

# Alternate Temperature Assessment

**Issued: July 30, 2021**

**UL Category Code: CHPX**

**Product: Type Pyrocrete 341**

**Report ID: XR747-1**

**COMPANY:**

**CARBOLINE CO  
350 HANLEY INDUSTRIAL CT  
SAINT LOUIS, MO, 63144-1510  
USA**



Type Pyrocrete 341 spray-applied fire resistive material is a cementitious mixture applied for fire resistance protection of structural steel framing members. This report is limited to the analysis and alternate limiting temperature thicknesses for the type of structural steel (e.g. column) as shown in the table here within.

During the standard UL 1709 evaluation, the thickness of the fire resistive material is established based on limiting steel temperatures of 1000°F (538°C) average limit and 1200°F (649°C) individual limit for columns. Based on the fire tests conducted and the performance of the fire resistive material, alternate limiting temperature thickness tables have been established. An alternate limiting temperature table is a UL design specific matrix that identifies the appropriate coating thickness for a selected steel size, limiting steel temperature, and a specified time duration. These tables are provided as additional information only, for implementation by Authorities Having Jurisdiction. The UL 1709 test method has a similar approach for establishing fire resistance ratings and therefore lends itself to this type of engineering analysis. This information is intended to be used in conjunction with the specified UL Design only. All requirements specified in the UL Design shall be met to achieve the appropriate analysis.

Refer to UL File R7209 for product Classification under category Spray-applied Fire-resistive Materials (CHPX), and Column Design No. XR747 for the fire resistance ratings developed in accordance with UL1709. The alternate limiting temperature thicknesses are intended to be used in conjunction with UL Design No. XR747 only. All required components specified in the referenced UL Design shall remain as required components to achieve the time periods shown using the alternate limiting temperature thicknesses. Only the version of UL Design No. XR747 as shown on Product iQ at [www.ul.com](http://www.ul.com) is considered current.

Type Pyrocrete 341 spray-applied fire resistive material described in this report shall be identified by a marking bearing the report holder's name or UL file number, the product name and the UL Classification Mark. The validity of this alternate temperature assessment is contingent upon this identification appearing on the product.

**Appendix A – Alternate Limiting Temperature Tables**

**Table A1 – Alternate Limiting Temperature 250°C (Metric)**

W/D	Hp/A	Min Required Thickness (mm) for Hourly Rating Period (min)									
		15	30	45	60	90	120	150	180	240	300
0.33	406	18	20	24	27	37	45	NR	NR	NR	NR
0.40	335	18	20	23	27	35	43	NR	NR	NR	NR
0.50	268	16	18	23	26	34	42	NR	NR	NR	NR
0.60	223	15	16	21	24	32	40	NR	NR	NR	NR
0.70	191	13	16	20	23	32	39	43	NR	NR	NR
0.80	167	10	15	18	23	31	37	40	43	50	NR
0.84	160	10	13	18	21	31	37	40	42	47	51
0.90	149	10	13	18	21	31	37	40	42	47	51
1.00	134	10	13	18	21	29	37	40	42	47	51
1.10	122	10	13	16	21	29	37	40	42	47	51
1.20	112	8	13	16	21	29	37	40	42	47	51
1.30	103	8	12	16	20	29	37	40	42	47	51
1.40	96	8	12	16	20	29	37	40	42	47	51
1.50	89	8	12	15	20	29	35	40	42	47	51
1.60	84	8	10	15	20	27	35	40	42	47	51
1.70	79	8	10	15	20	27	35	40	42	47	51
1.80	74	8	10	15	18	27	35	40	42	47	51
1.90	71	7	10	13	18	27	35	40	42	47	51
2.00	67	7	8	13	18	27	35	40	42	47	51
2.10	64	7	8	13	18	26	35	40	42	47	51
2.20	61	7	8	13	18	26	35	40	42	47	51
2.30	58	7	8	13	16	26	35	40	42	47	51
2.40	56	7	7	12	16	26	35	40	42	47	51
2.50	54	7	7	12	16	26	35	40	42	47	51
2.52	53	5	7	12	16	26	35	40	42	47	51

**Table A2 – Alternate Limiting Temperature 482°F (Imperial)**

W/D	Hp/A	Min Required Thickness (in.) for Hourly Rating Period (min)									
		15	30	45	60	90	120	150	180	240	300
0.33	406	11/16	3/4	15/16	1 1/16	1 7/16	1 3/4	NR	NR	NR	NR
0.40	335	11/16	3/4	7/8	1 1/16	1 3/8	1 11/16	NR	NR	NR	NR
0.50	268	5/8	11/16	7/8	1	1 5/16	1 5/8	NR	NR	NR	NR
0.60	223	9/16	5/8	13/16	15/16	1 1/4	1 9/16	NR	NR	NR	NR
0.70	191	1/2	5/8	3/4	7/8	1 1/4	1 1/2	1 11/16	NR	NR	NR
0.80	167	3/8	9/16	11/16	7/8	1 3/16	1 7/16	1 9/16	1 11/16	1 15/16	NR
0.84	160	3/8	1/2	11/16	13/16	1 3/16	1 7/16	1 9/16	1 5/8	1 13/16	2
0.90	149	3/8	1/2	11/16	13/16	1 3/16	1 7/16	1 9/16	1 5/8	1 13/16	2
1.00	134	3/8	1/2	11/16	13/16	1 1/8	1 7/16	1 9/16	1 5/8	1 13/16	2
1.10	122	3/8	1/2	5/8	13/16	1 1/8	1 7/16	1 9/16	1 5/8	1 13/16	2
1.20	112	5/16	1/2	5/8	13/16	1 1/8	1 7/16	1 9/16	1 5/8	1 13/16	2
1.30	103	5/16	7/16	5/8	3/4	1 1/8	1 7/16	1 9/16	1 5/8	1 13/16	2
1.40	96	5/16	7/16	5/8	3/4	1 1/8	1 7/16	1 9/16	1 5/8	1 13/16	2
1.50	89	5/16	7/16	9/16	3/4	1 1/8	1 3/8	1 9/16	1 5/8	1 13/16	2
1.60	84	5/16	3/8	9/16	3/4	1 1/16	1 3/8	1 9/16	1 5/8	1 13/16	2
1.70	79	5/16	3/8	9/16	3/4	1 1/16	1 3/8	1 9/16	1 5/8	1 13/16	2
1.80	74	5/16	3/8	9/16	11/16	1 1/16	1 3/8	1 9/16	1 5/8	1 13/16	2
1.90	71	1/4	3/8	1/2	11/16	1 1/16	1 3/8	1 9/16	1 5/8	1 13/16	2
2.00	67	1/4	5/16	1/2	11/16	1 1/16	1 3/8	1 9/16	1 5/8	1 13/16	2
2.10	64	1/4	5/16	1/2	11/16	1	1 3/8	1 9/16	1 5/8	1 13/16	2
2.20	61	1/4	5/16	1/2	11/16	1	1 3/8	1 9/16	1 5/8	1 13/16	2
2.30	58	1/4	5/16	1/2	5/8	1	1 3/8	1 9/16	1 5/8	1 13/16	2
2.40	56	1/4	1/4	7/16	5/8	1	1 3/8	1 9/16	1 5/8	1 13/16	2
2.50	54	1/4	1/4	7/16	5/8	1	1 3/8	1 9/16	1 5/8	1 13/16	2
2.52	53	3/16	1/4	7/16	5/8	1	1 3/8	1 9/16	1 5/8	1 13/16	2

**Table A3 – Alternate Limiting Temperature 300°C (Metric)**

W/D	Hp/A	Min Required Thickness (mm) for Hourly Rating Period (min)									
		15	30	45	60	90	120	150	180	240	300
0.33	406	18	20	23	26	34	42	NR	NR	NR	NR
0.40	335	18	18	21	26	32	40	NR	NR	NR	NR
0.50	268	16	16	21	24	32	39	NR	NR	NR	NR
0.60	223	13	16	20	23	31	39	43	NR	NR	NR
0.70	191	12	15	18	21	29	37	42	45	NR	NR
0.78	172	10	13	18	21	27	35	40	43	50	NR
0.80	167	10	13	16	21	27	35	39	42	48	NR
0.84	160	10	13	16	20	27	35	39	42	47	51
0.90	149	10	13	16	20	27	35	39	42	47	51
1.00	134	10	12	16	20	26	34	39	42	47	51
1.10	122	8	12	15	20	26	34	39	42	47	51
1.20	112	8	12	15	18	26	34	39	42	47	51
1.30	103	8	12	15	18	26	34	39	42	47	51
1.40	96	8	10	13	18	24	32	39	42	47	51
1.50	89	8	10	13	18	24	32	39	42	47	51
1.60	84	8	10	13	16	24	32	39	42	47	51
1.70	79	8	10	13	16	24	32	39	42	47	51
1.80	74	7	8	12	16	24	32	37	42	47	51
1.90	71	7	8	12	15	23	31	37	42	47	51
2.00	67	7	8	12	15	23	31	37	42	47	51
2.10	64	7	8	12	15	23	31	37	42	47	51
2.20	61	7	7	10	15	23	31	37	42	47	51
2.30	58	7	7	10	13	21	31	37	42	47	51
2.40	56	7	7	10	13	21	29	37	42	47	51
2.50	54	7	7	8	13	21	29	37	42	47	51
2.52	53	5	5	8	13	21	29	37	42	47	51

**Table A4 – Alternate Limiting Temperature 572°F (Imperial)**

W/D	Hp/A	Min Required Thickness (in.) for Hourly Rating Period (min)									
		15	30	45	60	90	120	150	180	240	300
0.33	406	11/16	3/4	7/8	1	1 5/16	1 5/8	NR	NR	NR	NR
0.40	335	11/16	11/16	13/16	1	1 1/4	1 9/16	NR	NR	NR	NR
0.50	268	5/8	5/8	13/16	15/16	1 1/4	1 1/2	NR	NR	NR	NR
0.60	223	1/2	5/8	3/4	7/8	1 3/16	1 1/2	1 11/16	NR	NR	NR
0.70	191	7/16	9/16	11/16	13/16	1 1/8	1 7/16	1 5/8	1 3/4	NR	NR
0.78	172	3/8	1/2	11/16	13/16	1 1/16	1 3/8	1 9/16	1 11/16	1 15/16	NR
0.80	167	3/8	1/2	5/8	13/16	1 1/16	1 3/8	1 1/2	1 5/8	1 7/8	NR
0.84	160	3/8	1/2	5/8	3/4	1 1/16	1 3/8	1 1/2	1 5/8	1 13/16	2
0.90	149	3/8	1/2	5/8	3/4	1 1/16	1 3/8	1 1/2	1 5/8	1 13/16	2
1.00	134	3/8	7/16	5/8	3/4	1	1 5/16	1 1/2	1 5/8	1 13/16	2
1.10	122	5/16	7/16	9/16	3/4	1	1 5/16	1 1/2	1 5/8	1 13/16	2
1.20	112	5/16	7/16	9/16	11/16	1	1 5/16	1 1/2	1 5/8	1 13/16	2
1.30	103	5/16	7/16	9/16	11/16	1	1 5/16	1 1/2	1 5/8	1 13/16	2
1.40	96	5/16	3/8	1/2	11/16	15/16	1 1/4	1 1/2	1 5/8	1 13/16	2
1.50	89	5/16	3/8	1/2	11/16	15/16	1 1/4	1 1/2	1 5/8	1 13/16	2
1.60	84	5/16	3/8	1/2	5/8	15/16	1 1/4	1 1/2	1 5/8	1 13/16	2
1.70	79	5/16	3/8	1/2	5/8	15/16	1 1/4	1 1/2	1 5/8	1 13/16	2
1.80	74	1/4	5/16	7/16	5/8	15/16	1 1/4	1 7/16	1 5/8	1 13/16	2
1.90	71	1/4	5/16	7/16	9/16	7/8	1 3/16	1 7/16	1 5/8	1 13/16	2
2.00	67	1/4	5/16	7/16	9/16	7/8	1 3/16	1 7/16	1 5/8	1 13/16	2
2.10	64	1/4	5/16	7/16	9/16	7/8	1 3/16	1 7/16	1 5/8	1 13/16	2
2.20	61	1/4	1/4	3/8	9/16	7/8	1 3/16	1 7/16	1 5/8	1 13/16	2
2.30	58	1/4	1/4	3/8	1/2	13/16	1 3/16	1 7/16	1 5/8	1 13/16	2
2.40	56	1/4	1/4	3/8	1/2	13/16	1 1/8	1 7/16	1 5/8	1 13/16	2
2.50	54	1/4	1/4	5/16	1/2	13/16	1 1/8	1 7/16	1 5/8	1 13/16	2
2.52	53	3/16	3/16	5/16	1/2	13/16	1 1/8	1 7/16	1 5/8	1 13/16	2

**Table A5 – Alternate Limiting Temperature 350°C (Metric)**

W/D	Hp/A	Min Required Thickness (mm) for Hourly Rating Period (min)									
		15	30	45	60	90	120	150	180	240	300
0.33	406	18	18	21	24	32	39	45	NR	NR	NR
0.40	335	18	18	21	24	31	37	45	NR	NR	NR
0.50	268	16	16	20	23	29	37	43	NR	NR	NR
0.60	223	15	15	18	21	27	35	42	47	NR	NR
0.70	191	15	15	16	20	26	34	40	43	NR	NR
0.80	167	13	13	16	20	26	32	39	42	48	NR
0.84	160	12	12	15	18	24	32	37	40	47	51
0.90	149	12	12	15	18	24	32	37	40	47	51
1.00	134	12	12	15	18	24	31	37	40	47	51
1.10	122	12	12	15	18	24	31	37	40	47	51
1.20	112	12	12	13	16	23	31	35	40	47	51
1.30	103	10	10	13	16	23	31	35	40	47	51
1.40	96	10	10	13	16	23	29	35	40	47	51
1.50	89	10	10	12	15	23	29	35	40	47	51
1.60	84	10	10	12	15	21	29	35	40	47	51
1.70	79	8	8	12	15	21	27	34	40	47	51
1.80	74	8	8	10	15	21	27	34	40	47	51
1.90	71	8	8	10	13	20	27	34	40	47	51
2.00	67	8	8	10	13	20	27	34	40	47	51
2.10	64	7	7	10	13	20	26	34	40	47	51
2.20	61	7	7	8	12	20	26	32	40	47	51
2.30	58	7	7	8	12	18	26	32	40	47	51
2.40	56	7	7	8	12	18	26	32	40	47	51
2.50	54	7	7	7	10	18	24	32	40	47	51
2.52	53	5	5	7	10	18	24	32	40	47	51

**Table A6 – Alternate Limiting Temperature 662°F (Imperial)**

W/D	Hp/A	Min Required Thickness (in.) for Hourly Rating Period (min)									
		15	30	45	60	90	120	150	180	240	300
0.33	406	11/16	11/16	13/16	15/16	1 1/4	1 1/2	1 3/4	NR	NR	NR
0.40	335	11/16	11/16	13/16	15/16	1 3/16	1 7/16	1 3/4	NR	NR	NR
0.50	268	5/8	5/8	3/4	7/8	1 1/8	1 7/16	1 11/16	NR	NR	NR
0.60	223	9/16	9/16	11/16	13/16	1 1/16	1 3/8	1 5/8	1 13/16	NR	NR
0.70	191	9/16	9/16	5/8	3/4	1	1 5/16	1 9/16	1 11/16	NR	NR
0.80	167	1/2	1/2	5/8	3/4	1	1 1/4	1 1/2	1 5/8	1 7/8	NR
0.84	160	7/16	7/16	9/16	11/16	15/16	1 1/4	1 7/16	1 9/16	1 13/16	2
0.90	149	7/16	7/16	9/16	11/16	15/16	1 1/4	1 7/16	1 9/16	1 13/16	2
1.00	134	7/16	7/16	9/16	11/16	15/16	1 3/16	1 7/16	1 9/16	1 13/16	2
1.10	122	7/16	7/16	9/16	11/16	15/16	1 3/16	1 7/16	1 9/16	1 13/16	2
1.20	112	7/16	7/16	1/2	5/8	7/8	1 3/16	1 3/8	1 9/16	1 13/16	2
1.30	103	3/8	3/8	1/2	5/8	7/8	1 3/16	1 3/8	1 9/16	1 13/16	2
1.40	96	3/8	3/8	1/2	5/8	7/8	1 1/8	1 3/8	1 9/16	1 13/16	2
1.50	89	3/8	3/8	7/16	9/16	7/8	1 1/8	1 3/8	1 9/16	1 13/16	2
1.60	84	3/8	3/8	7/16	9/16	13/16	1 1/8	1 3/8	1 9/16	1 13/16	2
1.70	79	5/16	5/16	7/16	9/16	13/16	1 1/16	1 5/16	1 9/16	1 13/16	2
1.80	74	5/16	5/16	3/8	9/16	13/16	1 1/16	1 5/16	1 9/16	1 13/16	2
1.90	71	5/16	5/16	3/8	1/2	3/4	1 1/16	1 5/16	1 9/16	1 13/16	2
2.00	67	5/16	5/16	3/8	1/2	3/4	1 1/16	1 5/16	1 9/16	1 13/16	2
2.10	64	1/4	1/4	3/8	1/2	3/4	1	1 5/16	1 9/16	1 13/16	2
2.20	61	1/4	1/4	5/16	7/16	3/4	1	1 1/4	1 9/16	1 13/16	2
2.30	58	1/4	1/4	5/16	7/16	11/16	1	1 1/4	1 9/16	1 13/16	2
2.40	56	1/4	1/4	5/16	7/16	11/16	1	1 1/4	1 9/16	1 13/16	2
2.50	54	1/4	1/4	1/4	3/8	11/16	15/16	1 1/4	1 9/16	1 13/16	2
2.52	53	3/16	3/16	1/4	3/8	11/16	15/16	1 1/4	1 9/16	1 13/16	2



**Table A7 – Alternate Limiting Temperature 400°C (Metric)**

W/D	Hp/A	Min Required Thickness (mm) for Hourly Rating Period (min)									
		15	30	45	60	90	120	150	180	240	300
0.33	406	18	18	21	24	31	37	43	NR	NR	NR
0.40	335	18	18	20	23	29	35	42	NR	NR	NR
0.50	268	16	16	18	21	27	34	40	NR	NR	NR
0.60	223	15	15	18	21	26	32	39	43	NR	NR
0.70	191	13	13	16	20	24	31	39	42	NR	NR
0.80	167	12	12	15	18	24	31	37	40	47	NR
0.84	160	12	12	15	18	23	29	35	39	45	NR
0.90	149	12	12	15	16	23	29	35	39	45	51
1.00	134	12	12	13	16	23	29	35	39	45	51
1.10	122	10	10	13	16	21	27	35	39	45	51
1.20	112	10	10	13	15	21	27	34	39	45	51
1.30	103	10	10	12	15	21	27	34	37	45	51
1.40	96	10	10	12	15	20	26	34	37	45	51
1.50	89	10	10	12	13	20	26	32	37	45	51
1.60	84	8	8	10	13	20	26	32	37	45	51
1.70	79	8	8	10	13	20	26	32	37	45	51
1.80	74	8	8	10	12	18	24	31	35	45	51
1.90	71	8	8	8	12	18	24	31	35	45	51
2.00	67	8	8	8	12	18	24	31	35	45	51
2.10	64	7	7	8	10	16	23	29	35	45	51
2.20	61	7	7	8	10	16	23	29	35	45	51
2.30	58	7	7	7	10	16	23	29	34	45	51
2.40	56	7	7	7	8	15	21	27	34	45	51
2.50	54	7	7	7	8	15	21	27	34	45	51
2.52	53	5	5	5	8	15	21	27	34	45	51

**Table A8 – Alternate Limiting Temperature 752°F (Imperial)**

W/D	Hp/A	Min Required Thickness (in.) for Hourly Rating Period (min)									
		15	30	45	60	90	120	150	180	240	300
0.33	406	11/16	11/16	13/16	15/16	1 3/16	1 7/16	1 11/16	NR	NR	NR
0.40	335	11/16	11/16	3/4	7/8	1 1/8	1 3/8	1 5/8	NR	NR	NR
0.50	268	5/8	5/8	11/16	13/16	1 1/16	1 5/16	1 9/16	NR	NR	NR
0.60	223	9/16	9/16	11/16	13/16	1	1 1/4	1 1/2	1 11/16	NR	NR
0.70	191	1/2	1/2	5/8	3/4	15/16	1 3/16	1 1/2	1 5/8	NR	NR
0.80	167	7/16	7/16	9/16	11/16	15/16	1 3/16	1 7/16	1 9/16	1 13/16	NR
0.84	160	7/16	7/16	9/16	11/16	7/8	1 1/8	1 3/8	1 1/2	1 3/4	NR
0.90	149	7/16	7/16	9/16	5/8	7/8	1 1/8	1 3/8	1 1/2	1 3/4	2
1.00	134	7/16	7/16	1/2	5/8	7/8	1 1/8	1 3/8	1 1/2	1 3/4	2
1.10	122	3/8	3/8	1/2	5/8	13/16	1 1/16	1 3/8	1 1/2	1 3/4	2
1.20	112	3/8	3/8	1/2	9/16	13/16	1 1/16	1 5/16	1 1/2	1 3/4	2
1.30	103	3/8	3/8	7/16	9/16	13/16	1 1/16	1 5/16	1 7/16	1 3/4	2
1.40	96	3/8	3/8	7/16	9/16	3/4	1	1 5/16	1 7/16	1 3/4	2
1.50	89	3/8	3/8	7/16	1/2	3/4	1	1 1/4	1 7/16	1 3/4	2
1.60	84	5/16	5/16	3/8	1/2	3/4	1	1 1/4	1 7/16	1 3/4	2
1.70	79	5/16	5/16	3/8	1/2	3/4	1	1 1/4	1 7/16	1 3/4	2
1.80	74	5/16	5/16	3/8	7/16	11/16	15/16	1 3/16	1 3/8	1 3/4	2
1.90	71	5/16	5/16	5/16	7/16	11/16	15/16	1 3/16	1 3/8	1 3/4	2
2.00	67	5/16	5/16	5/16	7/16	11/16	15/16	1 3/16	1 3/8	1 3/4	2
2.10	64	1/4	1/4	5/16	3/8	5/8	7/8	1 1/8	1 3/8	1 3/4	2
2.20	61	1/4	1/4	5/16	3/8	5/8	7/8	1 1/8	1 3/8	1 3/4	2
2.30	58	1/4	1/4	1/4	3/8	5/8	7/8	1 1/8	1 5/16	1 3/4	2
2.40	56	1/4	1/4	1/4	5/16	9/16	13/16	1 1/16	1 5/16	1 3/4	2
2.50	54	1/4	1/4	1/4	5/16	9/16	13/16	1 1/16	1 5/16	1 3/4	2
2.52	53	3/16	3/16	3/16	5/16	9/16	13/16	1 1/16	1 5/16	1 3/4	2

**Table A9 – Alternate Limiting Temperature 427°C (Metric)**

W/D	Hp/A	Min Required Thickness (mm) for Hourly Rating Period (min)									
		15	30	45	60	90	120	150	180	240	300
0.33	406	18	18	21	24	29	35	42	NR	NR	NR
0.40	335	18	18	20	23	29	35	42	NR	NR	NR
0.50	268	16	16	18	21	27	34	40	45	NR	NR
0.60	223	15	15	16	20	26	32	39	43	NR	NR
0.70	191	13	13	16	18	24	31	37	42	NR	NR
0.80	167	12	12	15	18	23	29	35	40	47	NR
0.84	160	12	12	15	16	23	29	35	39	45	51
0.90	149	12	12	13	16	21	27	34	39	45	51
1.00	134	10	10	13	16	21	27	34	39	45	51
1.10	122	10	10	13	15	21	27	34	37	45	51
1.20	112	10	10	12	15	21	26	32	37	45	51
1.30	103	10	10	12	15	20	26	32	37	45	51
1.40	96	10	10	12	13	20	26	32	35	45	51
1.50	89	8	8	12	13	20	24	31	35	45	51
1.60	84	8	8	10	13	18	24	31	35	45	51
1.70	79	8	8	10	12	18	24	31	35	45	51
1.80	74	8	8	10	12	18	23	29	34	45	51
1.90	71	8	8	8	12	16	23	29	34	45	51
2.00	67	8	8	8	10	16	23	27	34	45	51
2.10	64	7	7	8	10	16	21	27	32	45	51
2.20	61	7	7	7	10	15	21	27	32	45	51
2.30	58	7	7	7	8	15	21	26	32	45	51
2.40	56	7	7	7	8	15	20	26	32	45	51
2.50	54	7	7	7	8	13	20	26	31	45	51
2.52	53	5	5	5	8	13	20	26	31	45	51

**Table A10 – Alternate Limiting Temperature 800.6°F (Imperial)**

W/D	Hp/A	Min Required Thickness (in.) for Hourly Rating Period (min)									
		15	30	45	60	90	120	150	180	240	300
0.33	406	11/16	11/16	13/16	15/16	1 1/8	1 3/8	1 5/8	NR	NR	NR
0.40	335	11/16	11/16	3/4	7/8	1 1/8	1 3/8	1 5/8	NR	NR	NR
0.50	268	5/8	5/8	11/16	13/16	1 1/16	1 5/16	1 9/16	1 3/4	NR	NR
0.60	223	9/16	9/16	5/8	3/4	1	1 1/4	1 1/2	1 11/16	NR	NR
0.70	191	1/2	1/2	5/8	11/16	15/16	1 3/16	1 7/16	1 5/8	NR	NR
0.80	167	7/16	7/16	9/16	11/16	7/8	1 1/8	1 3/8	1 9/16	1 13/16	NR
0.84	160	7/16	7/16	9/16	5/8	7/8	1 1/8	1 3/8	1 1/2	1 3/4	2
0.90	149	7/16	7/16	1/2	5/8	13/16	1 1/16	1 5/16	1 1/2	1 3/4	2
1.00	134	3/8	3/8	1/2	5/8	13/16	1 1/16	1 5/16	1 1/2	1 3/4	2
1.10	122	3/8	3/8	1/2	9/16	13/16	1 1/16	1 5/16	1 7/16	1 3/4	2
1.20	112	3/8	3/8	7/16	9/16	13/16	1	1 1/4	1 7/16	1 3/4	2
1.30	103	3/8	3/8	7/16	9/16	3/4	1	1 1/4	1 7/16	1 3/4	2
1.40	96	3/8	3/8	7/16	1/2	3/4	1	1 1/4	1 3/8	1 3/4	2
1.50	89	5/16	5/16	7/16	1/2	3/4	15/16	1 3/16	1 3/8	1 3/4	2
1.60	84	5/16	5/16	3/8	1/2	11/16	15/16	1 3/16	1 3/8	1 3/4	2
1.70	79	5/16	5/16	3/8	7/16	11/16	15/16	1 3/16	1 3/8	1 3/4	2
1.80	74	5/16	5/16	3/8	7/16	11/16	7/8	1 1/8	1 5/16	1 3/4	2
1.90	71	5/16	5/16	5/16	7/16	5/8	7/8	1 1/8	1 5/16	1 3/4	2
2.00	67	5/16	5/16	5/16	3/8	5/8	7/8	1 1/16	1 5/16	1 3/4	2
2.10	64	1/4	1/4	5/16	3/8	5/8	13/16	1 1/16	1 1/4	1 3/4	2
2.20	61	1/4	1/4	1/4	3/8	9/16	13/16	1 1/16	1 1/4	1 3/4	2
2.30	58	1/4	1/4	1/4	5/16	9/16	13/16	1	1 1/4	1 3/4	2
2.40	56	1/4	1/4	1/4	5/16	9/16	3/4	1	1 1/4	1 3/4	2
2.50	54	1/4	1/4	1/4	5/16	1/2	3/4	1	1 3/16	1 3/4	2
2.52	53	3/16	3/16	3/16	5/16	1/2	3/4	1	1 3/16	1 3/4	2

**Table A11 – Alternate Limiting Temperature 450°C (Metric)**

W/D	Hp/A	Min Required Thickness (mm) for Hourly Rating Period (min)									
		15	30	45	60	90	120	150	180	240	300
0.33	406	18	18	20	23	29	35	40	NR	NR	NR
0.45	298	16	16	18	21	27	34	39	45	NR	NR
0.50	268	16	16	18	21	26	32	39	43	NR	NR
0.60	223	15	15	16	20	26	31	37	42	NR	NR
0.70	191	13	13	15	18	24	29	35	40	NR	NR
0.80	167	12	12	15	16	23	27	34	39	47	NR
0.84	160	12	12	13	16	21	27	34	39	45	51
0.90	149	10	10	13	16	21	27	32	37	45	51
1.00	134	10	10	13	15	21	26	32	37	45	51
1.10	122	10	10	13	15	20	26	32	37	45	51
1.20	112	10	10	12	15	20	26	31	35	43	51
1.30	103	10	10	12	13	20	24	31	35	43	51
1.40	96	10	10	12	13	18	24	31	35	43	51
1.50	89	8	8	10	13	18	24	29	34	43	51
1.60	84	8	8	10	12	18	23	29	34	43	51
1.70	79	8	8	10	12	16	23	27	34	43	51
1.80	74	8	8	10	12	16	21	27	32	42	51
1.90	71	8	8	8	10	16	21	27	32	42	51
2.00	67	7	7	8	10	15	21	26	32	42	51
2.10	64	7	7	8	8	15	20	26	31	42	51
2.20	61	7	7	7	8	15	20	26	31	42	51
2.30	58	7	7	7	8	13	20	24	31	40	51
2.35	57	7	7	7	8	13	20	24	29	40	51
2.40	56	7	7	7	7	13	18	24	29	40	51
2.50	54	7	7	7	7	13	18	23	29	40	51
2.52	53	5	5	5	7	12	18	23	29	40	51

**Table A12 – Alternate Limiting Temperature 842°F (Imperial)**

W/D	Hp/A	Min Required Thickness (in.) for Hourly Rating Period (min)									
		15	30	45	60	90	120	150	180	240	300
0.33	406	18	18	20	23	29	35	40	NR	NR	NR
0.45	298	16	16	18	21	27	34	39	45	NR	NR
0.50	268	16	16	18	21	26	32	39	43	NR	NR
0.60	223	15	15	16	20	26	31	37	42	NR	NR
0.70	191	13	13	15	18	24	29	35	40	NR	NR
0.80	167	12	12	15	16	23	27	34	39	47	NR
0.84	160	12	12	13	16	21	27	34	39	45	51
0.90	149	10	10	13	16	21	27	32	37	45	51
1.00	134	10	10	13	15	21	26	32	37	45	51
1.10	122	10	10	13	15	20	26	32	37	45	51
1.20	112	10	10	12	15	20	26	31	35	43	51
1.30	103	10	10	12	13	20	24	31	35	43	51
1.40	96	10	10	12	13	18	24	31	35	43	51
1.50	89	8	8	10	13	18	24	29	34	43	51
1.60	84	8	8	10	12	18	23	29	34	43	51
1.70	79	8	8	10	12	16	23	27	34	43	51
1.80	74	8	8	10	12	16	21	27	32	42	51
1.90	71	8	8	8	10	16	21	27	32	42	51
2.00	67	7	7	8	10	15	21	26	32	42	51
2.10	64	7	7	8	8	15	20	26	31	42	51
2.20	61	7	7	7	8	15	20	26	31	42	51
2.30	58	7	7	7	8	13	20	24	31	40	51
2.35	57	7	7	7	8	13	20	24	29	40	51
2.40	56	7	7	7	7	13	18	24	29	40	51
2.50	54	7	7	7	7	13	18	23	29	40	51
2.52	53	5	5	5	7	12	18	23	29	40	51

**Table A13 – Alternate Limiting Temperature 500°C (Metric)**

W/D	Hp/A	Min Required Thickness (mm) for Hourly Rating Period (min)									
		15	30	45	60	90	120	150	180	240	300
0.33	406	18	18	20	23	27	34	39	45	NR	NR
0.40	335	18	18	18	21	27	32	39	43	NR	NR
0.50	268	16	16	18	20	26	31	37	42	NR	NR
0.60	223	15	15	16	18	24	29	35	40	NR	NR
0.70	191	13	13	15	18	23	27	34	39	48	NR
0.80	167	12	12	13	16	21	26	32	37	45	NR
0.84	160	10	10	13	15	20	26	31	37	45	51
0.90	149	10	10	13	15	20	24	31	35	43	51
1.00	134	10	10	12	15	20	24	29	35	43	51
1.10	122	10	10	12	13	20	24	29	35	43	51
1.20	112	10	10	12	13	18	23	29	34	42	51
1.30	103	10	10	12	13	18	23	27	34	42	51
1.40	96	8	8	10	12	16	21	27	32	42	51
1.50	89	8	8	10	12	16	21	26	32	40	51
1.60	84	8	8	10	12	16	21	26	31	40	51
1.70	79	8	8	10	10	15	20	26	31	39	51
1.80	74	8	8	8	10	15	20	24	29	39	51
1.90	71	8	8	8	10	13	20	24	29	39	51
2.00	67	7	7	8	8	13	18	23	29	37	51
2.10	64	7	7	8	8	13	18	23	27	37	51
2.20	61	7	7	7	8	12	16	23	27	37	51
2.30	58	7	7	7	7	12	16	21	26	35	51
2.40	56	7	7	7	7	12	16	21	26	35	51
2.50	54	7	7	7	7	10	15	20	24	35	51
2.52	53	5	5	5	5	10	15	20	24	35	51

**Table A14 – Alternate Limiting Temperature 932°F (Imperial)**

W/D	Hp/A	Min Required Thickness (in.) for Hourly Rating Period (min)									
		15	30	45	60	90	120	150	180	240	300
0.33	406	11/16	11/16	3/4	7/8	1 1/16	1 5/16	1 1/2	1 3/4	NR	NR
0.40	335	11/16	11/16	11/16	13/16	1 1/16	1 1/4	1 1/2	1 11/16	NR	NR
0.50	268	5/8	5/8	11/16	3/4	1	1 3/16	1 7/16	1 5/8	NR	NR
0.60	223	9/16	9/16	5/8	11/16	15/16	1 1/8	1 3/8	1 9/16	NR	NR
0.70	191	1/2	1/2	9/16	11/16	7/8	1 1/16	1 5/16	1 1/2	1 7/8	NR
0.80	167	7/16	7/16	1/2	5/8	13/16	1	1 1/4	1 7/16	1 3/4	NR
0.84	160	3/8	3/8	1/2	9/16	3/4	1	1 3/16	1 7/16	1 3/4	2
0.90	149	3/8	3/8	1/2	9/16	3/4	15/16	1 3/16	1 3/8	1 11/16	2
1.00	134	3/8	3/8	7/16	9/16	3/4	15/16	1 1/8	1 3/8	1 11/16	2
1.10	122	3/8	3/8	7/16	1/2	3/4	15/16	1 1/8	1 3/8	1 11/16	2
1.20	112	3/8	3/8	7/16	1/2	11/16	7/8	1 1/8	1 5/16	1 5/8	2
1.30	103	3/8	3/8	7/16	1/2	11/16	7/8	1 1/16	1 5/16	1 5/8	2
1.40	96	5/16	5/16	3/8	7/16	5/8	13/16	1 1/16	1 1/4	1 5/8	2
1.50	89	5/16	5/16	3/8	7/16	5/8	13/16	1	1 1/4	1 9/16	2
1.60	84	5/16	5/16	3/8	7/16	5/8	13/16	1	1 3/16	1 9/16	2
1.70	79	5/16	5/16	3/8	3/8	9/16	3/4	1	1 3/16	1 1/2	2
1.80	74	5/16	5/16	5/16	3/8	9/16	3/4	15/16	1 1/8	1 1/2	2
1.90	71	5/16	5/16	5/16	3/8	1/2	3/4	15/16	1 1/8	1 1/2	2
2.00	67	1/4	1/4	5/16	5/16	1/2	11/16	7/8	1 1/8	1 7/16	2
2.10	64	1/4	1/4	5/16	5/16	1/2	11/16	7/8	1 1/16	1 7/16	2
2.20	61	1/4	1/4	1/4	5/16	7/16	5/8	7/8	1 1/16	1 7/16	2
2.30	58	1/4	1/4	1/4	1/4	7/16	5/8	13/16	1	1 3/8	2
2.40	56	1/4	1/4	1/4	1/4	7/16	5/8	13/16	1	1 3/8	2
2.50	54	1/4	1/4	1/4	1/4	3/8	9/16	3/4	15/16	1 3/8	2
2.52	53	3/16	3/16	3/16	3/16	3/8	9/16	3/4	15/16	1 3/8	2



**Table A15 – Alternate Limiting Temperature 550°C (Metric)**

W/D	Hp/A	Min Required Thickness (mm) for Hourly Rating Period (min)									
		15	30	45	60	90	120	150	180	240	300
0.33	406	18	18	18	21	27	32	37	43	NR	NR
0.40	335	18	18	18	21	26	31	37	42	NR	NR
0.50	268	16	16	16	20	24	29	34	40	NR	NR
0.60	223	15	15	15	18	23	27	32	39	NR	NR
0.70	191	13	13	13	16	21	26	31	37	47	NR
0.80	167	13	13	13	15	20	24	29	34	43	NR
0.84	160	12	12	12	15	20	24	29	34	43	51
0.90	149	12	12	12	15	18	23	27	34	43	51
1.00	134	12	12	12	13	18	23	27	32	42	51
1.10	122	12	12	12	13	18	23	27	32	42	51
1.20	112	10	10	10	13	16	21	26	31	40	51
1.30	103	10	10	10	12	16	21	26	31	40	51
1.40	96	10	10	10	12	15	20	24	29	39	51
1.50	89	10	10	10	12	15	20	24	29	39	51
1.60	84	10	10	10	10	15	18	23	27	37	51
1.70	79	8	8	8	10	13	18	23	27	37	51
1.80	74	8	8	8	10	13	18	21	26	35	51
1.90	71	8	8	8	8	12	16	21	26	35	51
2.00	67	8	8	8	8	12	16	21	24	34	51
2.10	64	7	7	7	8	12	15	20	24	34	51
2.20	61	7	7	7	8	10	15	20	24	32	51
2.30	58	7	7	7	7	10	13	18	23	32	51
2.40	56	7	7	7	7	8	13	18	23	31	51
2.50	54	7	7	7	7	8	13	16	21	31	51
2.52	53	5	5	5	5	8	13	16	21	29	51

**Table A16 – Alternate Limiting Temperature 1022°F (Imperial)**

W/D	Hp/A	Min Required Thickness (in.) for Hourly Rating Period (min)									
		15	30	45	60	90	120	150	180	240	300
0.33	406	11/16	11/16	11/16	13/16	1 1/16	1 1/4	1 7/16	1 11/16	NR	NR
0.40	335	11/16	11/16	11/16	13/16	1	1 3/16	1 7/16	1 5/8	NR	NR
0.50	268	5/8	5/8	5/8	3/4	15/16	1 1/8	1 5/16	1 9/16	NR	NR
0.60	223	9/16	9/16	9/16	11/16	7/8	1 1/16	1 1/4	1 1/2	NR	NR
0.70	191	1/2	1/2	1/2	5/8	13/16	1	1 3/16	1 7/16	1 13/16	NR
0.80	167	1/2	1/2	1/2	9/16	3/4	15/16	1 1/8	1 5/16	1 11/16	NR
0.84	160	7/16	7/16	7/16	9/16	3/4	15/16	1 1/8	1 5/16	1 11/16	2
0.90	149	7/16	7/16	7/16	9/16	11/16	7/8	1 1/16	1 5/16	1 11/16	2
1.00	134	7/16	7/16	7/16	1/2	11/16	7/8	1 1/16	1 1/4	1 5/8	2
1.10	122	7/16	7/16	7/16	1/2	11/16	7/8	1 1/16	1 1/4	1 5/8	2
1.20	112	3/8	3/8	3/8	1/2	5/8	13/16	1	1 3/16	1 9/16	2
1.30	103	3/8	3/8	3/8	7/16	5/8	13/16	1	1 3/16	1 9/16	2
1.40	96	3/8	3/8	3/8	7/16	9/16	3/4	15/16	1 1/8	1 1/2	2
1.50	89	3/8	3/8	3/8	7/16	9/16	3/4	15/16	1 1/8	1 1/2	2
1.60	84	3/8	3/8	3/8	3/8	9/16	11/16	7/8	1 1/16	1 7/16	2
1.70	79	5/16	5/16	5/16	3/8	1/2	11/16	7/8	1 1/16	1 7/16	2
1.80	74	5/16	5/16	5/16	3/8	1/2	11/16	13/16	1	1 3/8	2
1.90	71	5/16	5/16	5/16	5/16	7/16	5/8	13/16	1	1 3/8	2
2.00	67	5/16	5/16	5/16	5/16	7/16	5/8	13/16	15/16	1 5/16	2
2.10	64	1/4	1/4	1/4	5/16	7/16	9/16	3/4	15/16	1 5/16	2
2.20	61	1/4	1/4	1/4	5/16	3/8	9/16	3/4	15/16	1 1/4	2
2.30	58	1/4	1/4	1/4	1/4	3/8	1/2	11/16	7/8	1 1/4	2
2.40	56	1/4	1/4	1/4	1/4	5/16	1/2	11/16	7/8	1 3/16	2
2.50	54	1/4	1/4	1/4	1/4	5/16	1/2	5/8	13/16	1 3/16	2
2.52	53	3/16	3/16	3/16	3/16	5/16	1/2	5/8	13/16	1 1/8	2

**Table A17 – Alternate Limiting Temperature 600°C (Metric)**

W/D	Hp/A	Min Required Thickness (mm) for Hourly Rating Period (min)									
		15	30	45	60	90	120	150	180	240	300
0.33	406	18	18	18	21	26	31	35	42	NR	NR
0.40	335	18	18	18	20	24	29	35	40	NR	NR
0.50	268	16	16	16	18	23	29	34	39	NR	NR
0.60	223	15	15	15	16	21	27	32	37	47	NR
0.70	191	13	13	13	15	21	26	31	35	45	NR
0.80	167	12	12	12	15	20	24	29	32	43	NR
0.84	160	12	12	12	13	18	23	27	32	42	51
0.90	149	12	12	12	13	18	23	27	32	42	51
1.00	134	10	10	10	13	18	23	26	31	40	50
1.10	122	10	10	10	12	16	21	26	31	40	50
1.20	112	10	10	10	12	16	21	24	29	39	48
1.30	103	10	10	10	12	15	20	24	29	37	47
1.40	96	10	10	10	12	15	20	23	27	37	47
1.50	89	8	8	8	10	13	18	23	27	35	45
1.60	84	8	8	8	10	13	18	21	26	35	45
1.70	79	8	8	8	10	12	16	21	26	34	43
1.80	74	8	8	8	10	12	16	20	24	34	42
1.90	71	8	8	8	8	10	15	20	24	32	42
2.00	67	7	7	7	8	10	15	18	23	31	40
2.10	64	7	7	7	8	10	13	18	21	31	39
2.20	61	7	7	7	7	8	13	16	21	29	39
2.30	58	7	7	7	7	8	12	16	20	29	37
2.40	56	7	7	7	7	7	12	15	20	27	35
2.50	54	7	7	7	7	7	10	15	18	27	35
2.52	53	5	5	5	5	7	10	15	18	26	35

**Table A18 – Alternate Limiting Temperature 1112°F (Imperial)**

W/D	Hp/A	Min Required Thickness (in.) for Hourly Rating Period (min)									
		15	30	45	60	90	120	150	180	240	300
0.33	406	11/16	11/16	11/16	13/16	1	1 3/16	1 3/8	1 5/8	NR	NR
0.40	335	11/16	11/16	11/16	3/4	15/16	1 1/8	1 3/8	1 9/16	NR	NR
0.50	268	5/8	5/8	5/8	11/16	7/8	1 1/8	1 5/16	1 1/2	NR	NR
0.60	223	9/16	9/16	9/16	5/8	13/16	1 1/16	1 1/4	1 7/16	1 13/16	NR
0.70	191	1/2	1/2	1/2	9/16	13/16	1	1 3/16	1 3/8	1 3/4	NR
0.80	167	7/16	7/16	7/16	9/16	3/4	15/16	1 1/8	1 1/4	1 11/16	NR
0.84	160	7/16	7/16	7/16	1/2	11/16	7/8	1 1/16	1 1/4	1 5/8	2
0.90	149	7/16	7/16	7/16	1/2	11/16	7/8	1 1/16	1 1/4	1 5/8	2
1.00	134	3/8	3/8	3/8	1/2	11/16	7/8	1	1 3/16	1 9/16	1 15/16
1.10	122	3/8	3/8	3/8	7/16	5/8	13/16	1	1 3/16	1 9/16	1 15/16
1.20	112	3/8	3/8	3/8	7/16	5/8	13/16	15/16	1 1/8	1 1/2	1 7/8
1.30	103	3/8	3/8	3/8	7/16	9/16	3/4	15/16	1 1/8	1 7/16	1 13/16
1.40	96	3/8	3/8	3/8	7/16	9/16	3/4	7/8	1 1/16	1 7/16	1 13/16
1.50	89	5/16	5/16	5/16	3/8	1/2	11/16	7/8	1 1/16	1 3/8	1 3/4
1.60	84	5/16	5/16	5/16	3/8	1/2	11/16	13/16	1	1 3/8	1 3/4
1.70	79	5/16	5/16	5/16	3/8	7/16	5/8	13/16	1	1 5/16	1 11/16
1.80	74	5/16	5/16	5/16	3/8	7/16	5/8	3/4	15/16	1 5/16	1 5/8
1.90	71	5/16	5/16	5/16	5/16	3/8	9/16	3/4	15/16	1 1/4	1 5/8
2.00	67	1/4	1/4	1/4	5/16	3/8	9/16	11/16	7/8	1 3/16	1 9/16
2.10	64	1/4	1/4	1/4	5/16	3/8	1/2	11/16	13/16	1 3/16	1 1/2
2.20	61	1/4	1/4	1/4	1/4	5/16	1/2	5/8	13/16	1 1/8	1 1/2
2.30	58	1/4	1/4	1/4	1/4	5/16	7/16	5/8	3/4	1 1/8	1 7/16
2.40	56	1/4	1/4	1/4	1/4	1/4	7/16	9/16	3/4	1 1/16	1 3/8
2.50	54	1/4	1/4	1/4	1/4	1/4	3/8	9/16	11/16	1 1/16	1 3/8
2.52	53	3/16	3/16	3/16	3/16	1/4	3/8	9/16	11/16	1	1 3/8

**Table A19 – Alternate Limiting Temperature 650°C (Metric)**

W/D	Hp/A	Min Required Thickness (mm) for Hourly Rating Period (min)									
		15	30	45	60	90	120	150	180	240	300
0.33	406	18	18	18	20	24	29	34	39	NR	NR
0.40	335	18	18	18	20	24	29	34	39	NR	NR
0.50	268	16	16	16	20	24	29	32	37	45	NR
0.60	223	15	15	15	18	24	29	31	35	43	NR
0.70	191	12	12	15	18	24	27	29	34	42	NR
0.80	167	10	10	13	18	23	27	27	32	40	NR
0.84	160	10	10	13	18	23	27	27	31	39	51
0.90	149	10	10	12	18	23	26	27	31	39	51
1.00	134	10	10	12	16	21	26	26	29	39	50
1.10	122	10	10	12	16	21	24	26	29	37	50
1.20	112	8	8	12	15	20	23	24	27	37	48
1.30	103	8	8	10	15	18	23	23	27	35	47
1.40	96	8	8	10	13	18	21	23	26	35	47
1.50	89	8	8	10	13	16	20	21	26	34	45
1.60	84	8	8	10	13	15	20	21	24	34	45
1.70	79	8	8	10	12	15	18	20	24	32	43
1.80	74	8	8	8	12	13	16	20	23	32	42
1.90	71	7	7	8	10	12	15	18	23	31	42
2.00	67	7	7	8	10	12	15	18	21	31	40
2.10	64	7	7	8	8	10	13	16	21	29	39
2.20	61	7	7	7	8	10	12	16	20	29	39
2.30	58	7	7	7	7	8	12	15	20	27	37
2.40	56	7	7	7	7	7	10	15	18	27	35
2.50	54	7	7	7	7	7	8	13	18	26	35
2.52	53	5	5	5	5	5	8	13	18	26	35

**Table A20 – Alternate Limiting Temperature 1202°F (Imperial)**

W/D	Hp/A	Min Required Thickness (in.) for Hourly Rating Period (min)									
		15	30	45	60	90	120	150	180	240	300
0.33	406	11/16	11/16	11/16	3/4	15/16	1 1/8	1 5/16	1 1/2	NR	NR
0.40	335	11/16	11/16	11/16	3/4	15/16	1 1/8	1 5/16	1 1/2	NR	NR
0.50	268	5/8	5/8	5/8	3/4	15/16	1 1/8	1 1/4	1 7/16	1 3/4	NR
0.60	223	9/16	9/16	9/16	11/16	15/16	1 1/8	1 3/16	1 3/8	1 11/16	NR
0.70	191	7/16	7/16	9/16	11/16	15/16	1 1/16	1 1/8	1 5/16	1 5/8	NR
0.80	167	3/8	3/8	1/2	11/16	7/8	1 1/16	1 1/16	1 1/4	1 9/16	NR
0.84	160	3/8	3/8	1/2	11/16	7/8	1 1/16	1 1/16	1 3/16	1 1/2	2
0.90	149	3/8	3/8	7/16	11/16	7/8	1	1 1/16	1 3/16	1 1/2	2
1.00	134	3/8	3/8	7/16	5/8	13/16	1	1	1 1/8	1 1/2	1 15/16
1.10	122	3/8	3/8	7/16	5/8	13/16	15/16	1	1 1/8	1 7/16	1 15/16
1.20	112	5/16	5/16	7/16	9/16	3/4	7/8	15/16	1 1/16	1 7/16	1 7/8
1.30	103	5/16	5/16	3/8	9/16	11/16	7/8	7/8	1 1/16	1 3/8	1 13/16
1.40	96	5/16	5/16	3/8	1/2	11/16	13/16	7/8	1	1 3/8	1 13/16
1.50	89	5/16	5/16	3/8	1/2	5/8	3/4	13/16	1	1 5/16	1 3/4
1.60	84	5/16	5/16	3/8	1/2	9/16	3/4	13/16	15/16	1 5/16	1 3/4
1.70	79	5/16	5/16	3/8	7/16	9/16	11/16	3/4	15/16	1 1/4	1 11/16
1.80	74	5/16	5/16	5/16	7/16	1/2	5/8	3/4	7/8	1 1/4	1 5/8
1.90	71	1/4	1/4	5/16	3/8	7/16	9/16	11/16	7/8	1 3/16	1 5/8
2.00	67	1/4	1/4	5/16	3/8	7/16	9/16	11/16	13/16	1 3/16	1 9/16
2.10	64	1/4	1/4	5/16	5/16	3/8	1/2	5/8	13/16	1 1/8	1 1/2
2.20	61	1/4	1/4	1/4	5/16	3/8	7/16	5/8	3/4	1 1/8	1 1/2
2.30	58	1/4	1/4	1/4	1/4	5/16	7/16	9/16	3/4	1 1/16	1 7/16
2.40	56	1/4	1/4	1/4	1/4	1/4	3/8	9/16	11/16	1 1/16	1 3/8
2.50	54	1/4	1/4	1/4	1/4	1/4	5/16	1/2	11/16	1	1 3/8
2.52	53	3/16	3/16	3/16	3/16	3/16	5/16	1/2	11/16	1	1 3/8