

# Technical Information

## Revised Thermocouple Reference Tables

### 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**

# °F

## Nickel-Chromium vs. Copper-Nickel

# TYPE E

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

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	
-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	100
														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	11.627	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	14.953	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			

# Technical Information

## Revised Thermocouple Reference Tables

# TYPE

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

# E

# °F

Nickel-Chromium  
vs.  
Copper-Nickel

### 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
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	30.594	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	34.444	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	35.387	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	36.871	36.916	920
930	36.916	36.961	37.006	37.051	37.096	37.141	37.186	37.231	37.276	37.321	37.366	930
940	37.366	37.411	37.456	37.501	37.546	37.591	37.636	37.681	37.726	37.771	37.816	940
950	37.816	37.861	37.906	37.951	37.996	38.041	38.086	38.131	38.176	38.221	38.266	950
960	38.266	38.311	38.356	38.401	38.446	38.491	38.536	38.581	38.626	38.671	38.716	960
970	38.716	38.761	38.806	38.851	38.896	38.941	38.986	39.031	39.076	39.121	39.166	970
980	39.166	39.211	39.256	39.301	39.346	39.391	39.436	39.481	39.526	39.571	39.616	980
990	39.616	39.661	39.706	39.751	39.796	39.841	39.886	39.931	39.976	40.021	40.066	990
1000	40.066	40.111	40.156	40.201	40.246	40.291	40.336	40.381	40.426	40.471	40.516	1000
1010	40.516	40.561	40.606	40.651	40.696	40.741	40.786	40.831	40.876	40.921	40.966	1010
1020	40.966	41.011	41.056	41.101	41.146	41.191	41.236	41.281	41.326	41.371	41.416	1020
1030	41.416	41.461	41.506	41.551	41.596	41.641	41.686	41.731	41.776	41.821	41.866	1030
1040	41.866	41.911	41.956	42.001	42.046	42.091	42.136	42.181	42.226	42.271	42.316	1040
1050	42.316	42.361	42.406	42.451	42.496	42.541	42.586	42.631	42.676	42.721	42.766	1050
1060	42.766	42.811	42.856	42.901	42.946	42.991	43.036	43.081	43.126	43.171	43.216	1060
1070	43.216	43.261	43.306	43.351	43.396	43.441	43.486	43.531	43.576	43.621	43.666	1070
1080	43.666	43.711	43.756	43.801	43.846	43.891	43.936	43.981	44.026	44.071	44.116	1080
1090	44.116	44.161	44.206	44.251	44.296	44.341	44.386	44.431	44.476	44.521	44.566	1090
1100	44.566	44.611	44.656	44.701	44.746	44.791	44.836	44.881	44.926	44.971	45.016	1100
1110	45.016	45.061	45.106	45.151	45.196	45.241	45.286	45.331	45.376	45.421	45.466	1110
1120	45.466	45.511	45.556	45.601	45.646	45.691	45.736	45.781	45.826	45.871	45.916	1120
1130	45.916	45.961	46.006	46.051	46.096	46.141	46.186	46.231	46.276	46.321	46.366	1130
1140	46.366	46.411	46.456	46.501	46.546	46.591	46.636	46.681	46.726	46.771	46.816	1140
1150	46.816	46.861	46.906	46.951	46.996	47.041	47.086	47.131	47.176	47.221	47.266	1150
1160	47.266	47.311	47.356	47.401	47.446	47.491	47.536	47.581	47.626	47.671	47.716	1160
1170	47.716	47.761	47.806	47.851	47.896	47.941	47.986	48.031	48.076	48.121	48.166	1170
1180	48.166	48.211	48.256	48.301	48.346	48.391	48.436	48.481	48.526	48.571	48.616	1180
1190	48.616	48.661	48.706	48.751	48.796	48.841	48.886	48.931	48.976	49.021	49.066	1190
1200	49.066	49.111	49.156	49.201	49.246	49.291	49.336	49.381	49.426	49.471	49.516	1200
1210	49.516	49.561	49.606	49.651	49.696	49.741	49.786	49.831	49.876	49.921	49.966	1210
1220	49.966	50.011	50.056	50.101	50.146	50.191	50.236	50.281	50.326	50.371	50.416	1220
1230	50.416	50.461	50.506	50.551	50.596	50.641	50.686	50.731	50.776	50.821	50.866	1230
1240	50.866	50.911	50.956	51.001	51.046	51.091	51.136	51.181	51.226	51.271	51.316	1240
1250	51.316	51.361	51.406	51.451	51.496	51.541	51.586	51.631	51.676	51.721	51.766	1250
1260	51.766	51.811	51.856	51.901	51.946	51.991	52.036	52.081	52.126	52.171	52.216	1260
1270	52.216	52.261	52.306	52.351	52.396	52.441	52.486	52.531	52.576	52.621	52.666	1270
1280	52.666	52.711	52.756	52.801	52.846	52.891	52.936	52.981	53.026	53.071	53.116	1280
1290	53.116	53.161	53.206	53.251	53.296	53.341	53.386	53.431	53.476	53.521	53.566	1290
°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
1300	53.466	53.510	53.555	53.599	53.643	53.687	53.732	53.776	53.820	53.864	53.908	1300
1310	53.908	53.952	53.997	54.041	54.085	54.129	54.173	54.218	54.262	54.306	54.350	1310
1320	54.350	54.394	54.438	54.482	54.527	54.571	54.615	54.659	54.703	54.747	54.791	1320
1330	54.791	54.835	54.879	54.924	54.968	55.012	55.056	55.100	55.144	55.188	55.232	1330
1340	55.232	55.276	55.320	55.364	55.408	55.453	55.497	55.541	55.585	55.629	55.673	1340
1350	55.673	55.717	55.761	55.805	55.849	55.893	55.937	55.981	56.025	56.069	56.113	1350
1360	56.113	56.157	56.201	56.245	56.289	56.333	56.377	56.421	56.465	56.509	56.553	1360
1370	56.553	56.597	56.641	56.685	56.729	56.773	56.817	56.861	56.905	56.949	56.993	1370
1380	56.993	57.037	57.081	57.125	57.169	57.213	57.257	57.301	57.345	57.389	57.433	1380
1390	57.433	57.477	57.521	57.565	57.609	57.653	57.697	57.741	57.785	57.829	57.873	1390
1400	57.873	57.917	57.961	58.005	58.049	58.093	58.137	58.181	58.225	58.269	58.313	1400
1410	58.313	58.357	58.401	58.445	58.489	58.533	58.577	58.621	58.665	58.709	58.753	1410
1420	58.753	58.797	58.841	58.885	58.929	58.973	59.017	59.061	59.105	59.149	59.193	1420
1430	59.193	59.237	59.281	59.325	59.369	59.413	59.457	59.501	59.545	59.589	59.633	1430
1440	59.633	59.677	59.721	59.765	59.809	59.853	59.897	59.941	59.985	60.029	60.073	1440
1450	60.073	60.117	60.161	60.205	60.249	60.293	60.337	60.381	60.425	60.469	60.513	1450
1460	60.513	60.557	60.601	60.645	60.689	60.733	60.777	60.821				