

# Temperature Equivalent Chart for Orton Pyrometric Cones (° F) Cone Numbers 022-14



Cone	Self Supporting Cones						Large Cones			Small
	Regular		Iron Free		Iron Free		Regular	Iron Free	Regular	Regular
	27	108	270	27	108	270	108	270	108	540
Heating Rate ° F/hour (last 180° F of firing)										
022	1087	1094	N/A	N/A	N/A	N/A	1166			
021	1112	1143	N/A	N/A	N/A	1189				
020	1159	1180	N/A	N/A	N/A	1231				
019	1213	1252	1283	1249	1279	1333				
018	1267	1319	1353	1314	1350	1386				
017	1301	1360	1405	1357	1402	1443				
016	1368	1422	1465	1416	1461	1517				
015	1382	1456	1504	1450	1501	1549				
014	1395	1485	1540	1485	1537	1598				
013	1485	1539	1582	1539	1578	1616				
012	1549	1582	1620	1576	1616	1652				
011	1575	1607	1641	1603	1638	1679				
010	1636	1657	1679	1600	1627	1639	1648	1675	1623	1636
09	1665	1688	1706	1650	1686	1702	1683	1702	1683	1699
08	1692	1728	1753	1695	1735	1755	1728	1749	1733	1751
07	1764	1789	1809	1747	1780	1800	1783	1805	1778	1796
06	1798	1828	1855	1776	1816	1828	1823	1852	1816	1825
05½	1839	1859	1877	1814	1854	1870	1854	1873	1852	1868
05	1870	1888	1911	1855	1899	1915	1886	1915	1890	1911
04	1915	1945	1971	1909	1942	1956	1940	1958	1940	1953
03	1960	1987	2019	1951	1990	1999	1987	2014	1989	1996
02	1972	2016	2052	1983	2021	2039	2014	2048	2016	2035
01	1999	2046	2080	2014	2053	2073	2043	2079	2052	2070
1	2028	2079	2109	2046	2082	2098	2077	2109	2079	2095
2	2034	2088	2127	2066	2109	2124	2088	2124	2104	2120
3	2039	2106	2138	2086	2124	2144	2106	2134	2104	2120
4	2086	2124	2161	2086	2124	2144	2120	2158	2104	2120
5	2118	2167	2205	2163	2201	2216	2163	2201	2104	2120
5½	2133	2197	2237	2194	2233	2248	2194	2233	2104	2120
6	2165	2232	2269	2228	2266	2281	2228	2266	2104	2120
7	2194	2262	2295	2259	2291	2306	2259	2291	2104	2120
8	2212	2280	2320	2277	2316	2331	2277	2316	2104	2120
9	2235	2300	2336	2295	2332	2347	2295	2332	2104	2120
10	2284	2345	2381	2340	2377	2392	2340	2377	2104	2120
11	2322	2361	2399	2359	2394	2409	2359	2394	2104	2120
12	2345	2383	2419	2379	2415	2430	2379	2415	2104	2120
13	2389	2428	2458	2410*	2455*	2470	2410*	2455*	2104	2120
14	2464	2489	2523	2491*	2530*	2545	2491*	2530*	2104	2120

Pyrometric cones have been used to monitor ceramic firings for more than 100 years. They are useful in determining when a firing is complete, if the kiln provided enough heat, if there was a temperature difference in the kiln or if a problem occurred during the firing.

Cones are made from carefully controlled compositions. They bend in a repeatable manner (over a relatively small temperature range - usually less than 40° F). The final bending position is an indication of how much heat was absorbed.

### Behavior of Pyrometric Cones

Typically, it takes 15 to 25 minutes for a cone to bend once it starts. This depends on the cone number. The cone bends slowly at first but once it reaches the half way point (3 o'clock), it bends quickly. When the cone tip reaches a point level with the base, it is considered properly fired. This is the point for which temperature equivalents are determined. Differences between a cone touching the shelf and a cone at the 4 o'clock position are small, usually 1 or 2 degrees.

Temperatures shown on the charts were determined under controlled firing conditions in electric kilns and an air atmosphere. Temperatures are shown for specific heating rates. These heating rates are for the last 100° C or 180° F of the firing. Different heating rates will change the equivalent

temperature. The temperature will be higher for faster heating rates and lower for slower heating rates.

Cone bending may also be affected by reducing atmospheres or those containing sulfur oxides. Orton recommends the use of Iron-Free cones for all reduction firings (cones 010-3). If a cone is heated too fast, the cone surface fuses and binders used to make cones form gases that bloat the cone. If cones are to be fired rapidly, they should be calcined (pre-fired) before use. Cones should be calcined to about 850° F (455° C) in an air atmosphere.

If a cone is soaked at a temperature near its equivalent temperature, it will continue to mature, form glass and bend. The time for the cone to bend depends on several factors and as a general rule, a 1 to 2 hour soak is sufficient to deform the next higher cone number. A soak of 4 to 6 hours will be required to deform two higher (hotter) cones.

for more information on pyrometric cones, contact Orton or visit us at [www.ortonceramic.com](http://www.ortonceramic.com)

The Edward Orton Jr. Ceramic Foundation  
 P.O. Box 2760 • Westerville, OH 43086-2760  
 (614) 895-2663 • (614) 895-5610 fax  
[info@ortonceramic.com](mailto:info@ortonceramic.com)  
[www.ortonceramic.com](http://www.ortonceramic.com)

These tables provide a guide for the selection of cones. The actual bending temperature depends on firing conditions. Once the appropriate cones are selected, excellent, reproducible results can be expected. Temperatures shown are for specific mounted height above base. For Self Supporting - 1 3/4"; for Large - 2"; for Small - 1 5/16". For Large Cones mounted at 1 3/4" height, use Self Supporting temperatures. \* These Large Cones have different compositions and different temperature equivalents.

# Temperature Equivalent Chart for Orton Pyrometric Cones (°C) Cone Numbers 022-14



Cone	Self Supporting Cones						Large Cones			Small	
	Regular			Iron Free			Regular			Iron Free	
	Heating Rate °C/hour (last 100° C of firing)										
	15	60	150	15	60	150	60	150	60	150	300
022		586	590				N/A	N/A			630
021		600	617				N/A	N/A			643
020		626	638				N/A	N/A			666
019	656	678	695				676	693			723
018	686	715	734				712	732			752
017	705	738	763				736	761			784
016	742	772	796				769	794			825
015	750	791	818				788	816			843
014	757	807	838				807	836			870
013	807	837	861				837	859			880
012	843	861	882				858	880			900
011	857	875	894				873	892			915
010	891	903	915	871	886	893	898	913	884	891	919
009	907	920	930	899	919	928	917	928	917	926	955
008	922	942	956	924	946	957	942	954	945	955	983
007	962	976	987	953	971	982	973	985	970	980	1008
006	981	998	1013	969	991	998	995	1011	991	996	1023
05½	1004	1015	1025	990	1012	1021	1012	1023	1011	1020	1043
05	1021	1031	1044	1013	1037	1046	1030	1046	1032	1044	1062
04	1046	1063	1077	1043	1061	1069	1060	1070	1060	1067	1098
03	1071	1086	1104	1066	1088	1093	1086	1101	1087	1091	1131
02	1078	1102	1122	1084	1105	1115	1101	1120	1102	1113	1148
01	1093	1119	1138	1101	1123	1134	1117	1137	1122	1132	1178
1	1109	1137	1154	1119	1139	1148	1136	1154	1137	1146	1184
2	1112	1142	1164				1142	1162			1190
3	1115	1152	1170	1130	1154	1162	1152	1168	1151	1160	1196
4	1141	1162	1183				1160	1181			1209
5	1159	1186	1207				1184	1205			1221
5½	1167	1203	1225				1201	1223			N/A
6	1185	1222	1243				1220	1241			1255
7	1201	1239	1257				1237	1255			1264
8	1211	1249	1271				1247	1269			1300
9	1224	1260	1280				1257	1278			1317
10	1251	1285	1305				1282	1303			1330
11	1272	1294	1315				1293	1312			1336
12	1285	1306	1326				1304	1324			1355
13	1310	1331	1348				1321*	1346*			N/A
14	1351	1365	1384				1366*	1388*			N/A

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