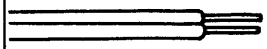
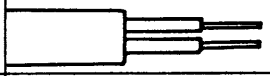
BASE METAL THERMO

335 8161

INSULATION	CONSTRUCTION	TYPE (Calibration)	CONDUCTORS Strands	∅ mm	mm²	CLASS: BS4937 : 1983 Part 20	USEABLE TEMPERATURE RANGE °C
NONE (BARE WIRE)	BARE WIRE	J, K, T	1	0.2	0.032	2	As for thermocouple
NONE (BARE WIRE)	BARE WIRE	J, K, T	1	0.315	0.078	2	"
NONE (BARE WIRE)	BARE WIRE	J, K, T	1	0.508	0.210	2	"
PVC	**Fig. 8** One pair of conductors PVC insulated and welded together in fig. 8 section 	J, K, T & VX	1	0.508	0.210	2	−10 +105
PVC	"	K, T, & VX	7	0.2	0.219	2	"
PVC	"	T	13	0.2	0.410	2	"
PVC	**Flat Pair** One pair of conductors, PVC insulated, laid flat and PVC sheathed 	J, K, T, E, U and VX	7	0.2	0.219	2	−10 +105
PVC	"	J, K, T, E, U and VX	13	0.2	0.410	2	"
PVC	"	K	1	0.508	0.210	2	"
PVC	"	J, K, T and VX	23	0.2	0.671	2	"
PVC	" with tinned copper screen	K	7	0.2	0.219	2	"
PVC	**Coiled** One pair of conductors, PVC insulated, PVC sheathed  Only in lengths of 1.5 metre, extended.	J, K, T & VX	10	0.12	0.113	2	− 10 + 105
PVC	**Twisted pair with screen** One pair of conductors, PVC insulated. Pair twisted together. Screened with mylar aluminium tape and copper drain wire. PVC sheathed 	J, K, T & VX	7	0.2	0.219	2	− 10 + 105

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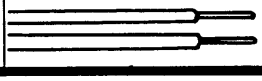
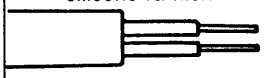
:OUPLE, EXTENSION AND COMPENSATIN

INSULATION	CONSTRUCTION	TYPE (Calibration)	CONDUCTORS Strands	∅ mm	mm²	CLASS: BS4937 : 1983 Part 20	USEABLE TEMPERATURE RANGE °C
PTFE	**Twin Twist** One pair of conductors, PTFE insulated. Pair twisted together 	J, K, T, E, U	1	0.2	0.032	1	−75 +250/300
PTFE	〃	J, K, T, E	1	0.315	0.078	1	〃
PTFE	〃	K, T	7	0.2	0.219	1	〃
PTFE	〃	K, T	1	0.508	0.210	1	〃
PTFE	**Flat Pair** One pair of conductors, PTFE insulated. Pair laid flat and PTFE sheathed 	K, T	1	0.315	0.078	1	−75 +250/300
PTFE	〃	J, K, T	7	0.2	0.219	1	〃
PTFE	〃	T	1	0.508	0.210	1	〃
PTFE	Thin wall PTFE insulated fine gauge wire (0.003″ PTFE wall) Single wires 	Iron, Constantan, Copper, Nickel Chromium, Nickel Aluminium	1	0.003″		2	〃
Glassfibre	**Flat Pair** One pair of conductors, glassfibre insulated. Pair laid flat and glassfibre braided overall. Impregnated with silicone varnish 	J, K, T	1	0.2	0.032	2	−60 +350/400
Glassfibre	〃	J, K, T, E	1	0.315	0.078	2	〃
Glassfibre	〃	J, K, T	1	0.508	0.210	2	〃
Glassfibre	〃	J, K, T, E	7	0.2	0.219	2	〃
Glassfibre	〃	K	1	0.711	0.397	2	〃
Glassfibre	〃	J, K, T	1	0.2	0.032	2	〃
Glassfibre	〃	J, K, T, E	13	0.2	0.410	2	〃

All information in the brochure is for general guidance and not necessarily definitive. For more information reference should be made to the appropriate 'standards' publications.

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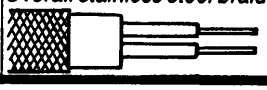
WIRES AND CABLES

INSULATION	CONSTRUCTION	TYPE (Calibration)	CONDUCTORS Strands	∅ mm	mm²	CLASS: BS4937 : 1983 Part 20	USEABLE TEMPERATURE RANGE °C
Glassfibre	**Flat Pair, Heavy Duty** One pair of conductors, glassfibre insulated. Pair laid flat and **Heavy Duty** double glassfibre braided overall. Unvarnished for 500°C	K	14	0.2	0.442	2	−60 +500
Glassfibre	**Flat Pair High Temperature** One pair of conductors, special glassfibre insulated. Pair laid flat and *special glass fibre* braided overall. *High temperature 700°C* 	K	1	0.508	0.210	1	−60 +700
Glassfibre	"	K	7	0.2	0.219	1	−60 +700
Ceramic Fibre	**Flat Pair High Temperature** One pair of conductors, ceramic fibre insulated. Pair laid flat and ceramic fibre insulated overall. *High temperature 1000°C*	K	1	0.315	0.078	2	−60 +1000
Glassfibre with stainless steel overbraid	**Flat Pair with stainless steel overbraid** One pair of conductors, glassfibre insulated. Pair laid flat and glassfibre braided overall. Impregnated with *silicone varnish.* *Overall stainless steel braid* 	J, K, T	7	0.2	0.219	2	−60 +350/400

Thermocouple Wire Solder

Application	For soldering of all thermocouple wires (to P.C.B.s etc) particularly nickel chromium/ nickel aluminium. Will solder virtually all metals, including stainless steel, and is especially suited to aluminium and aluminium alloys, giving good flow and penetration.
Specification	Type 45D ALU-SOL tin-lead-silver solder, containing 4 cores of flux. No separate flux is needed or recommended. Diameter of solder is 20 swg, giving 90 metres per 0.5 kg reel.
Notes	Do not inhale whilst soldering, as fumes from fluxes are dangerous. A higher than normal temperature is required for this type of solder, which has a melting range of 178-270°C.
To order	Available in 0.5 kg reels (90 metres of 20 swg).

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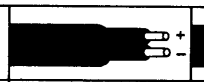
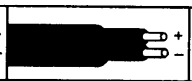
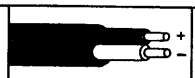
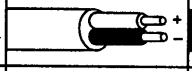
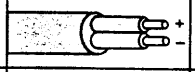
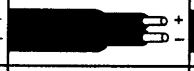
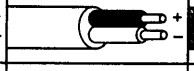
Base Metal Thermocouple Extension and Compensating Wires and Cables

CODE	CONDUCTORS +/-	INSULATION COLOUR CODES Extension & Compensating Leads				
		BRITISH BS 1843:1952	EXISTING STANDARD AMERICAN ANSI/MC 96.1	GERMAN DIN	IEC584-3: 1989, mod. BS4937. Part 30. 1993	
E	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 and R respectively) Copper/ Cupronic, Cu/CuNi, Copper/No. 11 Alloy)					RCA SCA
*MAGNETIC ( ) ALTERNATIVE & TRADE NAMES			FOR THERMOCOUPLE CONNECTORS, body colours are as outer sheath colours above		FOR THERMOCOUPLE CONNECTORS, body colours are as outer sheath colours above	

The British Standard Colour Code for Thermocouple Cables, BS1843: 1952 will be superseded by BS4937 PART 30 1993 (=IEC 584-3 1989 modified). BS1843 can be used under certain circumstances until 1/12/98.

Additional identification as to whether a thermocouple cable type is extension or compensating is indicated in the example which follows; however, please note that a letter A or B after the C for Compensating refers to the Cable Temperature Range in accordance with the Table of Tolerance Values set out in this standard.

K X 1 = K EXTENSION CLASS 1
K CA 2 = K COMPENSATING CLASS 2 0 to 150°C

For further information please refer to the publication BS4937 Part 30.

We can now supply cables and connectors coloured to IEC 584-3 1989 (modified) although all colours will not be available from stock for some time. To minimise confusion, the "new" connectors will be marked IEC and, with the exception of fascia (panel) versions will have a charcoal grey body with an area coloured accordingly. They will be clearly different in appearance.

THERMOCOUPLE WIRE

Twin, single conductor, having a temperature/e.m.f. relationship to the appropriate standard over the complete temperature range.

EXTENSION CABLE

Twin, stranded conductors for connection between measuring thermocouple and instrument (or external reference junction), of the same materials as the thermocouple, and having the same e.m.f./ temperature characteristics over a temperature range limited by the insulation material.

COMPENSATING WIRE OR CABLE

Twin, single or stranded conductors for connection between measuring thermocouple and instrument (or external reference junction), of different composition from the thermocouple material, but having similar e.m.f./temperature characteristics over a limited temperature range. Types U and Vx in Conductors-Table.

Table of Cable Tolerances

The figures shown in the tables are those appropriate to the measuring junction temperatures in the final column. In most cases the error expressed in degrees Celcius will be larger at lower thermocouple junction temperatures.

JX	±85 µV (±1,5°C)	±140 µV (±2,5°C)	-25°C to +200°C	500°C
TX	±30 µV (±0,5°C)	±60 µV (±1,0°C)	-25°C to +100°C	300°C
EX	±120 µV (±1,5°C)	±200 µV (±2,5°C)	-25°C to +200°C	500°C
KX	±60 µV (±1,5°C)	±100 µV (±2,5°C)	-25°C to +200°C	900°C
NX	±60 µV (±1,5°C)	±100 µV (±2,5°C)	-25°C to +200°C	900°C
KCA	–	±100 µV (±2,5°C)	0°C to +150°C	900°C
KCB	–	±100 µV (±2,5°C)	0°C to +100°C	900°C
NC	–	±100 µV (±2,5°C)	0°C to +150°C	900°C
RCA	–	±30 µV (±2,5°C)	0°C to +100°C	1000°C
RCB	–	±60 µV (±5,0°C)	0°C to +200°C	1000°C
SCA	–	±30 µV (±2,5°C)	0°C to +100°C	1000°C
SCB	–	±60 µV (±5,0°C)	0°C to +200°C	1000°C

Notes:
1. Cable temperature range may be restricted to figures lower than those shown in the table because of temperature limitations imposed by the insulant.
2. A Cable comprising two copper conductors may be used with Type B thermocouples. The expected maximum additional deviation within the cable temperature range 0°C to +100°C is 40µV. The equivalent in temperature is 3,5°C when the measuring junction of the thermocouple is at 1 400°C.

Connection of Thermocouples to Measuring Instruments

Ordinary copper wires should never be used, as the error will be equal to the difference in temperature between the connecting point of the thermocouple and the instrument (or external reference junction).

Extension or compensating wire or cable must be employed, and it is essential that the same polarity is maintained. If the polarity is reversed, the error is equal to twice the temperature difference between the connecting point of the thermocouple and the instrument (or external reference junction).

For maximum accuracy extension cables should be used, and the terminals and connectors should be of thermocouple materials to maintain continuity.

A practical guide to the selection of thermocouple wire and cable

Which Type?

When specifying the type of wire or cable, ensure that it is compatible with the associated instrument calibration and thermocouple type.

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.
PTFE	-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 glass fibre	-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.

Single or Multi-strand?

The choice is mainly determined by the application (e.g. termination considerations and internal diameter of associated sheath). Generally, single strand wires are used for hot junctions, and multistrand for extensions of the thermocouple as being more flexible. The greater the effective conductor diameter, the lower the value of thermocouple loop resistance; an important consideration with long cable runs.

CONDUCTOR SIZE EQUIVALENTS

No.	SWG		B & S (AWG)		No.	SWG		B & S (AWG)	
	inches	mm	inches	mm		inches	mm	inches	mm
0	0.324	8.23	0.3249	8.25	26	0.018	0.457	0.0159	0.404
1	0.300	7.62	0.2893	7.35	27	0.0164	0.417	0.0142	0.361
2	0.276	7.01	0.2576	6.54	28	0.0148	0.376	0.0126	0.320
3	0.252	6.40	0.2294	5.83	29	0.0136	0.345	0.0113	0.287
4	0.232	5.89	0.2043	5.19	30	0.0124	0.315	0.0100	0.254
5	0.212	5.38	0.1819	4.62	31	0.0116	0.295	0.0089	0.226
6	0.192	4.88	0.1620	4.11	32	0.0108	0.274	0.0080	0.203
7	0.176	4.47	0.1443	3.67	33	0.0100	0.254	0.0071	0.180
8	0.160	4.06	0.1285	3.26	34	0.0092	0.234	0.0063	0.160
9	0.144	3.66	0.1144	2.91	35	0.0084	0.213	0.0056	0142
10	0.128	3.25	0.1019	2.59	36	0.0076	0.193	0.0050	0.127
11	0.116	2.95	0.0907	2.30	37	0.0068	0.173	0.0045	0.114
12	0.104	2.64	0.0808	2.05	38	0.0060	0.152	0.0040	0.102
13	0.092	2.34	0.0720	1.83	39	0.0052	0.132	0.0035	0.089
14	0.080	2.03	0.0641	1.63	40	0.0048	0.122	0.0031	0.079
15	0.072	1.83	0.0571	1.45	41	0.0044	0.112	0.0028	0.071
16	0.064	1.63	0.0508	1.29	42	0.0040	0.102	0.0025	0.064
17	0.056	1.42	0.0453	1.15	43	0.0036	0.091	0.0022	0.056
18	0.048	1.22	0.0403	1.02	44	0.0032	0.081	0.0020	0.051
19	0.040	1.02	0.0359	0.912	45	0.0028	0.071	0.0018	0.046
20	0.036	0.914	0.0320	0.813	46	0.0024	0.061	-	-
21	0.032	0.813	0.0285	0.724	47	0.0020	0.051	-	-
22	0.028	0.711	0.0253	0.643	48	0.0016	0.041	-	-
23	0.024	0.610	0.0226	0.574	49	0.0012	0.030	-	-
24	0.022	0.559	0.0201	0.511	50	0.0010	0.025	-	-
25	0.020	0.508	0.0179	0.455					

SWG = (BRITISH) STANDARD WIRE GAUGE
B & S = BROWN AND SHARPE
AWG = AMERICAN WIRE GAUGE

STOCK SIZES

Insulated Wire Sizes (Subject to variation)

Sizes in mm

Insulation	Wire Size	Each Insulated Conductor	Overall Sheath
PVC			
Figure of 8	1/0.508	-	1.4 x 2.7
Flat Pair	7/0.2	1.7	3.4 x 4.8
"	13/0.2	1.9	3.4 x 5.1
"	23/0.2	2.0	3.5 x 5.5
PTFE			
Twisted Pair	1/0.2	0.6	
"	1/0.315	0.7	
"	1/0.508	0.8	
Flat Pair	1/0.315	0.6	1.3 x 1.9
"	7/0.2	0.9	5.5 x 2.4
GLASSFIBRE			
Flat Pair	1/0.2	0.5	1.0 x 1.4
"	1/0.315	0.7	1.1 x 1.7
"	1/0.508	0.8	1.3 x 2.0
"	7/0.2	0.8	1.1 x 1.9
"	14/0.2	1.0	1.3 x 2.2
GLASSFIBRE & S.S. OVERBRAID	7/0.2	0.9	1.6 x 2.4

LOOP RESISTANCE, OHMS PER COMBINED METRE APPROXIMATE (Sizes in mm)

Code	1/0.2	1/0.315	1/0.508	7/0.2	13/0.2	14/0.2	23/0.2
E	38.1	15.4	5.9	5.3	2.9	2.7	1.6
J	19.3	7.8	3.0	2.7	1.5	1.4	0.8
K	31.8	12.8	4.9	4.5	2.4	2.2	1.4
N	44.2	17.7	6.8	6.2	3.4	3.2	1.9
T	16.2	6.5	2.5	2.3	1.2	1.1	0.7
U	1.4	0.6	0.2	0.2	0.1	0.1	0.1
VX	16.2	6.5	2.5	2.3	1.2	1.1	0.7

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