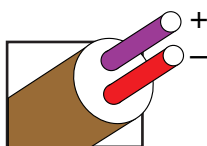
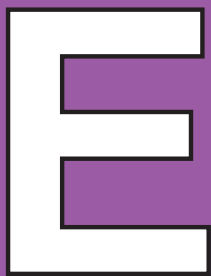


# Revised Thermocouple Reference Tables

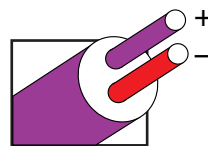
**TYPE E**  
Reference Tables  
N.I.S.T.  
Monograph 175  
Revised to ITS-90



Thermocouple Grade

**Nickel-Chromium vs. Copper-Nickel**

Extension Grade



**MAXIMUM TEMPERATURE RANGE**

Thermocouple Grade  
- 328 to 1652°F  
- 200 to 900°C

Extension Grade  
32 to 392°F  
0 to 200°C

**LIMITS OF ERROR**  
(whichever is greater)  
**Standard:** 1.7°C or 0.5% Above 0°C  
1.7°C or 1.0% Below 0°C  
**Special:** 1.0°C or 0.4%

**COMMENTS, BARE WIRE ENVIRONMENT:**  
Oxidizing or Inert; Limited Use in Vacuum or Reducing; Highest EMF Change per Degree

**TEMPERATURE IN DEGREES °F**  
**REFERENCE JUNCTION AT 32°F**

Thermoelectric Voltage in Millivolts

°F	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	0	°F	°F	0	1	2	3	4	5	6	7	8	9	10	°F	°F	0	1	2	3	4	5	6	7	8	9	10	°F	°F	0	1	2	3	4	5	6	7	8	9	10	°F	°F																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																			
-450							-9.835	-9.834	-9.833	-9.832	-9.830	-450	100	2.281	2.316	2.351	2.385	2.420	2.454	2.489	2.524	2.558	2.593	2.628	110	2.628	2.663	2.698	2.733	2.767	2.802	2.837	2.872	2.907	2.942	2.977	110	120	2.977	3.012	3.048	3.083	3.118	3.153	3.188	3.224	3.259	3.294	3.330	120	130	3.330	3.365	3.400	3.436	3.471	3.507	3.542	3.578	3.613	3.649	3.685	130	140	3.685	3.720	3.756	3.792	3.827	3.863	3.899	3.935	3.970	4.006	4.042	140	150	4.042	4.078	4.114	4.150	4.186	4.222	4.258	4.294	4.330	4.366	4.403	150	160	4.403	4.439	4.475	4.511	4.547	4.584	4.620	4.656	4.693	4.729	4.766	160	170	4.766	4.802	4.839	4.875	4.912	4.948	4.985	5.021	5.058	5.095	5.131	170	180	5.131	5.168	5.205	5.242	5.278	5.315	5.352	5.389	5.426	5.463	5.500	180	190	5.500	5.537	5.574	5.611	5.648	5.685	5.722	5.759	5.796	5.833	5.871	190	200	5.871	5.908	5.945	5.982	6.020	6.057	6.094	6.132	6.169	6.207	6.244	200	210	6.244	6.281	6.319	6.356	6.394	6.432	6.469	6.507	6.544	6.582	6.620	210	220	6.620	6.658	6.695	6.733	6.771	6.809	6.847	6.884	6.922	6.960	6.998	220	230	6.998	7.036	7.074	7.112	7.150	7.188	7.226	7.264	7.302	7.341	7.379	230	240	7.379	7.417	7.455	7.493	7.532	7.570	7.608	7.647	7.685	7.723	7.762	240	250	7.762	7.800	7.839	7.877	7.916	7.954	7.993	8.031	8.070	8.108	8.147	250	260	8.147	8.186	8.224	8.263	8.302	8.340	8.379	8.418	8.457	8.496	8.535	260	270	8.535	8.573	8.612	8.651	8.690	8.729	8.768	8.807	8.846	8.885	8.924	270	280	8.924	8.963	9.002	9.041	9.081	9.120	9.159	9.198	9.237	9.277	9.316	280	290	9.316	9.355	9.395	9.434	9.473	9.513	9.552	9.591	9.631	9.670	9.710	290	300	9.710	9.749	9.789	9.828	9.868	9.907	9.947	9.987	10.026	10.066	10.106	300	310	10.106	10.145	10.185	10.225	10.265	10.304	10.344	10.384	10.424	10.464	10.503	310	320	10.503	10.543	10.583	10.623	10.663	10.703	10.743	10.783	10.823	10.863	10.903	320	330	10.903	10.943	10.983	11.024	11.064	11.104	11.144	11.184	11.224	11.265	11.305	330	340	11.305	11.345	11.385	11.426	11.466	11.506	11.547	11.587	11.628	11.668	11.708	340	350	11.708	11.749	11.789	11.830	11.870	11.911	11.951	11.992	12.032	12.073	12.113	350	360	12.113	12.154	12.195	12.235	12.276	12.317	12.357	12.398	12.439	12.480	12.520	360	370	12.520	12.561	12.602	12.643	12.684	12.724	12.765	12.806	12.847	12.888	12.929	370	380	12.929	12.970	13.011	13.052	13.093	13.134	13.175	13.216	13.257	13.298	13.339	380	390	13.339	13.380	13.421	13.462	13.504	13.545	13.586	13.627	13.668	13.710	13.751	390	400	13.751	13.792	13.833	13.875	13.916	13.957	13.999	14.040	14.081	14.123	14.164	400	410	14.164	14.205	14.247	14.288	14.330	14.371	14.413	14.454	14.496	14.537	14.579	410	420	14.579	14.620	14.662	14.704	14.745	14.787	14.828	14.870	14.912	14.953	14.995	420	430	14.995	15.037	15.078	15.120	15.162	15.204	15.245	15.287	15.329	15.371	15.413	430	440	15.413	15.454	15.496	15.538	15.580	15.622	15.664	15.706	15.748	15.790	15.831	440	450	15.831	15.873	15.915	15.957	15.999	16.041	16.083	16.125	16.168	16.210	16.252	450	460	16.252	16.294	16.336	16.378	16.420	16.462	16.504	16.547	16.589	16.631	16.673	460	470	16.673	16.715	16.758	16.800	16.842	16.884	16.927	16.969	17.011	17.054	17.096	470	480	17.096	17.138	17.181	17.223	17.265	17.308	17.350	17.392	17.435	17.477	17.520	480	490	17.520	17.562	17.605	17.647	17.690	17.732	17.775	17.817	17.860	17.902	17.945	490	500	17.945	17.987	18.030	18.073	18.115	18.158	18.200	18.243	18.286	18.328	18.371	500	510	18.371	18.414	18.456	18.499	18.542	18.585	18.627	18.670	18.713	18.756	18.798	510	520	18.798	18.841	18.884	18.927	18.969	19.012	19.055	19.098	19.141	19.184	19.227	520	530	19.227	19.269	19.312	19.355	19.398	19.441	19.484	19.527	19.570	19.613	19.656	530	540	19.656	19.699	19.742	19.785	19.828	19.871	19.914	19.957	20.000	20.043	20.086	540	550	20.086	20.129	20.172	20.216	20.259	20.302	20.345	20.388	20.431	20.474	20.517	550	560	20.517	20.561	20.604	20.647	20.690	20.733	20.777	20.820	20.863	20.906	20.950	560	570	20.950	20.993	21.036	21.080	21.123	21.166	21.209	21.253	21.296	21.339	21.383	570	580	21.383	21.426	21.470	21.513	21.556	21.600	21.643	21.686	21.730	21.773	21.817	580	590	21.817	21.860	21.904	21.947	21.991	22.034	22.078	22.121	22.165	22.208	22.252	590	600	22.252	22.295	22.339	22.382	22.426	22.469	22.513	22.556	22.600	22.644	22.687	600	610	22.687	22.731	22.774	22.818	22.862	22.905	22.949	22.993	23.036	23.080	23.124	610	620	23.124	23.167	23.211	23.255	23.298	23.342	23.386	23.429	23.473	23.517	23.561	620	630	23.561	23.604	23.648	23.692	23.736	23.780	23.823	23.867	23.911	23.955	23.999	630	640	23.999	24.042	24.086	24.130	24.174	24.218	24.262	24.305	24.349	24.393	24.437	640	650	24.437	24.481	24.525	24.569	24.613	24.657	24.701	24.745	24.789	24.833	24.876	650	660	24.876	24.920	24.964	25.008	25.052	25.096	25.140	25.184	25.228	25.272	25.316	660	670	25.316	25.360	25.404	25.448	25.493	25.537	25.581	25.625	25.669	25.713	25.757	670	680	25.757	25.801	25.845	25.889	25.933	25.977	26.021	26.065	26.110	26.154	26.198	680	690	26.198	26.242	26.286	26.331	26.375	26.419	26.463	26.507	26.552	26.596	26.640	690

**MAXIMUM TEMPERATURE RANGE**

**Thermocouple Grade**

- 328 to 1652°F  
- 200 to 900°C

**Extension Grade**

32 to 392°F  
0 to 200°C

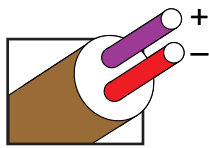
**LIMITS OF ERROR**

(whichever is greater)  
**Standard:** 1.7°C or 0.5% Above 0°C  
1.7°C or 1.0% Below 0°C  
**Special:** 1.0°C or 0.4%

**COMMENTS, BARE WIRE ENVIRONMENT:**

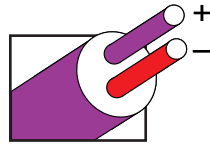
Oxidizing or Inert; Limited Use in Vacuum or Reducing; Highest EMF Change per Degree

**TEMPERATURE IN DEGREES °F  
REFERENCE JUNCTION AT 32°F**



**Thermocouple Grade**

**Nickel-Chromium  
vs.  
Copper-Nickel**



**Extension Grade**

**Revised Thermocouple Reference Tables**

**TYPE E**  
Reference Tables  
N.I.S.T. Monograph 175  
Revised to ITS-90

**Thermoelectric Voltage in Millivolts**

°F	0	1	2	3	4	5	6	7	8	9	10	°F
700	26.640	26.684	26.728	26.773	26.817	26.861	26.905	26.950	26.994	27.038	27.082	700
710	27.082	27.127	27.171	27.215	27.259	27.304	27.348	27.392	27.437	27.481	27.525	710
720	27.525	27.570	27.614	27.658	27.703	27.747	27.791	27.836	27.880	27.924	27.969	720
730	27.969	28.013	28.057	28.102	28.146	28.191	28.235	28.279	28.324	28.368	28.413	730
740	28.413	28.457	28.501	28.546	28.590	28.635	28.679	28.724	28.768	28.813	28.857	740
750	28.857	28.901	28.946	28.990	29.035	29.079	29.124	29.168	29.213	29.257	29.302	750
760	29.302	29.346	29.391	29.435	29.480	29.525	29.569	29.614	29.658	29.703	29.747	760
770	29.747	29.792	29.836	29.881	29.925	29.970	30.015	30.059	30.104	30.148	30.193	770
780	30.193	30.238	30.282	30.327	30.371	30.416	30.461	30.505	30.550	30.595	30.639	780
790	30.639	30.684	30.728	30.773	30.818	30.862	30.907	30.952	30.996	31.041	31.086	790
800	31.086	31.130	31.175	31.220	31.264	31.309	31.354	31.398	31.443	31.488	31.533	800
810	31.533	31.577	31.622	31.667	31.711	31.756	31.801	31.846	31.890	31.935	31.980	810
820	31.980	32.025	32.069	32.114	32.159	32.204	32.248	32.293	32.338	32.383	32.427	820
830	32.427	32.472	32.517	32.562	32.606	32.651	32.696	32.741	32.786	32.830	32.875	830
840	32.875	32.920	32.965	33.010	33.054	33.099	33.144	33.189	33.234	33.278	33.323	840
850	33.323	33.368	33.413	33.458	33.503	33.547	33.592	33.637	33.682	33.727	33.772	850
860	33.772	33.816	33.861	33.906	33.951	33.996	34.041	34.086	34.130	34.175	34.220	860
870	34.220	34.265	34.310	34.355	34.400	34.445	34.489	34.534	34.579	34.624	34.669	870
880	34.669	34.714	34.759	34.804	34.849	34.893	34.938	34.983	35.028	35.073	35.118	880
890	35.118	35.163	35.208	35.253	35.298	35.343	35.388	35.432	35.477	35.522	35.567	890
900	35.567	35.612	35.657	35.702	35.747	35.792	35.837	35.882	35.927	35.972	36.016	900
910	36.016	36.061	36.106	36.151	36.196	36.241	36.286	36.331	36.376	36.421	36.466	910
920	36.466	36.511	36.556	36.601	36.646	36.691	36.736	36.781	36.826	36.870	36.915	920
930	36.915	36.960	37.005	37.050	37.095	37.140	37.185	37.230	37.275	37.320	37.365	930
940	37.365	37.410	37.455	37.500	37.545	37.590	37.635	37.680	37.725	37.770	37.815	940
950	37.815	37.860	37.905	37.950	37.995	38.040	38.085	38.130	38.175	38.220	38.265	950
960	38.265	38.309	38.354	38.399	38.444	38.489	38.534	38.579	38.624	38.669	38.714	960
970	38.714	38.759	38.804	38.849	38.893	38.938	38.983	39.028	39.073	39.119	39.164	970
980	39.164	39.209	39.254	39.299	39.344	39.389	39.434	39.479	39.524	39.569	39.614	980
990	39.614	39.659	39.704	39.749	39.794	39.839	39.884	39.929	39.974	40.019	40.064	990
1000	40.064	40.109	40.154	40.199	40.244	40.288	40.333	40.378	40.423	40.468	40.513	1000
1010	40.513	40.558	40.603	40.648	40.693	40.738	40.783	40.828	40.873	40.918	40.963	1010
1020	40.963	41.008	41.053	41.098	41.143	41.188	41.233	41.278	41.323	41.368	41.413	1020
1030	41.413	41.458	41.503	41.548	41.593	41.638	41.683	41.728	41.773	41.818	41.863	1030
1040	41.863	41.908	41.953	41.998	42.043	42.088	42.133	42.178	42.223	42.268	42.313	1040
1050	42.313	42.358	42.403	42.448	42.493	42.538	42.583	42.628	42.673	42.718	42.763	1050
1060	42.763	42.808	42.853	42.898	42.943	42.988	43.033	43.078	43.123	43.168	43.213	1060
1070	43.213	43.258	43.303	43.348	43.393	43.438	43.479	43.524	43.569	43.614	43.659	1070
1080	43.659	43.704	43.749	43.794	43.839	43.884	43.929	43.974	44.019	44.064	44.109	1080
1090	44.109	44.154	44.199	44.244	44.289	44.334	44.379	44.424	44.469	44.514	44.559	1090
1100	44.559	44.604	44.649	44.694	44.739	44.784	44.829	44.874	44.919	44.964	45.009	1100
1110	45.009	45.054	45.099	45.144	45.189	45.234	45.279	45.324	45.369	45.414	45.459	1110
1120	45.459	45.504	45.549	45.594	45.639	45.684	45.729	45.774	45.819	45.864	45.909	1120
1130	45.909	45.954	45.999	46.044	46.089	46.134	46.179	46.224	46.269	46.314	46.359	1130
1140	46.359	46.404	46.449	46.494	46.539	46.584	46.629	46.674	46.719	46.764	46.809	1140
1150	46.809	46.854	46.899	46.944	46.989	47.034	47.079	47.124	47.169	47.214	47.259	1150
1160	47.259	47.304	47.349	47.394	47.439	47.484	47.529	47.574	47.619	47.664	47.709	1160
1170	47.709	47.754	47.799	47.844	47.889	47.934	47.979	48.024	48.069	48.114	48.159	1170
1180	48.159	48.204	48.249	48.294	48.339	48.384	48.429	48.474	48.519	48.564	48.609	1180
1190	48.609	48.654	48.699	48.744	48.789	48.834	48.879	48.924	48.969	49.014	49.059	1190
1200	49.059	49.104	49.149	49.194	49.239	49.284	49.329	49.374	49.419	49.464	49.509	1200
1210	49.509	49.554	49.599	49.644	49.689	49.734	49.779	49.824	49.869	49.914	49.959	1210
1220	49.959	50.004	50.049	50.094	50.139	50.184	50.229	50.274	50.319	50.364	50.409	1220
1230	50.409	50.454	50.499	50.544	50.589	50.634	50.679	50.724	50.769	50.814	50.859	1230
1240	50.859	50.904	50.949	50.994	51.039	51.084	51.129	51.174	51.219	51.264	51.309	1240
1250	51.309	51.354	51.399	51.444	51.489	51.534	51.579	51.624	51.669	51.714	51.759	1250
1260	51.759	51.804	51.849	51.894	51.939	51.984	52.029	52.074	52.119	52.164	52.209	1260
1270	52.209	52.254	52.299	52.344	52.389	52.434	52.479	52.524	52.569	52.614	52.659	1270
1280	52.659	52.704	52.749	52.794	52.839	52.884	52.929	52.974	53.019	53.064	53.109	1280
1290	53.109	53.154	53.199	53.244	53.289	53.334	53.379	53.424	53.469	53.514	53.559	1290

°F	0	1	2	3	4	5	6	7	8	9	10	°F
1300	53.566	53.611	53.655	53.699	53.743	53.787	53.831	53.875	53.919	53.963	54.007	1300
1310	54.007	54.051	54.095	54.139	54.183	54.227	54.271	54.315	54.359	54.403	54.447	1310
1320	54.447	54.491	54.535	54.579	54.623	54.667	54.711	54.755	54.799	54.843	54.887	1320
1330	54.887	54.931	54.975	55.019	55.063	55.107	55.151	55.195	55.239	55.283	55.327	1330
1340	55.327	55.371	55.415	55.459	55.503	55.547	55.591	55.635	55.679	55.723	55.767	1340
1350	55.767	55.811	55.855	55.899	55.943	55.987	56.031	56.075	56.119	56.163	56.207	1350
1360	56.207	56.251	56.295	56.339	56.383	56.427	56.471	56.515	56.559	56.603	56.647	1360
1370	56.647	56.691	56.735	56.779	56.823	56.867	56.911	56.955	56.999	57.043	57.087	1370
1380	57.087	57.131	57.175	57.219	57.263	57.307	57.351	57.395	57.439	57.483	57.527	1380
1390	57.527	57.571	57.615	57.659	57.703	57.747	57.791	57.835	57.879	57.923	57.967	1390
1400	57.967	58.011	58.055	58.099	58.143	58.187	58.231	58.275	58.319	58.363	58.407	1400
1410	58.407	58.451	58.495	58.539	58.583	58.627	58.671	58.715	58.759	58.803	58.847	1410
1420	58.847	58.891	58.935	58.979	59.023	59.067	59.111	59.155	59.199	59.243	59.287	1420
1430	59.287	59.331	59.375	59.419	59.463	59.507	59.551	59.595	59.639	59.683	59.727	1430
1440	59.727	59.771	59.815	59.859	59.903	59.947	59.991	60.035	60.079	60.123	60.167	1440
1450	60.167	60.211	60.255	60.299	60.343	60.387	60.431	60.475	60.519	60.563	60.607	1450
1460	60.607	60.651	60.695	60.739	60.783	60.827	60.871	60.915	60.959	61.003	61.047	1460
1470	61.047	61.091	61.135	61.179	61.223	61.267	61.311	61.355	6			