

# Revised Thermocouple Reference Tables

# TYPE N

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



Thermocouple Grade

Nickel-14.2% Chromium-1.4% Silicon

vs.  
Nickel-4.4% Silicon-0.1% Magnesium



Extension Grade

**MAXIMUM TEMPERATURE RANGE**  
Thermocouple Grade  
– 450 to 2372°F  
– 270 to 1300°C  
Extension Grade  
32 to 392°F  
0 to 200°C

**LIMITS OF ERROR**  
(whichever is greater)  
**Standard:** 2.2°C or 0.75% Above 0°C  
2.2°C or 2.0% Below 0°C  
**Special:** 1.1°C or 0.4%

**COMMENTS, BARE WIRE ENVIRONMENT:**  
Alternative to Type K; More Stable at High Temperatures

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

Thermoelectric Voltage in Millivolts

°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
1900	37.710	37.731	37.753	37.774	37.795	37.817	37.838	37.859	37.881	37.902	37.923	1900	2150	42.976	42.997	43.018	43.039	43.059	43.080	43.101	43.122	43.142	43.163	43.184	2150
1910	37.923	37.945	37.966	37.987	38.009	38.030	38.051	38.073	38.094	38.115	38.136	1910	2160	43.184	43.205	43.225	43.246	43.267	43.288	43.308	43.329	43.350	43.370	43.391	2160
1920	38.136	38.158	38.179	38.200	38.222	38.243	38.264	38.285	38.307	38.328	38.349	1920	2170	43.391	43.412	43.433	43.453	43.474	43.495	43.515	43.536	43.557	43.578	43.598	2170
1930	38.349	38.370	38.392	38.413	38.434	38.456	38.477	38.498	38.519	38.541	38.562	1930	2180	43.598	43.619	43.640	43.660	43.681	43.702	43.722	43.743	43.764	43.784	43.805	2180
1940	38.562	38.583	38.604	38.626	38.647	38.668	38.689	38.711	38.732	38.753	38.774	1940	2190	43.805	43.826	43.846	43.867	43.888	43.908	43.929	43.950	43.970	43.991	43.012	2190
1950	38.774	38.795	38.817	38.838	38.859	38.880	38.902	38.923	38.944	38.965	38.986	1950	2200	44.012	44.032	44.053	44.073	44.094	44.115	44.135	44.156	44.177	44.197	44.218	2200
1960	38.986	39.008	39.029	39.050	39.071	39.093	39.114	39.135	39.156	39.177	39.198	1960	2210	44.218	44.238	44.259	44.280	44.300	44.321	44.341	44.362	44.383	44.403	44.424	2210
1970	39.198	39.220	39.241	39.262	39.283	39.304	39.326	39.347	39.368	39.389	39.410	1970	2220	44.424	44.444	44.465	44.485	44.506	44.527	44.547	44.568	44.588	44.609	44.629	2220
1980	39.410	39.431	39.453	39.474	39.495	39.516	39.537	39.558	39.580	39.601	39.622	1980	2230	44.629	44.650	44.671	44.691	44.712	44.732	44.753	44.773	44.794	44.814	44.835	2230
1990	39.622	39.643	39.664	39.685	39.706	39.728	39.749	39.770	39.791	39.812	39.833	1990	2240	44.835	44.855	44.876	44.896	44.917	44.937	44.958	44.978	44.999	45.019	45.040	2240
2000	39.833	39.854	39.875	39.897	39.918	39.939	39.960	39.981	40.002	40.023	40.044	2000	2250	45.040	45.060	45.081	45.101	45.122	45.142	45.163	45.183	45.204	45.224	45.245	2250
2010	40.044	40.066	40.087	40.108	40.129	40.150	40.171	40.192	40.213	40.234	40.255	2010	2260	45.245	45.265	45.286	45.306	45.326	45.347	45.367	45.388	45.408	45.429	45.449	2260
2020	40.255	40.276	40.297	40.319	40.340	40.361	40.382	40.403	40.424	40.445	40.466	2020	2270	45.449	45.469	45.490	45.510	45.531	45.551	45.572	45.592	45.612	45.633	45.653	2270
2030	40.466	40.487	40.508	40.529	40.550	40.571	40.592	40.613	40.634	40.655	40.677	2030	2280	45.653	45.674	45.694	45.714	45.735	45.755	45.775	45.796	45.816	45.837	45.857	2280
2040	40.677	40.698	40.719	40.740	40.761	40.782	40.803	40.824	40.845	40.866	40.887	2040	2290	45.857	45.877	45.898	45.918	45.938	45.959	45.979	45.999	46.020	46.040	46.060	2290
2050	40.887	40.908	40.929	40.950	40.971	40.992	41.013	41.034	41.055	41.076	41.097	2050	2300	46.060	46.081	46.101	46.121	46.142	46.162	46.182	46.202	46.223	46.243	46.263	2300
2060	41.097	41.118	41.139	41.160	41.181	41.202	41.223	41.244	41.265	41.286	41.307	2060	2310	46.263	46.284	46.304	46.324	46.344	46.365	46.385	46.405	46.425	46.446	46.466	2310
2070	41.307	41.328	41.349	41.370	41.390	41.411	41.432	41.453	41.474	41.495	41.516	2070	2320	46.466	46.486	46.506	46.527	46.547	46.567	46.587	46.608	46.628	46.648	46.668	2320
2080	41.516	41.537	41.558	41.579	41.600	41.621	41.642	41.663	41.684	41.705	41.725	2080	2330	46.668	46.688	46.709	46.729	46.749	46.769	46.789	46.810	46.830	46.850	46.870	2330
2090	41.725	41.746	41.767	41.788	41.809	41.830	41.851	41.872	41.893	41.914	41.935	2090	2340	48.870	48.890	48.910	48.931	48.951	48.971	48.991	49.011	49.031	49.051	49.071	2340
2100	41.935	41.955	41.976	41.997	42.018	42.039	42.060	42.081	42.102	42.123	42.143	2100	2350	47.071	47.092	47.112	47.132	47.152	47.172	47.192	47.212	47.232	47.252	47.272	2350
2110	42.143	42.164	42.185	42.206	42.227	42.248	42.269	42.289	42.310	42.331	42.352	2110	2360	47.272	47.292	47.312	47.333	47.353	47.373	47.393	47.413	47.433	47.453	47.473	2360
2120	42.352	42.373	42.394	42.415	42.435	42.456	42.477	42.498	42.519	42.540	42.560	2120	2370	47.473	47.493	47.513									2370
2130	42.560	42.581	42.602	42.623	42.644	42.664	42.685	42.706	42.727	42.748	42.768	2130													
2140	42.768	42.789	42.810	42.831	42.852	42.872	42.893	42.914	42.935	42.956	42.976	2140													

**MAXIMUM TEMPERATURE RANGE**

**Thermocouple Grade**

-32 to 4208°F  
-0 to 2320°C

**Extension Grade**

32 to 1600°F  
0 to 870°C

**LIMITS OF ERROR**

(whichever is greater)

Standard: 4.5°C to 425°C

1.0% to 2320°C

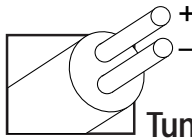
Special: Not Established

**COMMENTS, BARE WIRE ENVIRONMENT:**

Vacuum, Inert; Hydrogen; Beware of Embrittlement; Not Practical Below 750°F; Not for Oxidizing Atmosphere

**TEMPERATURE IN DEGREES °C**

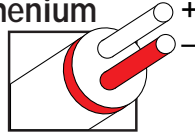
**REFERENCE JUNCTION AT 0°C**



Thermocouple Grade

NONE ESTABLISHED

**Tungsten-5% Rhenium vs. Tungsten-26% Rhenium**



Extension Grade

**Revised Thermocouple Reference Tables**

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

Z

Thermoelectric Voltage in Millivolts

°C	0	1	2	3	4	5	6	7	8	9	10	°C	°C	0	1	2	3	4	5	6	7	8	9	10	°C	°C
0	0.000	0.013	0.026	0.040	0.053	0.067	0.080	0.094	0.107	0.121	0.135	0	500	8.655	8.674	8.694	8.713	8.733	8.752	8.772	8.791	8.810	8.830	8.849	500	
10	0.135	0.148	0.162	0.176	0.189	0.203	0.217	0.231	0.244	0.258	0.272	10	510	8.849	8.869	8.888	8.908	8.927	8.947	8.966	8.986	9.005	9.024	9.044	510	
20	0.272	0.286	0.300	0.314	0.328	0.342	0.356	0.370	0.384	0.398	0.412	20	520	9.044	9.063	9.083	9.102	9.122	9.141	9.161	9.180	9.200	9.219	9.239	520	
30	0.412	0.426	0.440	0.454	0.469	0.483	0.497	0.511	0.525	0.540	0.554	30	530	9.239	9.258	9.278	9.297	9.317	9.336	9.356	9.375	9.395	9.414	9.434	530	
40	0.554	0.568	0.583	0.597	0.612	0.626	0.640	0.655	0.669	0.684	0.698	40	540	9.434	9.453	9.473	9.492	9.512	9.531	9.551	9.570	9.590	9.609	9.629	540	
50	0.698	0.713	0.727	0.742	0.757	0.771	0.786	0.801	0.815	0.830	0.845	50	550	9.629	9.648	9.668	9.687	9.707	9.726	9.746	9.765	9.785	9.804	9.824	550	
60	0.845	0.860	0.874	0.889	0.904	0.919	0.934	0.948	0.963	0.978	0.993	60	560	9.824	9.843	9.863	9.883	9.902	9.922	9.941	9.961	9.980	10.000	10.019	560	
70	0.993	1.008	1.023	1.038	1.053	1.068	1.083	1.098	1.114	1.129	1.144	70	570	10.019	10.039	10.058	10.078	10.097	10.117	10.137	10.156	10.176	10.195	10.215	570	
80	1.144	1.159	1.174	1.189	1.205	1.220	1.235	1.250	1.266	1.281	1.296	80	580	10.215	10.234	10.254	10.273	10.293	10.312	10.332	10.352	10.371	10.391	10.410	580	
90	1.296	1.312	1.327	1.342	1.358	1.373	1.389	1.404	1.420	1.435	1.451	90	590	10.410	10.430	10.449	10.469	10.488	10.508	10.528	10.547	10.567	10.586	10.606	590	
100	1.451	1.466	1.482	1.497	1.513	1.529	1.544	1.560	1.576	1.591	1.607	100	600	10.606	10.625	10.645	10.664	10.684	10.703	10.723	10.743	10.762	10.782	10.801	600	
110	1.607	1.623	1.639	1.654	1.670	1.686	1.702	1.718	1.733	1.749	1.765	110	610	10.801	10.821	10.840	10.860	10.879	10.899	10.919	10.938	10.958	10.977	10.997	610	
120	1.765	1.781	1.797	1.813	1.829	1.845	1.861	1.877	1.893	1.909	1.925	120	620	10.997	11.016	11.036	11.055	11.075	11.095	11.114	11.134	11.153	11.173	11.192	620	
130	1.925	1.941	1.957	1.973	1.989	2.006	2.022	2.038	2.054	2.070	2.087	130	630	11.192	11.212	11.231	11.251	11.270	11.290	11.310	11.329	11.349	11.368	11.388	630	
140	2.087	2.103	2.119	2.135	2.152	2.168	2.184	2.201	2.217	2.233	2.250	140	640	11.388	11.407	11.427	11.446	11.466	11.485	11.505	11.525	11.544	11.564	11.583	640	
150	2.250	2.266	2.283	2.299	2.316	2.332	2.349	2.365	2.382	2.398	2.415	150	650	11.583	11.603	11.622	11.642	11.661	11.681	11.700	11.720	11.739	11.759	11.778	650	
160	2.415	2.431	2.448	2.464	2.481	2.498	2.514	2.531	2.548	2.564	2.581	160	660	11.778	11.798	11.817	11.837	11.857	11.876	11.896	11.915	11.935	11.954	11.974	660	
170	2.581	2.598	2.614	2.631	2.648	2.665	2.682	2.698	2.715	2.732	2.749	170	670	11.974	11.993	12.013	12.032	12.052	12.071	12.091	12.110	12.130	12.149	12.169	670	
180	2.749	2.766	2.783	2.800	2.816	2.833	2.850	2.867	2.884	2.901	2.918	180	680	12.169	12.188	12.208	12.227	12.247	12.266	12.286	12.305	12.325	12.344	12.364	680	
190	2.918	2.935	2.952	2.969	2.986	3.003	3.020	3.038	3.055	3.072	3.089	190	690	12.364	12.383	12.403	12.422	12.442	12.461	12.481	12.500	12.520	12.539	12.558	690	
200	3.089	3.106	3.123	3.140	3.158	3.175	3.192	3.209	3.227	3.244	3.26	200	700	12.558	12.578	12.597	12.617	12.636	12.656	12.675	12.695	12.714	12.734	12.753	700	
210	3.261	3.278	3.296	3.313	3.330	3.348	3.365	3.382	3.400	3.417	3.434	210	710	12.753	12.772	12.792	12.811	12.831	12.850	12.870	12.889	12.909	12.928	12.947	710	
220	3.434	3.452	3.469	3.487	3.504	3.522	3.539	3.557	3.574	3.592	3.609	220	720	12.947	12.967	12.986	13.006	13.025	13.045	13.064	13.083	13.103	13.122	13.142	720	
230	3.609	3.627	3.644	3.662	3.679	3.697	3.714	3.732	3.750	3.767	3.785	230	730	13.142	13.161	13.180	13.200	13.219	13.239	13.258	13.277	13.297	13.316	13.336	730	
240	3.785	3.803	3.820	3.838	3.856	3.873	3.891	3.909	3.927	3.944	3.962	240	740	13.336	13.355	13.374	13.394	13.413	13.432	13.452	13.471	13.491	13.510	13.529	740	
250	3.962	3.980	3.998	4.015	4.033	4.051	4.069	4.087	4.104	4.122	4.140	250	750	13.529	13.549	13.568	13.587	13.607	13.626	13.645	13.665	13.684	13.703	13.723	750	
260	4.140	4.158	4.176	4.194	4.212	4.230	4.248	4.266	4.284	4.301	4.319	260	760	13.723	13.742	13.761	13.781	13.800	13.819	13.839	13.858	13.877	13.897	13.916	760	
270	4.319	4.337	4.355	4.373	4.391	4.410	4.428	4.446	4.464	4.482	4.500	270	770	13.916	13.935	13.955	13.974	13.993	14.012	14.032	14.051	14.070	14.090	14.109	770	
280	4.500	4.518	4.536	4.554	4.572	4.590	4.608	4.627	4.645	4.663	4.681	280	780	14.109	14.128	14.147	14.167	14.186	14.205	14.224	14.244	14.263	14.282	14.302	780	
290	4.681	4.699	4.717	4.736	4.754	4.772	4.790	4.809	4.827	4.845	4.863	290	790	14.302	14.321	14.340	14.359	14.378	14.398	14.417	14.436	14.455	14.474	14.494	790	
300	4.863	4.882	4.900	4.918	4.937	4.955	4.973	4.992	5.010	5.028	5.047	300	800	14.494	14.513	14.532	14.551	14.571	14.590	14.609	14.628	14.647	14.667	14.686	800	
310	5.047	5.065	5.083	5.102	5.120	5.139	5.157	5.175	5.194	5.212	5.231	310	810	14.686	14.705	14.724	14.743	14.762	14.782	14.801	14.820	14.839	14.858	14.877	810	
320	5.231	5.249	5.268	5.286	5.305	5.323	5.342	5.360	5.379	5.397	5.416	320	820	14.877	14.897	14.916	14.935	14.954	14.973	14.992	15.011	15.030	15.050	15.069	820	
330	5.416	5.434	5.453	5.471	5.490	5.508	5.527	5.546	5.564	5.583	5.601	330	830	15.069	15.088	15.107	15.126	15.145	15.164	15.183	15.202	15.221	15.241	15.260	830	
340	5.601	5.620	5.639	5.657	5.676	5.695	5.713	5.732	5.751	5.769	5.788	340	840	15.260	15.279	15.298	15.317	15.336	15.355	15.374	15.393	15.412	15.431	15.450	840	
350	5.788	5.807	5.825	5.844	5.863	5.882	5.900	5.919	5.938	5.956	5.975	350	850	15.450	15.469	15.488	15.507	15.526	15.545	15.564	15.583	15.602	15.621	15.640	850	
360	5.975	5.994	6.013	6.032	6.050	6.069	6.088	6.107	6.126	6.144	6.163	360	860	15.640	15.659	15.678	15.697	15.716	15.735	15.754	15.773	15.792	15.811	15.830	860	
370	6.163	6.182	6.201	6.220	6.239	6.257	6.276	6.295	6.314	6.333	6.352	370	870	15.830	15.849	15.868	15.887	15.906	15.925	15.944	15.963	15.982	16.001	16.020	870	
380	6.352	6.371	6.390	6.409	6.427	6.446	6.465	6.484	6.503	6.522	6.541	380	880	16.020	16.038	16.057	16.076	16.095	16.114	16.133	16.152	16.171	16.190	16.208	880	
390	6.541	6.560	6.579	6.598	6.617	6.636	6.655	6.674	6.693	6.712	6.731	390	890	16.208	16.227	16.246	16.265	16.284	16.303	16.322	16.340	16.359	16.378	16.397	890	
400	6.731	6.750	6.769	6.788	6.807	6.826	6.845	6.864	6.883	6.902	6.921	400	900	16.39												