ASTM E119, NON-LOADED
FIRE RESISTANCE & HOSE STREAM TESTING
FOR
PERMACAST
ON
PERMACAST FIRE TEST PANEL

[redacted]

April 21, 2025

Client: Permacast
6015 21st St. E
Bradebton, FL 34203

Attn: [redacted]

Subject: Non-Loaded Fire Resistance Testing According to ASTM E119

SAMPLE DESCRIPTION: PermacastFire Test Panel

The wall was made up of three panels butted side by side. Each panel was 10'-6" x 3'-6" x 6" thick. The panel were installed in the test frame so that the 10'-6" side was vertical. Angles were run along the top and bottom of each side of the test panel to secure it in place.

Thermocouples secured to the unexposed side of the wall were placed in accordance to ASTM E119 requirements.

[redacted]

PROCEDURE:

Fire Endurance Test:

The furnace used in this test measures10 ft wide by 10 ft high. The outside construction is steel and the furnace is lined with a ceramic refractory insulation. A single burner is centered vertically in the wall opposite the sample. This burner is rated for 1.5 million Btu/hr and is of the flat flame or non-impinging flame design. Two additional burners were mounted on the side of the furnace. Furnace conditions are monitored by nine Inconel-sheathed chromel-alumel thermocouples. These thermocouples are positioned approximately 6" from the face of the sample.

The sample was oriented vertically in the front opening of the 10 ft wide by 10 ft high furnace opening. The unexposed surface temperature of the sample was monitored by nine, 20-gauge type K, fiberglass sheathed thermocouples. An insulating pad was placed over each thermocouple on the unexposed side of the sample.

The metal frame in which the wall assembly is installed was wheeled over in position and locked in place. All gaps and openings between the wall assembly and furnace were filled with a ceramic refractory insulation. Once secured, the burners and data acquisition system were turned on and the test was started. The fire test was run following the ASTM E119 time-temperature curve.

The endpoint for the ASTM E 119 fire test occurs when either all the thermocouples on the sample reach an average of 250ºF plus ambient starting temperature, or any individual thermocouple on the sample exceeds 325ºF plus ambient starting temperature, or when the sample experiences burn-through.

Hose Stream Test:

Immediately after the fire endurance test the sample was subjected to the impact, erosion, and cooling effects of a hose stream directed first at the middle and then all parts of the sample.

The stream was delivered through a 2-1/2" hose equipped with a 1-1/8" discharge tip. The distance between the nozzle tip and the sample was 20 feet. The sample was exposed to the hose stream for 2-1/2 minutes.

The sample shall be considered to have failed the hose stream test if any opening develops that permits a projection of water beyond the unexposed surface.

OBSERVATIONS AND RESULTS:

The ambient temperature was 75□F.

At 15 minutes, water was running down the unexposed surface of the wall, which stopped around 1 hour into the test.

After 24 minutes the wall assembly met all of the passing requirements and the furnace was shut off.

The sample withstood the Hose Stream Test without any openings formed that permit a projection of water beyond the unexposed surface.

.The time-temperature data are contained on the following pages.

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[redacted] [redacted]

Executive Director Technical Director

DISCLAIMER: This test should be used to measure and describe the properties of materials, products or assemblies in response to heat and flame under controlled laboratory conditions and should not be used to describe or appraise the fire hazards or fire risks of materials, products or assemblies under actual fire conditions. However, results of this test may be used as elements of a fire risk assessment, which takes into account all of the factors that are pertinent to an assessment of fire hazard of a particular end use.

Notice: [redacted] will not be liable for any loss or damage resulting from the use of the data in this report, in excess of the invoice. This report pertains to the sample tested only. Such report shall not be interpreted to be a warranty, either expressed or implied as to the suitability or fitness of said sample for such uses or applications, as the party contracting for the report may apply such sample.

Unexposed Temperature											
Time	1	2	3	4	5	6	7	8	9	Unexposed Avg.	Furnace Avg.
(min)	degF	degF	degF	degF	degF	degF	degF	degF	degF	degF	degF
0	76	76	76	75	76	75	75	75	75	76	75
0.5	76	76	76	76	76	75	75	75	76	76	175
1	76	76	76	75	76	75	75	75	75	76	288
1.5	76	76	76	75	75	75	75	75	75	76	405
2	76	76	76	75	75	75	75	75	75	75	515
2.5	76	76	76	75	76	75	75	75	75	76	619
3	76	76	76	76	76	75	75	75	76	76	725
3.5	76	76	76	75	76	75	75	75	75	76	814
4	76	76	76	75	76	75	75	75	75	76	886
4.5	76	76	76	75	76	75	75	75	75	76	943
5	76	76	76	75	76	75	75	75	76	76	989
5.5	76	76	76	76	76	75	75	75	75	76	1026
6	76	76	76	76	76	75	75	75	75	76	1056
6.5	76	76	76	76	76	75	75	75	76	76	1179
7	76	76	76	76	76	75	75	75	76	76	1199
7.5	76	76	76	75	76	75	75	75	75	76	1216
8	76	76	76	76	76	75	75	75	75	76	1230
8.5	76	76	76	75	76	75	75	75	76	76	1241
9	76	76	76	75	76	75	75	75	75	76	1253
9.5	76	76	76	76	76	75	75	75	76	76	1264
10	76	76	76	76	76	75	75	75	76	76	1272
10.5	76	76	76	76	76	75	75	75	76	76	1279
11	76	76	76	76	76	75	75	75	76	76	1285
11.5	76	76	76	76	76	75	75	75	76	76	1291
12	76	76	76	76	76	75	75	75	75	76	1298
12.5	76	76	76	76	76	75	75	75	75	76	1304
13	76	76	76	76	76	75	75	75	76	76	1311
13.5	76	76	76	76	76	75	75	75	76	76	1316
14	76	76	76	76	76	75	75	75	76	76	1322
14.5	76	76	76	76	76	75	75	75	76	76	1327
15	76	76	76	76	76	75	75	75	76	76	1335

Unexposed Temperature											
Time	1	2	3	4	5	6	7	8	9	Unexposed Avg.	Furnace Avg.
(min)	degF	degF	degF	degF	degF	degF	degF	degF	degF	degF	degF
15.5	76	76	76	76	76	75	75	75	76	76	1351
16	76	76	76	76	76	75	75	75	76	76	1363
16.5	76	76	76	76	76	75	75	75	76	76	1372
17	77	76	76	76	76	75	75	75	76	76	1381
17.5	77	76	76	76	76	75	75	75	76	76	1388
18	77	76	76	76	76	75	76	75	76	76	1399
18.5	77	76	76	76	76	75	76	75	76	76	1409
19	77	76	76	76	76	75	75	76	76	76	1419
19.5	77	76	76	76	76	75	76	75	76	76	1425
20	77	76	76	76	76	76	76	76	76	76	1432
20.5	77	76	76	76	76	75	76	75	76	76	1438
21	77	76	76	76	76	76	76	76	76	76	1447
21.5	77	77	76	76	76	76	76	76	76	76	1464
22	77	77	76	76	76	76	76	76	76	76	1476
22.5	77	77	76	76	76	76	76	76	76	76	1485
23	77	77	76	76	76	76	76	76	76	76	1494
23.5	77	77	76	76	76	76	76	76	76	76	1501
24	77	77	76	76	76	76	76	76	76	76	1507
24.5	77	77	77	76	76	76	76	76	76	76	1512
25	77	77	77	76	77	76	76	76	76	76	1517
25.5	77	77	77	76	77	76	76	76	76	76	1523
26	77	77	77	77	77	76	76	76	76	76	1527
26.5	77	77	77	77	77	76	76	76	76	76	1533
27	77	77	77	77	77	76	76	76	76	76	1537
27.5	77	77	77	77	77	76	76	77	76	77	1541
28	77	77	77	77	77	76	76	77	76	77	1545
28.5	77	77	77	77	77	76	76	77	77	77	1549
29	77	77	77	77	77	76	76	77	77	77	1554
29.5	78	78	77	77	77	77	77	77	77	77	1557
30	78	78	77	77	78	77	77	77	77	77	1562
30.5	78	78	78	77	78	77	77	78	77	77	1566

Unexposed Temperature											
Time	1	2	3	4	5	6	7	8	9	Unexposed Avg.	Furnace Avg.
(min)	degF	degF	degF	degF	degF	degF	degF	degF	degF	degF	degF
31	78	78	78	78	78	77	77	78	77	78	1571
31.5	78	78	78	78	78	77	77	78	77	78	1574
32	78	79	78	78	78	77	77	78	77	78	1578
32.5	78	79	78	78	79	77	77	79	77	78	1534
33	79	79	78	78	79	77	77	79	77	78	1544
33.5	79	79	78	79	79	78	78	79	78	78	1553
34	79	79	79	79	79	78	78	80	78	79	1560
34.5	79	80	79	79	80	78	78	80	78	79	1566
35	79	80	79	79	80	78	78	80	78	79	1573
35.5	79	80	79	79	80	78	78	80	78	79	1578
36	80	80	80	80	81	78	78	81	79	80	1584
36.5	80	81	80	80	81	78	79	81	79	80	1589
37	80	81	80	80	81	79	79	82	79	80	1594
37.5	80	81	80	81	82	79	79	82	79	80	1599
38	80	82	80	81	82	79	79	82	80	81	1604
38.5	81	82	81	81	82	80	80	83	80	81	1610
39	81	82	81	82	83	80	80	83	80	81	1613
39.5	81	83	81	82	83	80	80	84	80	82	1617
40	81	83	82	82	84	80	80	84	80	82	1623
40.5	82	83	82	82	84	81	81	85	81	82	1626
41	82	84	82	83	85	82	81	85	81	83	1631
41.5	82	84	83	83	85	82	82	86	81	83	1585
42	82	85	83	84	86	82	82	86	82	83	1589
42.5	83	85	83	84	86	82	82	87	82	84	1593
43	83	85	84	85	87	83	83	87	82	84	1597
43.5	84	86	84	85	87	83	83	88	83	85	1602
44	84	86	85	85	88	84	84	89	83	85	1604
44.5	84	87	85	86	88	84	84	90	84	86	1609
45	85	87	86	86	89	85	85	90	84	86	1613
45.5	85	88	86	87	89	85	85	91	84	87	1619
46	86	88	86	87	90	86	86	92	85	87	1634

Unexposed Temperature											
Time	1	2	3	4	5	6	7	8	9	Unexposed Avg.	Furnace Avg.
(min)	degF	degF	degF	degF	degF	degF	degF	degF	degF	degF	degF
46.5	86	89	87	88	91	87	86	92	85	88	1596
47	86	90	87	88	91	87	87	93	86	88	1605
47.5	87	90	88	89	92	88	87	94	86	89	1614
48	87	91	88	89	93	89	88	95	87	90	1620
48.5	88	91	89	90	93	89	89	95	87	90	1623
49	88	92	89	91	94	91	89	96	88	91	1629
49.5	89	92	90	91	95	91	90	97	88	91	1634
50	89	93	91	92	95	92	91	98	89	92	1640
50.5	90	94	91	93	96	94	91	99	89	93	1644
51	90	94	92	93	97	95	92	100	90	94	1648
51.5	91	95	93	94	97	96	93	100	91	94	1651
52	91	96	93	95	98	97	93	101	91	95	1629
52.5	92	96	94	95	99	99	94	102	92	96	1636
53	93	97	94	96	100	100	95	103	93	97	1644
53.5	93	97	95	96	100	102	96	104	93	97	1646
54	94	98	96	97	101	104	96	105	94	98	1652
54.5	94	99	96	98	102	107	97	106	95	99	1659
55	95	100	97	99	103	109	98	107	95	100	1663
55.5	95	100	98	99	103	110	99	108	96	101	1667
56	96	101	98	100	104	112	100	109	97	102	1670
56.5	97	102	99	101	105	115	100	110	98	103	1675
57	97	103	100	102	106	116	101	110	98	104	1680
57.5	98	103	100	102	107	118	102	112	99	105	1684
58	99	104	101	103	107	120	103	112	100	105	1688
58.5	99	105	102	104	108	123	104	113	101	106	1692
59	100	106	103	105	109	125	105	114	102	107	1696
59.5	101	107	104	106	110	128	105	115	102	109	1700
60	101	107	105	107	111	131	106	116	103	110	1704
60.5	102	108	105	107	111	133	107	117	104	111	1709
61	103	109	106	108	112	136	108	118	105	112	1711
61.5	104	110	107	109	113	138	109	119	106	113	1713

Unexposed Temperature											
Time	1	2	3	4	5	6	7	8	9	Unexposed Avg.	Furnace Avg.
(min)	degF	degF	degF	degF	degF	degF	degF	degF	degF	degF	degF
62	104	111	108	110	114	140	110	120	106	114	1718
62.5	105	111	109	111	115	141	111	121	107	115	1723
63	106	112	110	112	116	143	112	122	109	116	1724
63.5	107	113	110	112	116	145	112	123	110	117	1726
64	107	114	111	113	117	147	113	124	111	117	1729
64.5	108	115	112	114	118	148	114	125	111	118	1731
65	109	115	113	115	119	150	115	126	112	119	1734
65.5	110	116	113	116	120	151	116	127	112	120	1743
66	110	117	114	117	121	152	117	128	113	121	1751
66.5	111	118	115	118	122	153	118	129	114	122	1757
67	112	119	115	119	122	154	119	130	114	123	1763
67.5	113	120	116	120	123	155	120	131	115	124	1770
68	114	121	116	121	124	157	121	132	116	124	1774
68.5	114	122	116	122	125	158	122	133	116	125	1730
69	115	122	117	123	126	159	122	134	117	126	1734
69.5	116	123	117	123	127	160	123	135	118	127	1737
70	117	124	118	124	127	161	124	136	119	128	1740
70.5	118	125	119	125	128	161	125	137	119	129	1745
71	119	126	119	126	129	162	126	138	120	129	1749
71.5	119	127	120	127	130	162	127	140	121	130	1747
72	120	128	121	128	131	163	128	140	122	131	1747
72.5	121	129	121	129	132	164	129	141	122	132	1751
73	122	130	122	130	132	164	130	142	123	133	1756
73.5	123	130	123	131	133	165	131	143	124	134	1756
74	124	131	123	132	134	165	132	144	124	134	1757
74.5	125	132	124	133	135	166	133	146	125	135	1763
75	125	133	125	134	136	167	134	146	126	136	1765
75.5	126	134	125	135	137	168	135	147	126	137	1766
76	127	135	126	136	138	168	136	148	127	138	1768
76.5	128	136	127	137	139	169	137	149	128	139	1771
77	129	137	127	138	140	169	138	150	128	139	1773

Unexposed Temperature											
Time	1	2	3	4	5	6	7	8	9	Unexposed Avg.	Furnace Avg.
(min)	degF	degF	degF	degF	degF	degF	degF	degF	degF	degF	degF
77.5	129	138	128	139	140	170	138	151	129	140	1775
78	131	139	129	140	141	170	139	152	129	141	1754
78.5	131	139	129	141	142	170	140	153	130	142	1754
79	132	140	130	142	143	169	141	154	130	142	1757
79.5	133	141	131	143	144	169	142	155	131	143	1759
80	134	142	131	144	145	169	143	156	132	144	1762
80.5	135	143	132	144	145	169	144	157	132	145	1763
81	136	144	132	145	146	169	145	158	133	145	1765
81.5	136	144	133	146	147	169	146	159	134	146	1769
82	137	146	134	147	148	169	147	160	135	147	1770
82.5	138	146	134	148	149	169	148	161	136	148	1772
83	139	147	135	149	150	169	149	162	136	148	1774
83.5	140	148	136	150	150	168	150	163	137	149	1775
84	141	149	136	151	151	168	150	163	138	150	1776
84.5	141	150	137	152	152	169	151	164	138	150	1780
85	142	150	137	153	153	170	152	165	139	151	1782
85.5	143	151	138	154	154	171	153	166	140	152	1781
86	144	152	139	155	155	174	154	167	140	153	1782
86.5	145	153	139	155	156	176	155	168	141	154	1785
87	145	154	140	156	156	179	156	169	141	155	1789
87.5	146	155	141	157	157	180	157	170	141	156	1790
88	147	156	142	158	158	182	158	171	141	157	1791
88.5	148	156	143	159	159	185	159	172	142	158	1792
89	149	157	143	160	160	189	159	172	141	159	1794
89.5	149	158	144	161	161	191	160	173	142	160	1795
90	150	159	144	161	161	194	161	174	142	161	1798
90.5	151	160	145	162	162	193	162	175	142	161	1798
91	152	161	144	163	163	199	163	176	142	162	1800
91.5	153	161	145	164	164	199	164	176	142	163	1803
92	154	162	145	165	165	203	165	177	142	164	1804
92.5	154	163	145	166	165	205	165	178	143	165	1806

Unexposed Temperature											
Time	1	2	3	4	5	6	7	8	9	Unexposed Avg.	Furnace Avg.
(min)	degF	degF	degF	degF	degF	degF	degF	degF	degF	degF	degF
93	155	164	145	167	167	203	166	179	143	165	1807
93.5	156	165	145	167	167	201	167	180	143	166	1807
94	157	166	145	168	168	202	168	180	144	166	1808
94.5	157	166	145	169	169	207	169	181	144	167	1810
95	158	167	145	170	170	207	170	182	144	168	1811
95.5	159	168	146	171	171	204	170	183	144	168	1812
96	160	169	146	171	171	195	171	183	145	168	1814
96.5	161	170	146	172	172	188	172	184	146	168	1816
97	161	170	146	173	173	194	173	185	146	169	1817
97.5	162	171	146	174	174	196	174	186	147	170	1797
98	163	172	147	175	175	194	175	186	147	170	1800
98.5	163	173	147	176	176	197	176	187	147	171	1802
99	164	174	147	176	176	199	176	188	148	172	1802
99.5	165	175	147	177	177	197	177	189	148	173	1803
100	166	175	147	178	178	197	178	190	149	173	1803
100.5	167	176	148	179	179	199	179	190	149	174	1804
101	167	177	148	179	180	197	180	191	150	174	1806
101.5	168	178	148	180	180	198	180	192	151	175	1807
102	168	179	148	181	181	201	181	192	151	176	1808
102.5	169	179	148	182	182	203	182	193	151	177	1809
103	170	180	148	183	183	201	183	194	152	177	1811
103.5	171	181	149	183	183	201	184	195	152	177	1812
104	172	182	149	184	184	199	184	195	152	178	1813
104.5	172	183	149	185	185	201	185	196	153	179	1816
105	173	183	149	185	186	201	186	196	153	179	1816
105.5	174	184	149	186	186	201	186	197	153	180	1817
106	174	185	149	187	187	199	187	198	154	180	1818
106.5	175	186	150	188	188	204	188	199	154	181	1819
107	175	186	150	188	189	202	189	199	155	181	1821
107.5	176	187	150	189	189	198	190	200	155	182	1822
108	177	188	150	190	190	195	190	201	156	182	1823

Unexposed Temperature											
Time	1	2	3	4	5	6	7	8	9	Unexposed Avg.	Furnace Avg.
(min)	degF	degF	degF	degF	degF	degF	degF	degF	degF	degF	degF
108.5	177	189	150	191	191	198	191	201	156	183	1823
109	178	190	151	192	192	198	192	202	157	183	1824
109.5	179	190	151	192	193	195	192	203	157	184	1825
110	179	191	152	193	193	197	194	203	158	184	1826
110.5	180	192	152	194	194	197	194	204	158	185	1829
111	181	193	152	195	195	196	195	204	158	185	1830
111.5	181	194	152	195	195	196	195	205	159	186	1833
112	182	194	152	196	196	194	196	206	159	186	1838
112.5	183	195	153	197	197	196	197	206	160	187	1839
113	184	196	153	198	198	195	198	207	160	188	1842
113.5	184	197	154	198	199	185	199	208	161	187	1845
114	185	198	154	199	199	182	199	208	161	187	1848
114.5	186	198	154	200	200	178	200	209	162	187	1849
115	186	199	154	201	201	175	201	210	162	188	1853
115.5	187	200	155	201	201	155	201	210	162	186	1855
116	188	200	155	202	202	103	202	210	162	180	1857
116.5	188	201	155	203	203	93	203	211	162	180	1859
117	189	202	156	203	203	91	203	212	162	180	1862
117.5	190	202	156	204	204	86	204	212	162	180	1835
118	190	203	157	205	205	86	205	213	162	181	1834
118.5	191	204	157	205	205	87	205	213	162	181	1835
119	192	204	157	206	206	86	206	214	163	182	1836
119.5	192	205	158	207	207	95	207	214	163	183	1837
120	193	206	158	207	207	79	207	215	164	182	1839
120.5	194	206	158	208	208	104	208	215	165	185	1840
121	194	207	159	209	209	85	209	216	165	184	1843
121.5	195	208	159	210	209	83	209	216	166	184	1843
122	196	208	160	210	210	204	210	217	165	198	1847
122.5	196	209	160	211	210	210	210	217	164	199	1848
123	197	209	160	211	211	211	211	218	164	199	1849
123.5	197	210	160	212	212	210	212	218	163	199	1850

Unexposed Temperature											
Time	1	2	3	4	5	6	7	8	9	Unexposed Avg.	Furnace Avg.
(min)	degF	degF	degF	degF	degF	degF	degF	degF	degF	degF	degF
124	198	211	161	212	212	210	212	219	163	200	1852
124.5	199	211	161	213	213	210	213	219	163	200	1851
125	199	211	162	213	213	210	213	220	163	201	1852
125.5	200	212	162	214	214	209	214	220	164	201	1854
126	200	213	162	215	214	208	214	221	165	201	1859
126.5	201	213	163	215	215	210	215	221	165	202	1860
127	202	214	163	216	215	208	215	222	166	202	1858
127.5	202	214	164	216	216	208	216	222	166	203	1859
128	203	215	164	217	217	208	217	222	166	203	1858
128.5	203	215	165	217	217	210	217	223	166	204	1859
129	204	216	165	218	217	211	218	224	167	204	1862
129.5	205	216	165	219	218	211	218	224	166	205	1863
130	205	217	165	219	218	211	219	224	167	205	1864
130.5	206	217	165	220	219	211	219	225	166	205	1865
131	206	218	166	220	219	209	220	225	167	205	1866
131.5	207	218	166	221	220	209	220	226	166	206	1867
132	207	218	167	221	220	208	221	226	166	206	1867
132.5	208	219	167	222	221	210	221	226	166	206	1869
133	208	219	167	222	221	211	222	227	166	207	1870
133.5	209	220	167	222	222	211	222	227	166	207	1871
134	209	220	168	223	222	211	222	228	166	208	1872
134.5	210	220	168	223	222	211	223	228	166	208	1871
135	211	221	169	224	223	210	224	229	166	208	1872
135.5	211	221	169	224	223	210	224	229	165	209	1874
136	211	222	170	225	224	212	224	229	165	209	1875
136.5	212	222	170	225	224	210	225	230	164	209	1876
137	212	222	170	226	224	211	225	230	164	209	1877
137.5	213	223	170	226	225	211	226	231	164	210	1879
138	213	223	170	226	225	211	226	231	163	210	1878
138.5	214	223	171	227	226	211	226	231	163	210	1878
139	214	224	171	227	226	211	227	232	163	210	1880

Unexposed Temperature											
Time	1	2	3	4	5	6	7	8	9	Unexposed Avg.	Furnace Avg.
(min)	degF	degF	degF	degF	degF	degF	degF	degF	degF	degF	degF
139.5	215	224	171	227	226	211	227	232	162	211	1879
140	215	224	172	228	227	210	228	232	163	211	1880
140.5	216	225	172	228	227	210	228	233	163	211	1881
141	216	225	172	229	227	211	228	233	163	211	1883
141.5	217	225	172	229	228	211	229	233	163	212	1884
142	217	226	173	229	228	210	229	234	163	212	1886
142.5	217	226	173	230	228	210	229	234	164	212	1884
143	218	226	173	230	229	211	230	235	164	213	1884
143.5	218	227	174	230	229	211	230	235	165	213	1884
144	219	227	174	231	229	211	230	235	165	213	1885
144.5	219	228	174	231	230	211	231	235	165	214	1886
145	220	228	175	231	230	211	231	236	165	214	1887
145.5	220	228	175	232	230	211	231	236	166	214	1888
146	221	228	176	232	231	210	231	237	166	215	1889
146.5	221	229	176	232	231	208	232	237	166	215	1889
147	221	229	176	233	231	210	232	237	166	215	1888
147.5	222	229	177	233	231	210	232	237	166	215	1889
148	222	229	177	233	232	210	233	238	167	216	1889
148.5	222	230	178	233	232	211	233	238	167	216	1889
149	223	230	178	234	232	210	233	239	167	216	1890
149.5	223	231	179	234	233	211	233	239	167	217	1891
150	224	231	179	235	233	211	234	239	167	217	1891
150.5	224	231	180	235	233	209	234	239	167	217	1892
151	224	231	180	235	233	211	234	240	167	217	1894
151.5	225	231	180	235	234	210	235	240	168	218	1893
152	225	232	181	236	234	210	235	240	168	218	1893
152.5	226	232	181	236	234	210	235	241	168	218	1894
153	226	232	182	236	235	211	235	241	168	218	1894
153.5	226	232	182	237	235	210	236	241	168	219	1894
154	227	233	183	237	235	211	236	241	168	219	1895
154.5	227	233	183	237	235	212	236	242	168	219	1895

Unexposed Temperature											
Time	1	2	3	4	5	6	7	8	9	Unexposed Avg.	Furnace Avg.
(min)	degF	degF	degF	degF	degF	degF	degF	degF	degF	degF	degF
155	227	233	184	237	236	211	236	242	168	219	1896
155.5	228	233	185	238	236	211	237	242	168	220	1897
156	228	233	185	238	236	211	237	243	168	220	1897
156.5	228	233	186	238	237	212	237	243	168	220	1898
157	229	234	187	239	237	213	237	243	168	221	1898
157.5	229	234	188	239	237	212	237	244	169	221	1898
158	229	234	190	239	237	212	237	244	168	221	1899
158.5	230	235	191	239	237	212	238	244	169	222	1902
159	230	235	192	240	238	213	238	244	169	222	1903
159.5	231	235	194	240	238	214	238	244	169	223	1906
160	231	235	196	240	238	215	239	245	169	223	1905
160.5	231	235	197	241	239	216	239	245	169	223	1908
161	231	236	198	241	239	217	239	246	169	224	1909
161.5	232	236	198	241	239	217	239	246	170	224	1910
162	232	236	199	241	239	218	239	246	170	224	1911
162.5	232	236	200	242	239	218	239	246	170	225	1912
163	232	236	201	242	240	217	239	246	170	225	1913
163.5	233	236	202	242	240	219	240	246	170	225	1912
164	233	237	202	242	240	220	240	247	170	225	1914
164.5	233	237	203	242	240	221	240	247	170	226	1916
165	233	237	203	243	240	220	240	247	170	226	1917
165.5	234	237	204	243	240	219	240	248	170	226	1918
166	234	237	204	243	241	220	240	248	170	226	1918
166.5	234	237	204	243	241	220	240	248	170	226	1920
167	235	237	205	244	241	220	241	248	170	227	1920
167.5	235	237	205	244	241	221	241	248	171	227	1921
168	235	238	205	244	242	220	241	249	171	227	1921
168.5	235	238	206	244	241	220	241	249	171	227	1922
169	235	238	206	244	242	219	241	249	170	227	1924
169.5	236	238	206	244	242	220	241	249	171	228	1922
170	236	238	206	245	242	221	241	249	171	228	1923

Unexposed Temperature											
Time	1	2	3	4	5	6	7	8	9	Unexposed Avg.	Furnace Avg.
(min)	degF	degF	degF	degF	degF	degF	degF	degF	degF	degF	degF
170.5	236	238	206	245	242	219	241	250	171	228	1924
171	237	239	207	245	242	217	242	250	172	228	1925
171.5	237	238	207	245	242	217	242	250	172	228	1925
172	237	239	207	246	243	220	242	250	172	228	1926
172.5	238	239	208	246	243	219	242	251	172	228	1926
173	238	239	208	246	243	219	242	251	172	229	1927
173.5	238	239	208	246	243	217	242	251	172	228	1928
174	238	239	208	246	243	218	242	251	173	229	1928
174.5	239	239	209	247	243	217	242	251	172	229	1929
175	239	239	209	247	243	217	242	251	173	229	1929
175.5	239	240	209	247	244	217	243	252	173	229	1929
176	239	240	209	247	244	217	243	252	174	229	1930
176.5	239	240	210	247	244	216	243	252	173	229	1930
177	240	240	210	247	244	217	243	252	174	230	1928
177.5	240	240	210	248	244	218	243	252	174	230	1932
178	240	240	210	248	244	216	243	253	174	230	1934
178.5	240	240	211	248	244	217	244	253	174	230	1936
179	241	240	211	248	245	216	244	253	175	230	1938
179.5	241	241	211	248	245	215	244	253	175	230	1939
180	241	241	212	248	245	215	244	253	176	230	1919
180.5	241	241	212	249	245	215	244	253	176	231	1913
181	242	241	212	249	245	215	244	254	177	231	1899
181.5	242	241	212	249	245	215	244	254	178	231	1892
182	242	241	213	249	245	214	244	254	179	231	1886
182.5	242	242	213	249	245	215	244	254	179	231	1924
183	242	242	213	250	246	215	244	254	179	232	1943
183.5	242	242	213	250	246	214	244	254	180	232	1929
184	243	242	214	250	246	216	245	255	181	232	1937
184.5	243	242	214	250	246	216	245	255	181	232	1942
185	243	242	214	250	246	215	245	255	182	233	1947
185.5	244	243	214	250	246	216	245	255	183	233	1928

Unexposed Temperature											
Time	1	2	3	4	5	6	7	8	9	Unexposed Avg.	Furnace Avg.
(min)	degF	degF	degF	degF	degF	degF	degF	degF	degF	degF	degF
186	244	243	215	251	246	216	245	255	183	233	1933
186.5	244	243	215	251	246	216	245	255	183	233	1937
187	244	243	215	251	247	216	245	256	184	233	1941
187.5	244	243	215	251	247	216	246	256	184	234	1943
188	245	244	216	251	247	217	246	256	184	234	1920
188.5	245	244	216	251	247	216	246	256	185	234	1923
189	245	244	216	251	247	217	246	256	185	234	1926
189.5	245	244	217	252	247	217	246	256	186	234	1928
190	245	244	217	252	247	216	246	257	187	234	1930
190.5	246	244	217	252	247	218	247	257	187	235	1930
191	246	244	217	252	248	218	247	257	188	235	1932
191.5	246	244	217	252	248	219	247	257	189	235	1934
192	246	244	218	253	248	219	247	257	190	236	1937
192.5	246	244	218	253	248	218	247	257	191	236	1937
193	247	245	218	253	248	219	247	257	191	236	1937
193.5	247	245	219	253	248	219	247	258	192	236	1938
194	247	245	219	253	248	219	248	258	193	237	1940
194.5	247	245	219	253	248	219	248	258	193	237	1941
195	248	245	219	254	249	219	248	258	194	237	1942
195.5	248	245	220	254	249	220	248	258	195	237	1944
196	248	245	220	254	249	221	248	258	195	237	1944
196.5	248	246	220	254	249	221	248	258	196	238	1946
197	248	246	220	254	249	221	248	259	196	238	1944
197.5	248	246	221	254	249	221	248	259	197	238	1946
198	249	246	221	255	249	221	249	259	198	238	1947
198.5	249	246	221	255	250	222	249	259	198	239	1948
199	249	246	221	255	250	222	249	260	199	239	1949
199.5	249	246	221	255	250	222	249	260	200	239	1949
200	249	247	222	255	250	222	249	260	200	239	1949
200.5	250	247	222	255	251	223	249	260	201	240	1951
201	250	247	222	255	251	222	249	260	201	240	1951

Unexposed Temperature											
Time	1	2	3	4	5	6	7	8	9	Unexposed Avg.	Furnace Avg.
(min)	degF	degF	degF	degF	degF	degF	degF	degF	degF	degF	degF
201.5	250	247	222	256	251	222	250	260	202	240	1951
202	250	247	223	256	251	222	250	261	202	240	1952
202.5	250	248	223	256	251	223	250	261	203	240	1953
203	250	248	223	256	251	222	250	261	203	241	1953
203.5	251	248	223	256	251	223	250	261	204	241	1952
204	251	248	224	257	252	224	251	262	205	241	1953
204.5	251	249	224	257	252	224	251	262	206	242	1954
205	251	249	224	257	252	224	251	262	206	242	1955
205.5	251	249	225	257	252	224	251	262	206	242	1955
206	252	249	225	257	253	223	251	262	207	242	1956
206.5	252	249	225	257	253	224	251	263	207	242	1956
207	252	250	226	258	253	225	252	263	208	243	1955
207.5	252	250	226	258	253	225	252	263	209	243	1956
208	253	250	226	258	254	225	252	263	209	243	1955
208.5	253	250	227	258	254	226	252	264	210	244	1954
209	253	251	227	258	254	226	253	264	210	244	1956
209.5	253	251	227	258	254	226	253	264	211	244	1956
210	253	251	227	258	255	226	253	264	211	244	1956
210.5	254	251	228	259	255	226	253	265	212	245	1955
211	254	252	228	259	255	227	253	265	212	245	1954
211.5	254	252	228	259	255	228	254	265	213	245	1956
212	254	252	228	259	255	228	254	265	213	246	1955
212.5	255	252	229	260	256	228	254	266	214	246	1955
213	255	253	229	260	256	229	255	266	215	246	1954
213.5	255	253	230	260	257	229	255	266	215	247	1955
214	255	254	230	260	257	229	255	267	215	247	1956
214.5	256	254	230	260	257	229	255	267	216	247	1956
215	256	254	230	261	257	229	256	267	217	247	1956
215.5	256	254	231	261	258	230	256	267	217	248	1957
216	256	254	231	261	258	229	256	268	217	248	1957
216.5	256	255	232	261	258	230	257	268	218	248	1958

Unexposed Temperature											
Time	1	2	3	4	5	6	7	8	9	Unexposed Avg.	Furnace Avg.
(min)	degF	degF	degF	degF	degF	degF	degF	degF	degF	degF	degF
217	257	255	232	262	258	230	257	268	219	249	1958
217.5	257	255	232	262	259	231	257	269	219	249	1957
218	257	255	233	262	259	231	257	269	219	249	1957
218.5	257	256	233	262	259	231	257	269	220	249	1958
219	257	256	233	262	259	231	258	269	220	250	1958
219.5	258	256	234	263	260	231	258	269	221	250	1959
220	258	257	234	263	260	231	258	270	221	250	1959
220.5	258	257	235	263	260	231	258	270	222	250	1958
221	258	257	235	263	261	232	259	270	222	251	1959
221.5	259	257	235	263	261	233	259	271	223	251	1959
222	259	258	236	264	261	233	259	271	223	251	1960
222.5	259	258	236	264	261	233	260	271	224	252	1961
223	259	258	236	264	262	234	260	272	224	252	1959
223.5	260	259	237	265	262	235	260	272	225	253	1960
224	260	259	237	265	263	234	261	272	226	253	1959
224.5	260	259	238	265	263	235	261	273	226	253	1962
225	260	260	238	265	263	235	261	273	227	254	1961
225.5	261	260	238	265	263	235	261	273	227	254	1961
226	261	260	239	266	264	236	262	273	228	254	1961
226.5	261	261	239	266	264	236	262	274	229	255	1962
227	262	261	240	266	264	236	262	274	229	255	1962
227.5	262	261	240	266	265	235	263	274	230	255	1964
228	262	261	240	266	265	237	263	275	230	255	1964
228.5	262	262	241	267	265	236	263	275	231	256	1963
229	262	262	241	267	266	238	263	275	231	256	1964
229.5	263	262	242	267	266	238	264	275	232	257	1966
230	263	263	242	267	266	239	264	276	233	257	1965
230.5	263	263	243	267	266	239	264	276	233	257	1965
231	263	263	243	268	267	238	265	276	234	257	1967
231.5	263	263	243	268	267	238	265	277	234	258	1969
232	264	264	243	268	267	239	265	277	235	258	1970

Unexposed Temperature											
Time	1	2	3	4	5	6	7	8	9	Unexposed Avg.	Furnace Avg.
(min)	degF	degF	degF	degF	degF	degF	degF	degF	degF	degF	degF
232.5	264	264	244	268	268	239	265	277	235	258	1969
233	264	264	244	269	268	240	266	278	236	259	1969
233.5	265	265	245	269	268	239	266	278	237	259	1970
234	265	265	245	269	269	240	266	278	238	259	1971
234.5	265	266	246	269	269	241	266	279	239	260	1972
235	265	266	246	270	270	240	267	279	239	260	1971
235.5	266	266	247	270	270	241	267	279	240	261	1974
236	266	267	247	270	270	243	267	280	241	261	1975
236.5	266	267	247	271	271	243	268	280	241	261	1976
237	266	267	248	271	271	243	268	280	242	262	1977
237.5	267	268	248	271	271	244	268	280	243	262	1978
238	267	268	249	271	272	243	269	281	244	263	1977
238.5	267	269	249	271	272	242	269	281	245	263	1976
239	267	269	250	272	272	243	269	282	246	263	1976
239.5	268	269	250	272	273	243	270	282	247	264	1978
240	268	270	251	272	273	244	270	282	248	264	1978
240.5	268	270	251	273	273	245	270	283	249	265	1980
241	269	270	251	273	274	244	271	283	250	265	1981
241.5	269	271	252	273	274	245	271	283	251	265	1982
242	269	271	253	273	275	245	271	284	252	266	1983