

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		
	Heating Rate ° F/hour (last 180° F of firing)										
	27	108	270	27	108	270	108	270	108	270	540
022		1087	1094				N/A	N/A			1166
021		1112	1143				N/A	N/A			1189
020		1159	1180				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	1686
09	1665	1688	1706	1650	1686	1702	1683	1702	1683	1699	1751
08	1692	1728	1753	1695	1735	1755	1728	1749	1733	1751	1801
07	1764	1789	1809	1747	1780	1800	1783	1805	1778	1796	1846
06	1798	1828	1855	1776	1816	1828	1823	1852	1816	1825	1873
05½	1839	1859	1877	1814	1854	1870	1854	1873	1852	1868	1909
05	1870	1888	1911	1855	1899	1915	1886	1915	1890	1911	1944
04	1915	1945	1971	1909	1942	1956	1940	1958	1940	1953	2008
03	1960	1987	2019	1951	1990	1999	1987	2014	1989	1996	2068
02	1972	2016	2052	1983	2021	2039	2014	2048	2016	2035	2098
01	1999	2046	2080	2014	2053	2073	2043	2079	2052	2070	2152
1	2028	2079	2109	2046	2082	2098	2077	2109	2079	2095	2163
2	2034	2088	2127				2088	2124			2174
3	2039	2106	2138	2066	2109	2124	2106	2134	2104	2120	2185
4	2086	2124	2161				2120	2158			2208
5	2118	2167	2205				2163	2201			2230
5½	2133	2197	2237				2194	2233			N/A
6	2165	2232	2269				2228	2266			2291
7	2194	2262	2295				2259	2291			2307
8	2212	2280	2320				2277	2316			2372
9	2235	2300	2336				2295	2332			2403
10	2284	2345	2381				2340	2377			2426
11	2322	2361	2399				2359	2394			2437
12	2345	2383	2419				2379	2415			2471
13	2389	2428	2458				2410*	2455*			N/A
14	2464	2489	2523				2491*	2530*			N/A

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

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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	N/A	N/A	630				
021	600	617	N/A	N/A	N/A	643					
020	626	638	N/A	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
005	1021	1031	1044	1013	1037	1046	1030	1046	1032	1044	1062
004	1046	1063	1077	1043	1061	1069	1060	1070	1060	1067	1098
003	1071	1086	1104	1066	1088	1093	1086	1101	1087	1091	1131
002	1078	1102	1122	1084	1105	1115	1101	1120	1102	1113	1148
001	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	1130	1154	1162	1142	1162	1151	1160	1190
3	1115	1152	1170	1130	1154	1162	1152	1168	1151	1160	1196
4	1141	1162	1183	1160	1181	1181	1160	1181	1151	1160	1209
5	1159	1186	1207	1184	1205	1205	1184	1205	1151	1160	1221
5½	1167	1203	1225	1201	1223	1223	1201	1223	1151	1160	N/A
6	1185	1222	1243	1220	1241	1241	1220	1241	1151	1160	1255
7	1201	1239	1257	1237	1255	1255	1237	1255	1151	1160	1264
8	1211	1249	1271	1247	1269	1269	1247	1269	1151	1160	1300
9	1224	1260	1280	1257	1278	1278	1257	1278	1151	1160	1317
10	1251	1285	1305	1282	1303	1303	1282	1303	1151	1160	1330
11	1272	1294	1315	1293	1312	1312	1293	1312	1151	1160	1336
12	1285	1306	1326	1304	1324	1324	1304	1324	1151	1160	1355
13	1310	1331	1348	1321*	1346*	1346*	1321*	1346*	1151	1160	N/A
14	1351	1365	1384	1366*	1388*	1388*	1366*	1388*	1151	1160	N/A

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