Insulated Metal-Sheathed Cable

XACTPAK Cable



Calibration

ASTM Type J

1—Type J's positive leg (JP) is iron. Its negative leg (JN) is approximately 45 percent nickel-55 percent copper. When protected by compacted mineral insulation and outer sheath, Type J is usable from 0 to 815°C (32 to 1500°F). Type J is not susceptible to short range ordering in the 0 to 538°C (700 to 1000°F) temperature range, (+2 to +4°F drift) which occurs with ASTM Type E and K. This low cost, stable thermocouple calibration is primarily used with 96 percent pure MgO insulation and stainless steel sheath.

ASTM Type K

2—Type K's positive leg (KP) is approximately 90 percent nickel-10 percent chromium. Its negative leg (KN) is approximately 95 percent nickel-two percent aluminum-two percent manganese-one percent silicon. When protected by compacted mineral insulation and outer sheath, Type K is usable from -35 to 1260°C (-32 to 2300°F). If the application is between 600 to 1100°F, we recommend Type J or N because of short range ordering that can cause drift of +2 to +4°F in a few hours time. Type K is relatively stable to radiation transmission in nuclear environments. For applications below 0°C (32°F), special alloy selections are usually required.

ASTM Type T

3—Type T's positive leg (TP) is pure copper. Its negative leg (TN) is approximately 45 percent nickel-55 percent copper. When protected by compacted mineral insulation and outer sheath, Type T is usable from 0 to 350°C (32 to 660°F) and very stable in cryogenic and low temperature applications. For applications below 0°C (32°F) special alloy selections may be required.

ASTM Type E

4—Type E's positive leg (EP) is approximately 90 percent nickel-10 percent chromium. Its negative leg (EN) is approximately 45 percent nickel-55 percent copper. When protected by compacted mineral insulation and outer sheath, Type E is usable from 0 to 900°C (32 to 1650°F) and has the highest EMF output per degree of all ASTM types. If the application temperature is between 600 to 1100°F, we recommend Type J or N because of short range ordering which can cause drift of +1 to +3°F in a few hours time. For applications below 0°C (32°F), special alloy selections may be required.

ASTM Type N

8—Type N's positive leg (nicrosil) is approximately 14 percent chromium-1.4 percent silicon-84.6 nickel. Its negative leg (nisil) is approximately 4.4 percent silicon-95.6 percent nickel. When protected by compacted mineral insulation and outer sheath, it's usable from 0 to 1260°C (32 to 2300°F). Type N overcomes several problems inherent in Type K. Short range ordering, (+2 to +4°F drift), in the 315 to 590°C (600 to 1100°F) range is greatly reduced, and drift rate at high temperatures is considerably less. Type N is also more stable than Type K in nuclear environments.

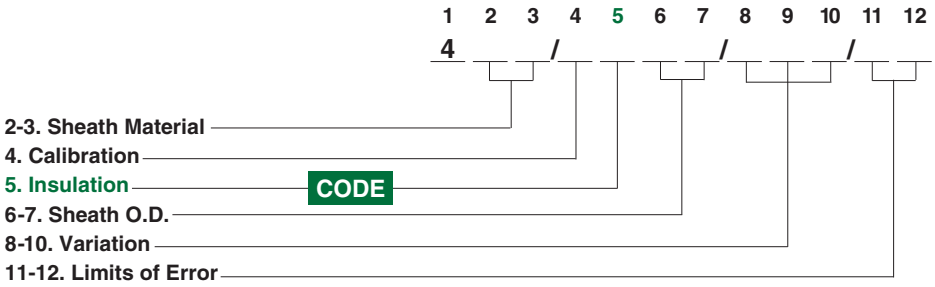
Miscellaneous

9—Consult factory.

Mineral Insulated Metal-Sheathed Cable

XACTPAK Cable

Insulation



High Purity Magnesium Oxide (MgO) 99.4 Percent Minimum Purity

1—Low impurity levels make this insulation very useful for all thermocouple calibrations up to 1370°C (2500°F). Above 2500°F we recommend using hafnia oxide insulation because of MgO's low resistivity. This material meets the requirements established in ASTM E-235.

Alumina Oxide (Al2O3) 99.6% Minimum Purity

2—Although this material is comparable to MgO in its electrical properties and cost, it does not compact well and tends to "powder out." This undesirable characteristic has made this insulation unpopular in industry so cable with this type of insulation is available only as a "special."

Magnesium Oxide (MgO) 96% Minimum Purity

5—This low cost insulation is similar to high purity MgO (1) except it should be used in applications below 1095°C (2000°F) because of the impurity levels. This insulation *should not* be used with platinum or in nuclear applications.

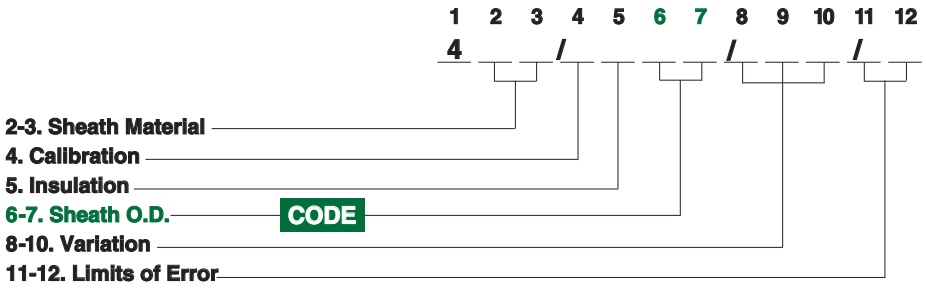
Hafnia Oxide (HfO2)

7—Hafnia is now being used as a substitute for beryllia oxide because of beryllia's toxicity problem. The temperature limit of hafnia is 2500°C (4530°F), which is higher than BeO.

Mineral Insulated Metal-Sheathed Cable

XACTPAK Cable

Sheath O.D.



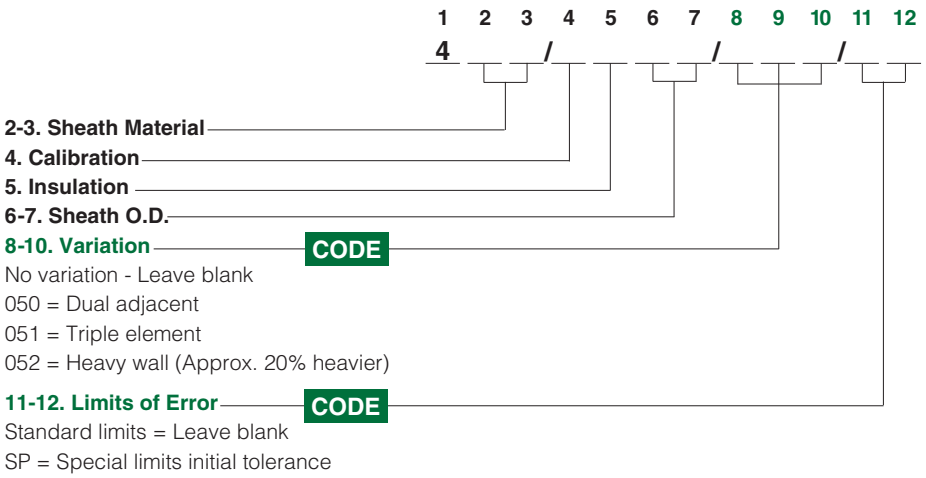
Code No.	Sheath Diameter		Approximate Standard	Coil Weight	Average Response Time* Still Water (seconds)	
	Nominal	Tolerance		lbs/100 ft.	G-JCT	U-JCT
01	0.020 inch	+0.001 –0.0005	9 inch	0.08	<0.02	0.03
02	0.032 inch	+0.001 –0.0005	9 inch	0.20	0.02	0.07
03	0.040 inch	+0.001 –0.0005	9 inch	0.32	0.04	0.13
04	0.063 inch	±0.001	24 inch	0.74	0.220	0.40
05	0.090 inch	±0.001	24 inch	1.50	0.33	0.68
06	0.114 inch	+0.002 –0.001	24 inch	2.45	0.38	0.85
07	0.125 inch	+0.002 –0.001	24 inch	3.00	0.50	1.10
08	0.188 inch	+0.002 –0.001	24 inch	6.65	1.00	2.30
11	0.250 inch	+0.003 –0.001	24 inch	11.65	2.20	4.10
12	0.313 inch	+0.003 –0.001	24 inch	19.60	5.00	7.00
13	0.375 inch	+0.003 –0.001	straight or 40 inch coils	28.10	8.00	11.00
14	0.430 inch	+0.003 –0.001	straight or 40 inch coils	35.0	11.00	15.00
15	0.500 inch	+0.003 –0.001	straight or 40 inch coils	47.0	15.00	20.00
16	0.010 inch	+0.001 –0.0005	9 inch	0.019	<0.02	<0.02
17	0.011 inch	+0.001 –0.0005	9 inch	0.022	<0.02	<0.02
18	0.0126 inch	+0.001 –0.0005	9 inch	0.029	<0.02	<0.02
19	0.025 inch	+0.001 –0.0005	9 inch	0.13	<0.02	0.05
51	0.5 mm	±0.02	23 cm	0.08	<0.02	0.03
52	1.0 mm	±0.02	23 cm	0.32	0.04	0.13
53	1.5 mm	±0.02	61 cm	0.65	<0.15	0.35
54	2.0 mm	±0.03	61 cm	1.13	0.25	0.55
55	3.0 mm	±0.03	61 cm	2.60	0.40	0.90
56	4.5 mm	±0.03	61 cm	6.00	0.95	2.00
57	6.0 mm	±0.05	61 cm	10.50	2.00	3.50
58	8.0 mm	±0.05	61 cm	19.65	5.00	7.00
59	9.0 mm	±0.05	61 cm	25.00	7.50	10.00

*Note: First order response time 63.2%.

Mineral Insulated Metal-Sheathed Cable

XACTPAK Cable

Variation/Limits of Error



Single Element

Code* No.	Sheath Diameter	Sheath Material	Calibration	Insulation	Nominal AWG Gauge	Nominal Wall Thickness in.	Maximum Stock Length ft	Maximum Recommended Operating Temperature °C	(°F)
401/2101	0.020	Alloy 600	K	99.4% MgO	38	0.003	100	871	(1600)
402/2101	0.020	304 SS	K	99.4% MgO	38	0.003	100	871	(1600)
401/2102	0.032	Alloy 600	K	99.4% MgO	34	0.004	150	871	(1600)
401/1103	0.040	Alloy 600	J	99.4% MgO	32	0.006	250	816	(1500)
401/2103	0.040	Alloy 600	K	99.4% MgO	32	0.006	250	871	(1600)
402/1103	0.040	304 SS	J	99.4% MgO	32	0.006	250	816	(1500)
404/2103	0.040	316 SS	K	99.4% MgO	32	0.006	250	871	(1600)
401/2104	0.063	Alloy 600	K	99.4% MgO	28	0.009	1000	1093	(2000)
401/2107	0.125	Alloy 600	K	99.4% MgO	22	0.017	900	1177	(2150)
401/2507	0.125	Alloy 600	K	96% MgO	22	0.017	900	1093	(2000)
401/8107	0.125	Alloy 600	N	99.4% MgO	22	0.017	900	1177	(2150)
402/1507	0.125	304 SS	J	96% MgO	22	0.017	900	816	(1500)
402/2107	0.125	304 SS	K	99.4% MgO	22	0.017	900	871	(1600)
402/2507	0.125	304 SS	K	96% MgO	22	0.017	900	871	(1600)
402/3507	0.125	304 SS	T	96% MgO	22	0.017	500	350	(662)
403/2507	0.125	310 SS	K	96% MgO	22	0.017	900	1093	(2000)
404/2507	0.125	316 SS	K	96% MgO	22	0.017	900	871	(1600)
404/3507	0.125	316 SS	T	96% MgO	22	0.017	500	350	(662)
404/4507	0.125	316 SS	E	96% MgO	22	0.017	900	871	(1600)
418/2107	0.125	Hastelloy® X	K	99.4% MgO	22	0.014	125	1204	(2200)
401/2108	0.188	Alloy 600	K	99.4% MgO	19	0.025	350	1177	(2150)
401/2508	0.188	Alloy 600	K	96% MgO	19	0.025	350	1093	(2000)
402/1508	0.188	304 SS	J	96% MgO	19	0.025	350	816	(1500)
402/2508	0.188	304 SS	K	96% MgO	19	0.025	350	871	(1600)
403/2508	0.188	310 SS	K	96% MgO	19	0.025	350	1093	(2000)
404/1508	0.188	316 SS	J	96% MgO	19	0.025	350	816	(1500)

CONTINUED

*To specify special limits add to code number: /SP

Mineral Insulated Metal-Sheathed Cable

XACTPAK Cable

Single Element
Continued

Code* No.	Sheath Diameter	Sheath Material	Calibration	Insulation	Nominal AWG Gauge	Nominal Wall Thickness in.	Maximum Stock Length ft	Maximum Recommended Operating Temperature °C	(°F)
404/2508	0.188	316 SS	K	96% MgO	19	0.025	350	871	(1600)
401/1511	0.250	Alloy 600	J	96% MgO	16	0.033	220	816	(1500)
401/2111	0.250	Alloy 600	K	99.4% MgO	16	0.033	220	1177	(2150)
401/2511	0.250	Alloy 600	K	96% MgO	16	0.033	220	1093	(2000)
402/1511	0.250	304 SS	J	96% MgO	16	0.033	220	816	(1500)
402/2511	0.250	304 SS	K	96% MgO	16	0.033	220	871	(1600)
403/2511	0.250	310 SS	K	96% MgO	16	0.033	220	1093	(2000)
404/1511	0.250	316 SS	J	96% MgO	16	0.033	220	816	(1500)
404/2511	0.250	316 SS	K	96% MgO	16	0.033	220	871	(1600)
401/2512	0.313	Alloy 600	K	96% MgO	14	0.041	150	1093	(2000)
401/2513	0.375	Alloy 600	K	96% MgO	13	0.052	100	1093	(2000)

*To specify special limits add to code number: /SP

Double Element—Adjacent Conductors

Code* No.	Sheath Diameter	Sheath Material	Calibration	Insulation	Nominal AWG Gauge	Nominal Wall Thickness in.	Maximum Stock Length ft	Maximum Recommended Operating Temperature °C	(°F)
401/2507/050	0.125	Alloy 600	K	96% MgO	24	0.017	900	1093	(2000)
404/1507/050	0.125	316SS	J	96% MgO	24	0.017	900	816	(1500)
402/1508/050	0.188	304 SS	J	96% MgO	21	0.025	350	816	(1500)
401/2511/050	0.188	Alloy 600	K	96% MgO	18	0.033	220	1093	(2000)
401/4511/050	0.250	Alloy 600	E	96% MgO	18	0.033	220	871	(1600)
404/1511/050	0.250	316 SS	J	96% MgO	18	0.033	220	816	(1500)

*To specify special limits add to code number: /SP

XACTSEAL

Watlow developed a premium sealant for sealing the exposed ends of XACTPAK sheathed type material against moisture penetration. At room temperature, thin layers of the sealant air-dry in approximately one hour. It may be baked at up to 120°C (250°F) to accelerate drying. The sealant comes ready to use from its own container; use G.E. #1500 or equivalent should a thinner be needed. XACTSEAL is a temporary sealant. For long term storage we recommend that the ends of the cable be seal welded.

Code No.	Description
8010	4 oz dispenser can

Mineral Insulated Metal-Sheathed Cable

XACTPAK Cable

Mineral Insulated Metal-Sheathed RTD Cable

This cable is used for making rugged RTD probes. Special spacing allows room for elements to be placed between conductors. Dimensions are shown below.

1	2	3	4	5	6	7	8	9	10
4			/	9			/		

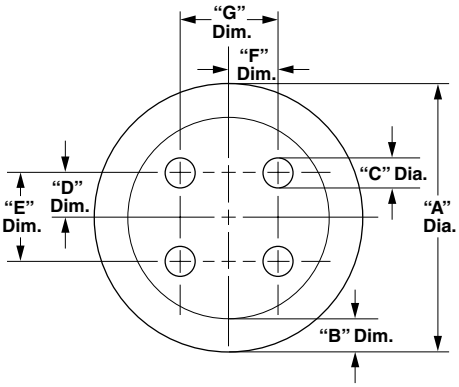
2-3. Sheath Material
01 = Alloy 600
04 = 316 SS

4. Wire
9 = Nickel 201

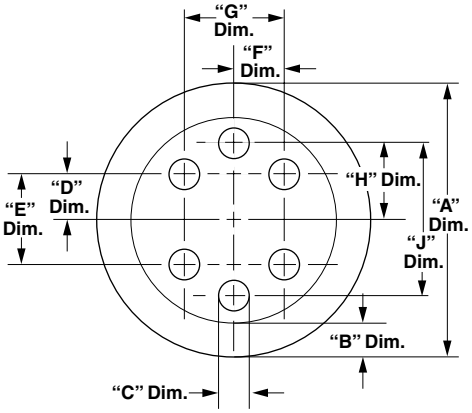
5. Wire Insulation
1 = 99.4% MgO
5 = 96% MgO

6-7. Sheath O.D.
07 = 0.125 inch diameter
08 = 0.188 inch diameter
11 = 0.250 inch diameter
12 = 0.313 inch diameter

8-10. Variation
001 = 6-Wire
003 = 4-Wire



4 Conductor RTD MIMS Cable



6 Conductor RTD MIMS Cable

A Diameter	B Wall Thickness	C Diameter	Spacing Nominal			
			D Dim.	E Dim.	F Dim.	G Dim.
0.125 +0.002 -0.001	0.015 ± 0.002	0.014 ± 0.002	0.022	0.045	0.025	0.050
0.188 +0.002 -0.001	0.023 ± 0.002	0.020 ± 0.002	0.034	0.068	0.037	0.074
0.250 +0.003 -0.001	0.030 ± 0.005	0.027 ± 0.003	0.045	0.090	0.050	0.100
0.313 +0.003 -0.001	0.038 ± 0.005	0.032 ± 0.003	0.056	0.112	0.062	0.124

A Dim.	B Dim.	C Dim.	D Dim.	E Dim.	F Dim.	G Dim.	H Dim.	J Dim.
0.125 +0.002 -0.001	0.015 ± 0.002	0.014 ± 0.002	0.022	0.045	0.025	0.050	0.034	0.068
0.188 +0.002 -0.001	0.023 ± 0.002	0.020 ± 0.002	0.034	0.068	0.037	0.074	0.052	0.104
0.250 +0.003 -0.001	0.030 ± 0.005	0.027 ± 0.003	0.045	0.090	0.050	0.100	0.068	0.137
0.313 +0.003 -0.001	0.038 ± 0.005	0.032 ± 0.003	0.056	0.112	0.062	0.124	0.085	0.170

Mineral Insulated, Metal-Sheathed Cable

XACTPAK Cable

Made-to-order Mineral Insulated (MI) Cable

In addition to our full line of metal-sheathed, mineral-insulated thermocouple cable, we will also manufacture metal-sheathed, mineral-insulated signal cable with copper, stainless steel or other conductor materials to meet many specialized requirements. (MI) cable incorporating one or more conductors can be made from a large variety of sheath and insulation materials. Properly selected combinations of materials provide (MI) cable with these outstanding performance features:

- It is totally impervious to moisture.
- It can withstand extremes of temperature and pressure.
- It can endure highly oxidizing or corrosive conditions.
- It adapts well to nuclear applications because of its low neutron capture cross section which is unaffected by radiation heating. (Selected sheaths and calibrations.)
- It can be easily formed to a radius equal to approximately twice its diameter without insulation breakdown. It maintains its shape after forming.

1	2	3	4	5	6	7	8	9	10	11	12
4			/				/			/	

2-3. Sheath Material

01 = Alloy 600	18 = Hastelloy® X
02 = 304 SS	19 = Inconel® 601
03 = 310 SS	25 = Inconel® 625
04 = 316 SS	32 = Haynes® Alloy 230
05 = 347 SS	38 = Alloy HR-160
13 = 446 SS	42 = Alloy 718
16 = 321 SS	99 = Miscellaneous

4. Calibration

1 = J	4 = E
2 = K	8 = N
3 = T	9 = Misc.

5. Insulation

0 = Unused	7 = Hafnia oxide
1 = Magnesium oxide 99.4%	8 = Unassigned
2 = Alumina oxide 99.6%	9 = Miscellaneous
5 = Magnesium oxide 96%	

6-7. Sheath O.D. [inch (mm)]

01 = 0.020	11 = 0.250	19 = 0.025	58 = (8.0 ± 0.05)
02 = 0.032	12 = 0.313	51 = (0.5 ± 0.02)	59 = (9.0 ± 0.05)
03 = 0.040	13 = 0.375	52 = (1.0 ± 0.02)	99 = Miscellaneous
04 = 0.063	14 = 0.430	53 = (1.5 ± 0.02)	
05 = 0.090	15 = 0.500	54 = (2.0 ± 0.03)	
06 = 0.114	16 = 0.010	55 = (3.0 ± 0.03)	
07 = 0.125	17 = 0.011	56 = (4.5 ± 0.03)	
08 = 0.188	18 = 0.0126	57 = (6.0 ± 0.05)	

8-10. Variation

Leave blank = No variation
001 = Dual diagonal
050 = Dual adjacent
051 = Triple element

Examples
401/2107
401/2107/SP
402/1511/050/SP

11-12. Limits of Error

Standard = Leave blank
Special limits = SP