

MAXIMUM TEMPERATURE RANGE

Thermocouple Grade

32 to 1382°F
0 to 750°C

Extension Grade

32 to 392°F
0 to 200°C

LIMITS OF ERROR

(whichever is greater)

Standard: 2.2°C or 0.75%

Special: 1.1°C or 0.4%

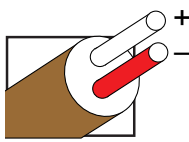
COMMENTS, BARE WIRE ENVIRONMENT:

Reducing, Vacuum, Inert; Limited Use in Oxidizing at High Temperatures;

Not Recommended for Low Temperatures

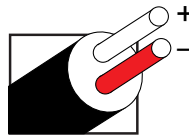
TEMPERATURE IN DEGREES °F

REFERENCE JUNCTION AT 32°F



Thermocouple Grade

Iron vs. Copper-Nickel



Revised Thermocouple Reference Tables

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



Z

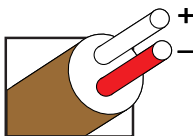
Thermoelectric Voltage in Millivolts

°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
-340													300	7.949	7.979	8.010	8.041	8.071	8.102	8.133	8.163	8.194	8.225	8.255	300
-330	-8.030	-8.019	-8.008	-7.996	-7.985	-7.973	-7.962	-7.950	-7.938	-7.927	-7.915	-330	310	8.255	8.286	8.317	8.347	8.378	8.409	8.439	8.470	8.501	8.532	8.562	310
-320	-7.915	-7.903	-7.892	-7.880	-7.868	-7.854	-7.841	-7.829	-7.816	-7.804	-7.791	-320	320	8.562	8.593	8.624	8.654	8.685	8.716	8.747	8.777	8.808	8.839	8.869	320
-310	-7.791	-7.778	-7.765	-7.752	-7.739	-7.726	-7.713	-7.699	-7.686	-7.672	-7.659	-310	330	8.869	8.900	8.931	8.962	8.992	9.023	9.054	9.085	9.115	9.146	9.177	330
-300	-7.659	-7.645	-7.632	-7.618	-7.604	-7.590	-7.576	-7.562	-7.548	-7.534	-7.519	-300	340	9.177	9.208	9.238	9.269	9.300	9.331	9.362	9.392	9.423	9.454	9.485	340
-290	-7.519	-7.505	-7.491	-7.476	-7.462	-7.447	-7.432	-7.417	-7.403	-7.388	-7.373	-290	350	9.485	9.515	9.546	9.577	9.608	9.639	9.669	9.700	9.731	9.762	9.793	350
-280	-7.373	-7.357	-7.342	-7.327	-7.312	-7.296	-7.281	-7.265	-7.250	-7.234	-7.219	-280	360	9.793	9.823	9.854	9.885	9.916	9.947	9.977	10.008	10.039	10.070	10.101	360
-270	-7.219	-7.203	-7.187	-7.171	-7.155	-7.139	-7.123	-7.107	-7.090	-7.074	-7.058	-270	370	10.101	10.131	10.162	10.193	10.224	10.255	10.285	10.316	10.347	10.378	10.409	370
-260	-7.058	-7.041	-7.025	-7.008	-6.991	-6.975	-6.958	-6.941	-6.924	-6.907	-6.890	-260	380	10.409	10.440	10.470	10.501	10.532	10.563	10.594	10.625	10.655	10.686	10.717	380
-250	-6.890	-6.873	-6.856	-6.839	-6.821	-6.804	-6.787	-6.769	-6.752	-6.734	-6.716	-250	390	10.717	10.748	10.779	10.810	10.840	10.871	10.902	10.933	10.964	10.995	11.025	390
-240	-6.716	-6.699	-6.681	-6.663	-6.645	-6.627	-6.609	-6.591	-6.573	-6.555	-6.536	-240	400	11.025	11.056	11.087	11.118	11.149	11.180	11.211	11.241	11.272	11.303	11.334	400
-230	-6.536	-6.518	-6.500	-6.481	-6.463	-6.444	-6.426	-6.407	-6.388	-6.370	-6.351	-230	410	11.334	11.365	11.396	11.426	11.457	11.488	11.519	11.550	11.581	11.612	11.642	410
-220	-6.351	-6.332	-6.313	-6.294	-6.275	-6.256	-6.236	-6.217	-6.198	-6.179	-6.159	-220	420	11.642	11.673	11.704	11.735	11.766	11.797	11.828	11.858	11.889	11.920	11.951	420
-210	-6.165	-6.146	-6.126	-6.106	-6.086	-6.066	-6.046	-6.026	-6.005	-5.985	-5.962	-210	430	11.951	11.982	12.013	12.044	12.074	12.105	12.136	12.167	12.198	12.229	12.260	430
-200	-5.962	-5.942	-5.922	-5.902	-5.882	-5.862	-5.842	-5.821	-5.801	-5.781	-5.760	-200	440	12.260	12.290	12.321	12.352	12.383	12.414	12.445	12.476	12.506	12.537	12.568	440
-190	-5.760	-5.740	-5.719	-5.699	-5.678	-5.657	-5.637	-5.616	-5.595	-5.574	-5.553	-190	450	12.568	12.599	12.630	12.661	12.692	12.722	12.753	12.784	12.815	12.846	12.877	450
-180	-5.553	-5.532	-5.511	-5.490	-5.469	-5.448	-5.426	-5.405	-5.384	-5.363	-5.341	-180	460	12.877	12.907	12.938	12.969	13.000	13.031	13.062	13.093	13.124	13.155	13.186	460
-170	-5.341	-5.320	-5.298	-5.277	-5.255	-5.233	-5.212	-5.190	-5.168	-5.146	-5.125	-170	470	13.185	13.216	13.247	13.278	13.308	13.339	13.370	13.401	13.432	13.463	13.494	470
-160	-5.125	-5.103	-5.081	-5.059	-5.037	-5.015	-4.992	-4.970	-4.948	-4.926	-4.903	-160	480	13.494	13.524	13.555	13.586	13.617	13.648	13.679	13.709	13.740	13.771	13.802	480
-150	-4.903	-4.881	-4.859	-4.836	-4.814	-4.791	-4.769	-4.746	-4.724	-4.701	-4.678	-150	490	13.802	13.833	13.864	13.894	13.925	13.956	13.987	14.018	14.049	14.079	14.110	490
-140	-4.678	-4.655	-4.633	-4.610	-4.587	-4.564	-4.541	-4.518	-4.495	-4.472	-4.449	-140	500	14.110	14.141	14.172	14.203	14.233	14.264	14.295	14.326	14.357	14.388	14.418	500
-130	-4.449	-4.425	-4.402	-4.379	-4.356	-4.332	-4.309	-4.286	-4.262	-4.239	-4.215	-130	510	14.418	14.449	14.480	14.511	14.542	14.573	14.604	14.634	14.665	14.696	14.727	510
-120	-4.215	-4.192	-4.168	-4.144	-4.121	-4.097	-4.073	-4.050	-4.026	-4.002	-3.978	-120	520	14.727	14.757	14.788	14.819	14.850	14.881	14.911	14.942	14.973	15.004	15.035	520
-110	-3.978	-3.954	-3.930	-3.906	-3.882	-3.858	-3.834	-3.810	-3.786	-3.761	-3.737	-110	530	15.035	15.065	15.096	15.127	15.158	15.189	15.219	15.250	15.281	15.312	15.343	530
-100	-3.737	-3.713	-3.688	-3.664	-3.640	-3.615	-3.591	-3.566	-3.542	-3.517	-3.493	-100	540	15.343	15.373	15.404	15.435	15.466	15.496	15.527	15.558	15.589	15.620	15.650	540
-90	-3.493	-3.468	-3.443	-3.419	-3.394	-3.369	-3.344	-3.320	-3.295	-3.270	-3.245	-90	550	15.650	15.681	15.712	15.743	15.773	15.804	15.835	15.866	15.897	15.927	15.958	550
-80	-3.245	-3.220	-3.195	-3.170	-3.145	-3.120	-3.095	-3.070	-3.044	-3.019	-2.994	-80	560	15.958	15.989	16.020	16.050	16.081	16.112	16.143	16.174	16.204	16.235	16.266	560
-70	-2.994	-2.969	-2.943	-2.918	-2.893	-2.867	-2.842	-2.817	-2.791	-2.766	-2.740	-70	570	16.266	16.296	16.327	16.358	16.389	16.419	16.450	16.481	16.512	16.542	16.573	570
-60	-2.740	-2.714	-2.689	-2.663	-2.638	-2.612	-2.586	-2.560	-2.535	-2.509	-2.483	-60	580	16.573	16.604	16.635	16.666	16.696	16.727	16.758	16.788	16.819	16.850	16.881	580
-50	-2.483	-2.457	-2.431	-2.405	-2.379	-2.353	-2.327	-2.301	-2.275	-2.249	-2.223	-50	590	16.881	16.911	16.942	16.973	17.003	17.034	17.065	17.096	17.126	17.157	17.188	590
-40	-2.223	-2.197	-2.171	-2.145	-2.118	-2.092	-2.066	-2.040	-2.013	-1.987	-1.961	-40	600	17.188	17.219	17.249	17.280	17.311	17.341	17.372	17.403	17.434	17.464	17.495	600
-30	-1.961	-1.934	-1.908	-1.881	-1.854	-1.828	-1.802	-1.775	-1.749	-1.722	-1.695	-30	610	17.495	17.526	17.556	17.587	17.618	17.649	17.679	17.710	17.741	17.771	17.802	610
-20	-1.695	-1.669	-1.642	-1.615	-1.589	-1.562	-1.535	-1.508	-1.482	-1.455	-1.428	-20	620	17.802	17.833	17.863	17.894	17.925	17.955	17.986	18.017	18.048	18.078	18.109	620
-10	-1.428	-1.401	-1.374	-1.347	-1.320	-1.293	-1.266	-1.239	-1.212	-1.185	-1.158	-10	630	18.109	18.140	18.170	18.201	18.232	18.262	18.293	18.324	18.354	18.385	18.416	630
0	-1.158	-1.131	-1.104	-1.076	-1.049	-1.022	-0.995	-0.967	-0.940	-0.913	-0.886	0	640	18.416	18.446	18.477	18.508	18.538	18.569	18.600	18.630	18.661	18.692	18.722	640
0	-0.886	-0.858	-0.831	-0.803	-0.776	-0.749	-0.721	-0.694	-0.666	-0.639	-0.611	0	650	18.722	18.753	18.784	18.814	18.845	18.876	18.906	18.937	18.968	18.999	19.029	650
10	-0.611	-0.583	-0.556	-0.528	-0.501	-0.473	-0.445	-0.418	-0.390	-0.362	-0.334	10	660	19.029	19.060	19.090	19.121	19.152	19.182	19.213	19.244	19.274	19.305	19.336	660
20	-0.334	-0.307	-0.279	-0.251	-0.223	-0.195	-0.168	-0.140	-0.112	-0.084	-0.056	20	670	19.336	19.366	19.397	19.428	19.458	19.489	19.520	19.550	19.581	19.612	19.642	670
30	-0.056	-0.028	0.000	0.028	0.056	0.084	0.112	0.140	0.168	0.196	0.225	30	680	19.642	19.673	19.704	19.734	19.765	19.795	19.826	19.857	19.887	19.918	19.949	680
40	0.225	0.253	0.281	0.309	0.337	0.365	0.394	0.422	0.450	0.478	0.507	40	690	19.949	19.979	20.010	20.041	20.071	20.102	20.132	20.163	20.194	20.224	20.255	690
50	0.507	0.535	0.563	0.592	0.620	0.649	0.677	0.705	0.734	0.762	0.791	50	700	20.255	20.286	20.316	20.347	20.378	20.408	20.439	20.469	20.500	20.531	20.561	700
60	0.791	0.819	0.848	0.876	0.905	0.933	0.962	0.991	1.019	1.048	1.076	60	710	20.561	20.592	20.623	20.653	20.684	20.715	20.745	20.776				

Revised Thermocouple Reference Tables

TYPE J

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



Thermocouple Grade

MAXIMUM TEMPERATURE RANGE

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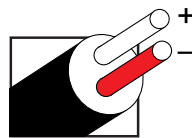
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TEMPERATURE IN DEGREES °F

REFERENCE JUNCTION AT 32°F

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Extension Grade

Thermoelectric Voltage in Millivolts

°F	0	1	2	3	4	5	6	7	8	9	10	°F
950	27.953	27.985	28.016	28.047	28.078	28.109	28.141	28.172	28.203	28.234	28.266	950
960	28.266	28.297	28.328	28.359	28.391	28.422	28.453	28.485	28.516	28.547	28.579	960
970	28.579	28.610	28.641	28.672	28.704	28.735	28.767	28.798	28.829	28.861	28.892	970
980	28.892	28.923	28.955	28.986	29.018	29.049	29.080	29.112	29.143	29.175	29.206	980
990	29.206	29.238	29.269	29.301	29.332	29.363	29.395	29.426	29.458	29.489	29.521	990
1000	29.521	29.552	29.584	29.616	29.647	29.679	29.710	29.742	29.773	29.805	29.836	1000
1010	29.836	29.868	29.900	29.931	29.963	29.995	30.026	30.058	30.089	30.121	30.153	1010
1020	30.153	30.184	30.216	30.248	30.279	30.311	30.343	30.375	30.406	30.438	30.470	1020
1030	30.470	30.502	30.533	30.565	30.597	30.629	30.660	30.692	30.724	30.756	30.788	1030
1040	30.788	30.819	30.851	30.883	30.915	30.947	30.979	31.011	31.043	31.074	31.106	1040
1050	31.106	31.138	31.170	31.202	31.234	31.266	31.298	31.330	31.362	31.394	31.426	1050
1060	31.426	31.458	31.490	31.522	31.554	31.586	31.618	31.650	31.682	31.714	31.746	1060
1070	31.746	31.778	31.811	31.843	31.875	31.907	31.939	31.971	32.003	32.035	32.068	1070
1080	32.068	32.100	32.132	32.164	32.196	32.229	32.261	32.293	32.325	32.358	32.390	1080
1090	32.390	32.422	32.455	32.487	32.519	32.551	32.584	32.616	32.648	32.681	32.713	1090
1100	32.713	32.746	32.778	32.810	32.843	32.875	32.908	32.940	32.973	33.005	33.037	1100
1110	33.037	33.070	33.102	33.135	33.167	33.200	33.232	33.265	33.298	33.330	33.363	1110
1120	33.363	33.395	33.428	33.460	33.493	33.526	33.558	33.591	33.624	33.656	33.689	1120
1130	33.689	33.722	33.754	33.787	33.820	33.853	33.885	33.918	33.951	33.984	34.016	1130
1140	34.016	34.049	34.082	34.115	34.148	34.180	34.213	34.246	34.279	34.312	34.345	1140
1150	34.345	34.378	34.411	34.444	34.476	34.509	34.542	34.575	34.608	34.641	34.674	1150
1160	34.674	34.707	34.740	34.773	34.806	34.840	34.873	34.906	34.939	34.972	35.005	1160
1170	35.005	35.038	35.071	35.104	35.138	35.171	35.204	35.237	35.270	35.303	35.337	1170
1180	35.337	35.370	35.403	35.437	35.470	35.503	35.536	35.570	35.603	35.636	35.670	1180
1190	35.670	35.703	35.736	35.770	35.803	35.837	35.870	35.903	35.937	35.970	36.004	1190
1200	36.004	36.037	36.071	36.104	36.138	36.171	36.205	36.238	36.272	36.305	36.339	1200
1210	36.339	36.373	36.406	36.440	36.473	36.507	36.541	36.574	36.608	36.642	36.675	1210
1220	36.675	36.709	36.743	36.777	36.810	36.844	36.878	36.912	36.945	36.979	37.013	1220
1230	37.013	37.047	37.081	37.114	37.148	37.182	37.216	37.250	37.284	37.318	37.352	1230
1240	37.352	37.386	37.420	37.454	37.488	37.522	37.556	37.590	37.624	37.658	37.692	1240
1250	37.692	37.726	37.760	37.794	37.828	37.862	37.896	37.930	37.964	37.999	38.033	1250
1260	38.033	38.067	38.101	38.135	38.169	38.203	38.238	38.272	38.306	38.341	38.375	1260
1270	38.375	38.409	38.444	38.478	38.512	38.546	38.581	38.615	38.650	38.684	38.718	1270
1280	38.718	38.753	38.788	38.822	38.856	38.890	38.925	38.959	38.994	39.028	39.063	1280
1290	39.063	39.097	39.132	39.166	39.201	39.235	39.270	39.305	39.339	39.374	39.408	1290
1300	39.408	39.443	39.478	39.512	39.547	39.582	39.616	39.651	39.686	39.720	39.755	1300
1310	39.755	39.790	39.825	39.859	39.894	39.929	39.964	39.998	40.033	40.068	40.103	1310
1320	40.103	40.138	40.173	40.207	40.242	40.277	40.312	40.347	40.382	40.417	40.452	1320
1330	40.452	40.487	40.522	40.556	40.591	40.626	40.661	40.696	40.731	40.766	40.801	1330
1340	40.801	40.836	40.872	40.907	40.942	40.977	41.012	41.047	41.082	41.117	41.152	1340
1350	41.152	41.187	41.222	41.258	41.293	41.328	41.363	41.398	41.433	41.469	41.504	1350
1360	41.504	41.539	41.574	41.610	41.645	41.680	41.715	41.751	41.786	41.821	41.856	1360
1370	41.856	41.892	41.927	41.962	41.998	42.033	42.068	42.104	42.139	42.174	42.210	1370
1380	42.210	42.245	42.281	42.316	42.351	42.387	42.422	42.458	42.493	42.528	42.564	1380
1390	42.564	42.599	42.635	42.670	42.706	42.741	42.777	42.812	42.848	42.883	42.919	1390
1400	42.919	42.954	42.990	43.025	43.061	43.096	43.132	43.167	43.203	43.239	43.274	1400
1410	43.274	43.310	43.346	43.381	43.417	43.452	43.488	43.524	43.559	43.595	43.631	1410
1420	43.631	43.667	43.702	43.738	43.774	43.809	43.845	43.881	43.917	43.953	43.988	1420
1430	43.988	44.024	44.060	44.096	44.131	44.167	44.203	44.239	44.275	44.310	44.346	1430
1440	44.346	44.382	44.418	44.454	44.490	44.525	44.561	44.597	44.633	44.669	44.705	1440
1450	44.705	44.741	44.777	44.812	44.848	44.884	44.920	44.956	44.992	45.028	45.064	1450
1460	45.064	45.099	45.135	45.171	45.207	45.243	45.279	45.315	45.351	45.387	45.423	1460
1470	45.423	45.458	45.494	45.530	45.566	45.602	45.638	45.674	45.710	45.746	45.782	1470
1480	45.782	45.818	45.853	45.889	45.925	45.961	45.997	46.033	46.069	46.105	46.141	1480
1490	46.141	46.177	46.212	46.248	46.284	46.320	46.356	46.392	46.428	46.464	46.500	1490
1500	46.500	46.535	46.571	46.607	46.643	46.679	46.715	46.751	46.786	46.822	46.858	1500
1510	46.858	46.894	46.930	46.966	47.002	47.037	47.073	47.109	47.145	47.181	47.216	1510
1520	47.216	47.252	47.288	47.324	47.359	47.395	47.431	47.467	47.503	47.538	47.574	1520
1530	47.574	47.610	47.646	47.681	47.717	47.753	47.788	47.824	47.860	47.896	47.931	1530
1540	47.931	47.967	48.003	48.038	48.074	48.110	48.145	48.181	48.217	48.252	48.288	1540
1550	48.288	48.324	48.359	48.395	48.430	48.466	48.502	48.537	48.573	48.608	48.644	1550
1560	48.644	48.679	48.715	48.750	48.786	48.822	48.857	48.893	48.928	48.964	48.999	1560
1570	48.999	49.034	49.070	49.105	49.141	49.176	49.212	49.247	49.283	49.318	49.353	1570
1580	49.353	49.389	49.424	49.460	49.495	49.530	49.566	49.601	49.636	49.672	49.707	1580
1590	49.707	49.742	49.778	49.813	49.848	49.883	49.919	49.954	49.989	50.024	50.060	1590
°F	0	1	2	3	4	5	6	7	8	9	10	°F