

LABFACILITY THERMOCOUPLE INFORMATION - AT A GLANCE

SELECTING SENSOR CABLES: GUIDE TO INSULATION & COVERING

Which insulation Material?	usable temperature range	Application Notes
PVC	-10°C to 105°C	Good general purpose insulation for 'light' environments. Waterproof and very flexible.
PFA (extruded)	-75°C to 250°C	Resistant to oils, acids other adverse agents and fluids. Good mechanical strength and flexibility. PTFE better for steam/elevated pressure environments
PTFE (taped & wrapped)	-75°C to 250/300°C	Resistant to oils, acids other adverse agents and fluids. Good mechanical strength and flexibility.
Glassfibre (varnished)	-60°C to 350/400°C	Good temperature range but will not prevent ingress of fluids. Fairly flexible but does not provide good mechanical protection.
High temperature glassfibre	-60°C to 700°C	Will withstand temperature up to 700°C but will not prevent ingress of fluids. Fairly flexible, not good protection against physical disturbance.
Ceramic Fibre	0 to 1000°C	Will withstand high temperature, up to 1000°C. Will not protect against fluids or physical disturbance.
Glassfibre (varnished) stainless steel overbraid	-60°C to 350/400°C	Good resistance to physical disturbance and high temperature (up to 400°C). Will not prevent ingress of fluids.

Screened or unscreened? With long cable runs, the cable may need to be screened and earthed at one end (at the instrument) to minimise noise pick-up (interference) on the measuring circuit. Alternative types of screened cable construction are available and these include the use of copper or mylar screening. Twisted pair configurations are offered and these can incorporate screening as required.

THERMOCOUPLE ACCURACIES

Tolerance classes for thermocouples to IEC 60584-2(1982) (Amend 1-1989) BS EN60584-2(1993)

Fe-Con (J)	Class	Temperature Range	Accuracy	Notes	Alternative
Fe-Con (J)	Class 1	- 40 +750°C:	±0.004	. t	or ±1.5°C
	Class 2	- 40 +750°C:	±0.0075	. t	or ±2.5°C
	Class 3	- -	-	-	-
Cu-Con (T)	Class 1	- 40 +350°C:	±0.004	. t	or ±0.5°C
	Class 2	- 40 +350°C:	±0.0075	. t	or ±1.0°C
	Class 3	-200 + 40°C:	±0.015	. t	or ±1.0°C
NiCr -Ni (K) and NiCrSi-NiSi (N)	Class 1	- 40 +1000°C:	±0.004	. t	or ±1.5°C
	Class 2	- 40 +1200°C:	±0.0075	. t	or ±2.5°C
	Class 3	-200 + 40°C:	±0.015	. t	or ±2.5°C
NiCr-Con (E)	Class 1	- 40 +800°C:	±0.004	. t	or ±1.5°C
	Class 2	- 40 +900°C:	±0.0075	. t	or ±2.5°C
	Class 3	-200 + 40°C:	±0.015	. t	or ±2.5°C
Pt10Rh-Pt (S) and Pt13Rh-Pt (R)	Class 1	0 +1600°C:	±[1+(t-1000).0.003]		or ±1.0°C
	Class 2	- 40 +1600°C:	±0.0025	. t	or ±1.5°C
	Class 3	- -	-	-	-
Pt30Rh-Pt6Rh (B)	Class 1	- -	-	-	-
	Class 2	+600 +1700°C:	±0.0025	. t	or ±1.5°C
	Class 3	+600 +1700°C:	±0.005	. t	or ±4.0°C

Note: t = actual temperature Use the larger of the two deviation values

COLOUR CODES: THERMOCOUPLE CONNECTORS, EXTENSION AND COMPENSATING WIRES AND CABLES

TYPE	CONDUCTORS +/-	INSULATION COLOUR CODES Extension & Compensating Leads			CABLE CODE
		BRITISH BS1843: 1952	FORMER STANDARD AMERICAN ANSI/MC 96.1	GERMAN DIN 43713 / 43714	
EX	NICKEL CHROMIUM/CONSTANTAN (Nickel Chromium/Copper Nickel, Chromel/Constantan, T1/Advance, NiCr/Constantan)				EX
J	IRON*/CONSTANTAN (Iron/Copper Nickel, Fe/Konst Iron/Advance, Fe/Constantan I/C)				JX
K	NICKEL CHROMIUM/NICKEL ALUMINIUM* (NC/NA, Chromel/ Alumel, C/A, T1/T2, NiCr/Ni, NiCr/ NiAl)				KX
N	NICROSIL/NISIL				NX NC
T	COPPER/CONSTANTAN (Copper/Copper Nickel, Cu/Con, Copper/Advance)				TX
Vx	COPPER/CONSTANTAN (LOW NICKEL) (Cu/Constantan) Compensating for K (Cu/Constantan)				KCB
U	COPPER/COPPER NICKEL Compensating for Platinum 10% or 13% Rhodium/Platinum (Codes S & R respectively) (Copper/Cupronic Cu/CuNi, Copper/No. 11 Alloy)				RCA SCA
* Magnetic, () Alternative & Trade Name		FOR THERMOCOUPLE CONNECTORS body colours are similar to outer sheath colours		FOR THERMOCOUPLE CONNECTORS body colours are similar to outer sheath colours	

CALIBRATION GUIDE

Thermocouple Type	emf in absolute millivolts (IEC 584)					
	100°C	400°C	800°C	1000°C	1200°C	1500°C
T	4.279	20.872	-	-	-	-
E	6.319	28.946	61.017	76.373	-	-
J	5.269	21.848	45.494	57.953	69.553	-
K	4.096	16.397	33.275	41.276	48.838	-
N	2.774	12.974	28.455	36.256	43.846	-
R	0.647	3.408	7.950	10.506	13.228	17.451
S	0.646	3.259	7.345	9.587	11.951	15.582
B	0.033	0.787	3.154	4.834	6.786	10.099