

APPENDIX 1.

1.1 Thermoelectromotive Force Tables

► Standard thermoelectromotive force tables for type K thermocouples Unit : μV

-200	-100	-0	Temp ($^{\circ}\text{C}$)	Temp ($^{\circ}\text{C}$)	0	100	200	300	400	500	600	700	800	900	1000	1100	1200
-5891	-3553	-0	-0	0	0	4095	8137	12207	16395	20640	24902	29128	33277	37325	41269	45108	48828
	-3852	-392	-10	10	397	4508	8537	12623	16818	21066	25327	29547	33686	37724	41657	45486	
	-4138	-777	-20	20	798	4919	8938	13039	17241	21493	25751	29965	34095	38122	42045	45863	
	-4410	-1156	-30	30	1203	5327	9341	13456	17664	21919	26176	30383	34502	38519	42432	46238	
	-4669	-1527	-40	40	1611	5733	9745	13874	18088	22346	26599	30799	34909	38915	42817	46612	
	-4912	-1889	-50	50	2022	6137	10151	14292	18513	22772	27022	31214	35314	39310	43202	46985	
	-5141	-2243	-60	60	2436	6539	10560	14712	18938	23198	27445	31629	35718	39703	43585	47356	
	-5354	-2586	-70	70	2850	6939	10969	15132	19363	23624	27867	32042	36121	40096	43968	47726	
	-5550	-2920	-80	80	3266	7338	11381	15552	19788	24050	28288	32455	36524	40488	44349	48095	
	-5730	-3242	-90	90	3681	7737	11793	15974	20214	24476	28709	32866	36925	40879	44729	48462	

► Standard thermoelectromotive force tables for type J thermocouples

-200	-100	-0	Temp.($^{\circ}\text{C}$)	Temp.($^{\circ}\text{C}$)	0	100	200	300	400	500	600	700	800
-7890	-4632	0	-0	0	0	5268	10777	16325	21846	27388	33096	39130	45498
	-5036	-501	-10	10	507	5812	11332	16879	22397	27949	33683	39754	
	-5426	-995	-20	20	1019	6359	11887	17432	22949	28511	34273	40382	
	-5801	-1481	-30	30	1536	6907	12442	17984	23501	29075	34867	41013	
	-6159	-1960	-40	40	2058	7457	12998	18537	24054	29642	35464	41647	
	-6499	-2431	-50	50	2585	8008	13553	19089	24607	30210	36066	42283	
	-6821	-2892	-60	60	3115	8560	14108	19640	25161	30782	36671	42922	
	-7122	-3344	-70	70	3649	9113	14663	20192	25716	31356	37280	43563	
	-7402	-3785	-80	80	4186	9667	15217	20743	26272	31933	37893	44207	
	-7659	-4215	-90	90	4725	10222	15771	21295	26829	32513	38510	44852	

APPENDIX 1.

► Standard thermoelectromotive force tables for type E thermocouples

Unit : μV

-200	-100	-0	Temp.(°C)	Temp.(°C)	0	100	200	300	400	500	600
-8824	-5237	0	-0	0	0	6317	13419	21033	28943	36999	45085
	-5680	-581	-10	10	591	6996	14161	21814	29744	37808	
	-6107	-1151	-20	20	1192	7683	14909	22597	30546	38617	
	-6516	-1709	-30	30	1801	8377	15661	23383	31350	39426	
	-6907	-2254	-40	40	2419	9078	16417	24171	32155	40236	
	-7279	-2787	-50	50	3047	9787	17178	24961	32960	41045	
	-7631	-3306	-60	60	3683	10501	17942	25754	33767	41853	
	-7963	-3811	-70	70	4329	11222	18710	26549	34574	42662	
	-8273	-4301	-80	80	4983	11949	19481	27345	35382	43470	
	-8561	-4777	-90	90	5646	12681	20256	28143	36190	44278	

► Standard thermoelectromotive force tables for type T thermocouples

-200	-100	-0	Temp.(°C)	Temp.(°C)	0	100	200	300	400
-5603	-3378	0	-0	0	0	4277	9286	14860	20869
	-3656	-383	-10	10	391	4749	9820	15443	
	-3923	-757	-20	20	789	5227	10360	16030	
	-4177	-1121	-30	30	1196	5712	10905	16621	
	-4419	-1475	-40	40	1611	6204	11456	17217	
	-4648	-1819	-50	50	2035	6702	12011	17816	
	-4865	-2152	-60	60	2467	7207	12572	18420	
	-5069	-2475	-70	70	2908	7718	13137	19027	
	-5261	-2788	-80	80	3357	8235	13707	19638	
	-5439	-3089	-90	90	3813	8757	14281	20252	

APPENDIX 1.

► Standard thermoelectromotive force tables for type B thermocouples

Unit : μV

Temp. (°C)	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500	1600	1700	1800
0	786	1241	1791	2430	3154	3957	4833	5777	6783	7845	8952	10094	11257	12426	13585
10	827	1292	1851	2499	3231	4041	4924	5875	6887	7953	9065	10210	11374	12543	
20	870	1344	1912	2569	3308	4126	5016	5973	6991	8063	9178	10325	11491	12659	
30	913	1397	1974	2639	3387	4212	5109	6073	7096	8172	9291	10441	11608	12776	
40	957	1450	2036	2710	3466	4298	5202	6172	7202	8283	9405	10558	11725	12892	
50	1002	1505	2100	2782	3546	4386	5297	6273	7308	8393	9519	10674	11842	13008	
60	1048	1560	2164	2855	3626	4474	5391	6374	7414	8504	9634	10790	11959	13124	
70	1095	1617	2230	2928	3708	4562	5487	6475	7521	8616	9748	10907	12076	13239	
80	1143	1674	2296	3003	3790	4652	5583	6577	7628	8727	9863	11024	12193	13354	
90	1192	1732	2363	3078	3873	4742	5680	6680	7736	8839	9979	11141	12310	13470	

► Standard thermoelectromotive force tables for type R thermocouples

Temp. (°C)	0	100	200	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500	1600	1700
0	0	647	1468	2400	3407	4471	5582	6741	7949	9203	10503	11846	13224	14624	16035	17445	18842	20215
10	54	723	1557	2498	3511	4580	5696	6860	8072	9331	10636	11983	13363	14765	16176	17585	18981	20350
20	111	800	1647	2596	3616	4689	5810	6979	8196	9460	10768	12119	13502	14906	16317	17726	19119	20483
30	171	879	1738	2695	3721	4799	5925	7098	8320	9589	10902	12257	13642	15047	16458	17866	19257	20616
40	232	959	1830	2795	3826	4910	6040	7218	8445	9718	11035	12394	13782	15188	16599	18006	19395	20748
50	296	1041	1923	2896	3933	5021	6155	7339	8570	9848	11170	12532	13922	15329	16741	18146	19533	20878
60	363	1124	2017	2997	4039	5132	6272	7460	8696	9978	11304	12669	14062	15470	16882	18286	19670	21006
70	431	1208	2111	3099	4146	5244	6388	7582	8822	10109	11439	12808	14202	15611	17022	18425	19807	
80	501	1294	2207	3201	4254	5356	6505	7704	8949	10240	11574	12946	14343	15752	17163	18564	19944	
90	573	1380	2303	3304	4362	5469	6623	7826	9076	10371	11710	13085	14483	15893	17304	18703	20080	

APPENDIX 1.

► Standard thermoelectromotive force tables for type S thermocouples

Unit : μV

Temp. (°C)	0	100	200	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500	1600	1700
0	0	645	1440	2323	3260	4234	5237	6274	7345	8448	9598	10754	11947	13155	14368	15576	16771	17942
10	55	719	1525	2414	3356	4333	5339	6380	7454	8560	9700	10872	12067	13276	14489	15697	16890	18056
20	113	795	1611	2506	3452	4432	5442	6486	7563	8673	9816	10991	12188	13397	14610	15817	17008	18170
30	173	872	1698	2599	3549	4532	5544	6592	7672	8786	9932	11110	12308	13519	14731	15937	17125	18282
40	235	950	1785	2692	3645	4632	5648	6699	7782	8899	10048	11229	12429	13640	14852	16057	17243	18394
50	299	1029	1873	2786	3743	4732	5751	6805	7892	9012	10165	11348	12550	13761	14973	16176	17360	18504
60	365	1109	1962	2880	3840	4832	5855	6913	8003	9126	10282	11467	12671	13883	15094	16296	17477	18612
70	432	1190	2051	2974	3938	4933	5960	7020	8114	9240	10400	11587	12792	14004	15215	16415	17594	
80	502	1273	2141	3069	4036	5034	6064	7128	8225	9355	10517	11707	12913	14215	15536	16834	18011	
90	573	1356	2232	3164	4135	5136	6169	7236	8336	9470	10635	11827	13034	14247	15456	16653	17826	

1.2 Thermocouple

1.2.1 Normal and Overheat Temperature Limits

Material Code	Previous Code (reference)	Wire Diameter (mm)	Normal Temperature Limit (1) °C	Overheat Temperature Limit (2) °C
B	—	0.50	1500	1700
R	—	0.50	1400	1600
S				
K	CA	0.65	650	850
		1.00	750	950
		1.60	850	1050
		2.30	900	1100
		3.20	1000	1200
E	CRC	0.65	450	500
		1.00	500	550
		1.60	550	650
		2.30	600	750
		3.20	700	800
J	IC	0.65	400	500
		1.00	450	550
		1.60	500	650
		2.30	550	750
		3.20	600	750
T	CC	0.32	200	250
		0.65	200	250
		1.00	250	300
		1.60	300	300

REMARK

Note (1) : Normal temperature limit refers to the limit temperature for continuous operation of the thermocouple in air.

Note (2) : Overheat temperature limit refers to the limit temperature only available for short period operation in a very necessary condition.

1.2.2 Temperature Tolerances

Material Code	Previous Code (reference)	Measured temperature range °C	Class	Tolerance (1)
B	—	600 to 1700	0.5	$\pm 4\text{ }^{\circ}\text{C}$ or measured temperature $\pm 0.5\%$
R	—	0 to 1600	0.25	$\pm 1.5\text{ }^{\circ}\text{C}$ or measured temperature $\pm 0.25\%$
S				
K	CA	0 to 1000	0.4	$\pm 1.5\text{ }^{\circ}\text{C}$ or measured temperature $\pm 0.4\%$
		0 to 1200	0.75	$\pm 2.5\text{ }^{\circ}\text{C}$ or measured temperature $\pm 0.75\%$
		-200 to 0	1.5	$\pm 2.5\text{ }^{\circ}\text{C}$ or measured temperature $\pm 1.5\%$
E	CRC	0 to 800	0.4	$\pm 1.5\text{ }^{\circ}\text{C}$ or measured temperature $\pm 0.4\%$
		0 to 800	0.75	$\pm 2.5\text{ }^{\circ}\text{C}$ or measured temperature $\pm 0.75\%$
		-200 to 0	1.5	$\pm 2.5\text{ }^{\circ}\text{C}$ or measured temperature $\pm 1.5\%$
J	IC	0 to 750	0.4	$\pm 1.5\text{ }^{\circ}\text{C}$ or measured temperature $\pm 0.4\%$
		0 to 750	0.75	$\pm 2.5\text{ }^{\circ}\text{C}$ or measured temperature $\pm 0.75\%$
T	CC	0 to 350	0.4	$\pm 0.5\text{ }^{\circ}\text{C}$ or measured temperature $\pm 0.4\%$
		0 to 350	0.75	$\pm 1\text{ }^{\circ}\text{C}$ or measured temperature $\pm 0.75\%$
		-200 to 0	1.5	$\pm 1\text{ }^{\circ}\text{C}$ or measured temperature $\pm 1.5\%$

REMARK

Note (1) : Tolerance refer to the maximum permitted limit of the difference in temperature between the temperature looked up in a standard thermoelectromotive force table corresponding to the thermoelectromotive force, and the measuring junction temperature.

The tolerance is taken as the large of the temperature ($^{\circ}\text{C}$) and percentage (%) values.

1.3 Compensating Wire

1.3.1 Types and Specifications of Compensating Wire

Combined thermocouple		Compensating wire		Class	Material		Operating temperature(°C)	Junction temperature (°C)	Compensating wire error tolerance(Ω)	Wire dielectrics(Ω) ⁽³⁾	Color of surface fiber	Color of Core fiber		Remark	
Code	Previous code	Code	Previous code		+ part	- part						+	-		
B	-	BX-G	-	General /Normal	Cu	Cu	0 to 90	0 to 100	- ⁽¹⁾	0.05	gray	red	white	compensation type	
R	-	RX-G	-	General /Normal	Cu	Cu/Ni alloy	0 to 90	0 to 150	+3 ⁽²⁾ -7	0.1	black	red	white		
S		SX-G		Heat tolerance /Normal			0 to 150								
K	CA	KX-G	WCA-G	General /Normal	Ni/Cr alloy	Ni alloy	-20 to 90	-20 to 150	± 2.5	1.5	blue	red	white	expansion type	
		KX-GS	WCA-GS	General /Precision			± 1.5								
		KX-H	WCA-H	Heat tolerance /Normal			± 2.5								
		KX-HS	WCA-HS	Heat tolerance /Precision			± 1.5								
		WX-G	WCA-G	General /Normal	Fi	Cu/Ni alloy	-20 to 90		± 3.0	0.5				compensation type	
		WX-H	WCA-H	Heat tolerance /Normal			0 to 150								
		VX-G	WCA-G	General /Normal	Cu	Cu/Ni alloy	-20 to 90	-20 to 100	0.8						
E	CRC	EX-G	WCRC-G	General /Normal	Ni/Cr alloy	Cu/Ni alloy	-20 to 90	-20 to 150	± 2.5	1.5	violet	red	white	expansion type	
		EX-H	WCRC-H	Heat tolerance /Normal			0 to 150								
J	IC	JX-G	WIC-G	General /Normal	Fi	Cu/Ni alloy	-20 to 90		-20 to 150	± 2.5	0.8	yellow	red	white	expansion type
		JX-H	WIC-H	Heat tolerance /Normal			0 to 150								
T	CC	TX-G	WCC-C	General /Normal	Cu	Cu/Ni alloy	-20 to 90		0 to 150	± 2.0	0.8	brown	red	white	expansion type
		TX-GS	-	General /Precision			± 1.0								
		TX-H	WCC-H	Heat tolerance /Normal			± 2.0								
		TX-HS	-	Heat tolerance /Precision			± 1.0								

REMARK

Note (1) : The BX-G uses same material core(Cu) on the two parts of + and -. Therefore, error tolerance is not defined.

Note (2) : The thermocouple type R and S's thermoelectromotive force characteristics is non-linear, so it is not real measurement error of temperatures.

Note (3) : This should be applied to the wires of 1.25 mm² or more section area.