

THERMASTEEL CORPORATION FIRE TEST REPORT

SCOPE OF WORK

ASTM E119 TESTING ON LOADBEARING ASSEMBLY CONTAINING THERMASTEEL WALL
FRAME SYSTEM

REPORT NUMBER

M8525.01-121-24-R1

TEST DATE(S)

09/28/21

ISSUE DATE

10/18/21

REVISION DATE

10/19/21

PAGES

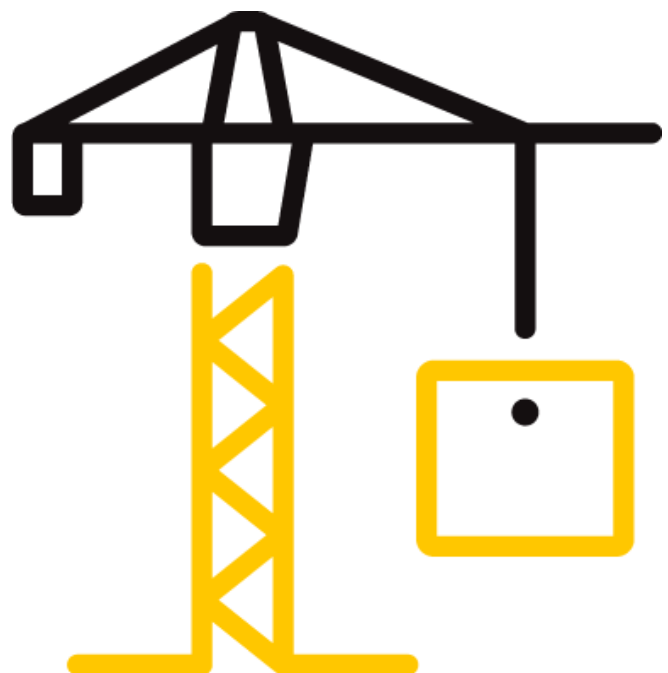
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DOCUMENT CONTROL NUMBER

ATI 00662 (07/24/17)

RT-R-AMER-Test-2782

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TEST REPORT FOR THERMASTEEL CORPORATION

Report No.: M8525.01-121-24-R1

Date: 10/18/21

Revision Date: 10/19/21

REPORT ISSUED TO

ThermaSteel Corporation

609 West Rock Road

Radford, Virginia 24141

SECTION 1

SCOPE

Intertek Building & Construction (B&C) was contracted by ThermaSteel Corporation, 609 West Rock Road Radford, Virginia 24141 to evaluate the fire-resistance characteristics of a wall assembly containing ThermaSteel Wall Frame System. Testing was conducted at the Intertek B&C test facility in York, Pennsylvania. Results obtained are tested values and were secured by using the designated test method(s). A summary of test results and the complete graphical test data is reported herein.

This report does not constitute certification of this product nor an opinion or endorsement by this laboratory.

SECTION 2

SUMMARY OF TEST RESULTS

Wall System: Exterior Load-bearing Wall Assembly

Combustible Components: EPS (expanded polystyrene) core insulation

ASTM E119 Test Results

The assembly described and tested in this report **did** meet the Conditions of Acceptance of ASTM E119 when exposed to a fire-resistance rating of **120 minutes**. Construction summary of the full assembly is located in Section 5 of this test report.

For INTERTEK B&C:

COMPLETED BY:	Logan Chronister	REVIEWED BY:	Ethan Grove
TITLE:	Project Engineer – Fire Testing	TITLE:	Manager – Fire Testing
SIGNATURE:		SIGNATURE:	
DATE:	10/19/21	DATE:	10/19/21

lvc:ddr

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SECTION 3**TEST METHOD**

The assembly was evaluated in accordance with the following:

ASTM E119-20, *Standard Test Methods for Fire Tests of Building Construction and Materials***ASTM E2226-15b**, *Standard Practice for Application of Hose Stream***SECTION 4****LIST OF OFFICIAL OBSERVERS**

NAME	COMPANY
Brock Blume	ThermaSteel Inc
Brad Roach	ThermaSteel Inc
Logan Chronister	Intertek B&C
Scott Gingrich	Intertek B&C
Mark Dluzeski	Intertek B&C
Tim Feltman	Intertek B&C

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SECTION 5**TEST PROCEDURE**

The ASTM E119 standard measures the fire-resistance performance by quantifying the temperature rise on the unexposed face of the building element when the exposed side is subjected to the standardized ASTM E119 Time vs. Temperature curve.

The furnace used for testing has an exposure space of 14 ft. wide by 12 ft. tall by 4 ft. deep. The furnace is equipped with six burners capable of producing 1.5 MBtu/hr. of energy each. Three burners are positioned on each side wall of the furnace to allow for an even distribution of heat flux across the surface area of the test specimen. The exposed area of the furnace is reduced to 10 ft. by 10 ft. by utilizing a frame consisting of steel and concrete with the exposed surface protected by ceramic-fiber blankets. The temperature inside the furnace is controlled by adjusting the blower speed of the air provided to the burners. This temperature is determined by the average of the nine thermocouples symmetrically distributed over the full area of the assembly which are placed 6 inches off the exposed wall surface.

The neutral-pressure-plane is controlled by two pressure transducers that adjust the opening of the exhaust damper. The assembly described in Section 8 was built inside of a 10 ft. by 10 ft. steel frame test fixture with the inside perimeter lined with solid concrete masonry units and positioned against the open face of the furnace.

Ten 18-gauge, Type K thermocouples covered by 6 in. by 6 in. by 0.4 in. thick dry felt pads and positioned on the unexposed surfaces of the specimens to measure heat transmission. See Drawing 5 Section 13 to see placement of thermocouples.

The fire exposure tests were conducted under loadbearing conditions and were then submitted to the ASTM E2226 hose stream test under loadbearing conditions. After the 120-minute fire exposure tests a 30-psi water pressure hose stream was applied for 150 seconds to the exposed surfaces per the requirements of ASTM E2226.

When the indicated resistance period is $\frac{1}{2}$ h or over, determined by the average or maximum temperature rise on the unexposed or maximum temperature rise on the unexposed surface or within the test specimen, or by failure under load, a correction shall be applied for variation of the furnace exposure from that prescribed, where it will affect the classification, by multiplying the indicated period by two thirds of the difference in area between the curve of average furnace temperature and the standard curve for the first three fourths of the period and dividing the product by the area between the standard curve and a base line of 68°F for the same part of the indicated period, the latter area increased by 54°F*h (3240°F*min) to compensate for the thermal lag of the furnace thermocouples during the first part of the test. For fire exposure in the test higher than the standard, the indicated resistance period shall be increased by the amount of the correction and be similarly decreased for fire exposure below standard.

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SECTION 5 (CONTINUED)

TEST PROCEDURE

The correction can be expressed by the following equation:

$$C = \frac{2I(A - A_s)}{3(A_s + L)}$$

where:

C=correction in the same units as I,

I=indicated fire-resistance period,

A=area under the curve of indicated average furnace temperature for the first three fourths of the indicated period,

AS=area under the standard furnace curve for the same part of the indicated period, and

L=lager correction in the same units as A and AS (54°F*h or 30°C*h (3240°F*min or 1800°C*min))

SECTION 6

LOADING CALCULATION

$$F_t = W + DL * N$$

$$A = N_a * A_{eff.}$$

$$P = \frac{F_t}{A}$$

VARIABLE	DESCRIPTION	VALUE	UNIT
W	Uniform Load of Dead Weight	3054.5	lb.
DL	Design Load / Lineal Ft.	3,000	lb./ft.
N	Number of Lineal Ft.	10	Ft.
N _a	Number of Actuators	4	--
A _{eff.}	Effective Area / Actuator	5.15	in. ²
A	Total Area	20.6	in. ²
F _t	Total Force	33,055	lb.
P	Pressure in Hydraulic Line	1605	PSI

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SECTION 7**TEST SPECIMEN DESCRIPTION****Exposed Cladding**

The full exposed surface of the wall assembly was clad with 3 layers 5/8 in. thick National Gypsum Gold Bond® Fire-Shield® gypsum board meeting ASTM C1396. The first layer of gypsum board was fastened to the wall framing with #6 x 1-1/4 in. long, bugle head, self-drilling screws with a nominal spacing of 8 in. around the board perimeter and 12 in. in the field. Drywall orientation consisted of three pieces fastened vertically to the wall framing, with the run edge running parallel with the framing and the cut edge perpendicular to the framing. Drywall orientation on the second layer consisted of horizontally oriented boards with the run edge running perpendicular with the framing and the cut edge parallel to the framing with the 24 in. wide piece of drywall at the bottom of the wall assembly. The second layer of gypsum board was fastened to the wall framing with #6 x 2 in. long, bugle head, self-drilling screws with a nominal spacing of 8 in. around the board perimeter and 12 in. in the field with a 1 in. offset. Drywall orientation of the third layer of gypsum board consisted of three pieces oriented vertically to the wall framing, with the run edge running parallel with the framing and the cut edge perpendicular to the framing. Gypsum board was attached to the wall with #8-18 x 3 in. bugle head self-tapping screws every 8 in. around the perimeters and 12 in. in the fields. All joints on the third layer of gypsum board were offset 16 in. from the first layer of vertical gypsum joints. All joints of all layers were taped with USG Sheetrock® Brand paper joint tape and spackled with USG Sheetrock® Brand joint compound. All fastener heads were spackled with USG Sheetrock® Brand joint compound.

Metal Framing

The core wall was consisted of three panels which were 10 ft. tall. Two of the panels were 4 ft. wide, with the center panel of the assembly being 2 ft. wide. These three panels were pre-assembled from the manufacturer in the following way. The framing consisted of 10 ft. long, 3-5/8 in. wide, 18-gauge galvanized steel studs fastened to 10 ft. length, 18-gauge galvanized steel angle every 16 inches on center with two #10 - 18 x 3/4 in. long self-drilling, pan head fastener per stud flange. The studs were fastened to the flange of the track on the 3-5/8 in. wide web every 16 in. so that there were two steel studs located in the track every 16 in. At approximately 5 ft. a phenolic plate was attached to the flange of the opposing steel studs to join them together. Two #10 x 3/4 in Tech Screws were used to attach either side of the Phenolic Plate to the flange of the steel stud. The three panels were attached together with 10 ft. long, 5-1/2 in. 18-gauge steel track on the top and bottom of the panel assemblies with #10 x 3/4 in. Tech Screws to create one 10 ft. x 10 ft. wall panel assembly.

Framing Insulation

Framing insulation consisted of ThermaSteel EPS R-35 core. This insulation core came installed in the in the panel assemblies.

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SECTION 7 (CONTINUED)**TEST SPECIMEN DESCRIPTION****Unexposed Sheathing**

The full exposed surface of the wall assembly was clad with 3 layers 5/8 in. thick National Gypsum Gold Bond® Fire-Shield® gypsum board meeting ASTM C1396. The first layer of gypsum board was fastened to the wall framing with #6 x 1-1/4 in. long, bugle head, self-drilling screws with a nominal spacing of 8 in. around the board perimeter and 12 in. in the field. Drywall orientation consisted of three pieces fastened vertically to the wall framing, with the run edge running parallel with the framing and the cut edge perpendicular to the framing. Drywall orientation on the second layer consisted of horizontally oriented boards with the run edge running perpendicular with the framing and the cut edge parallel to the framing with the 24 in. wide piece of drywall at the bottom of the wall assembly. The second layer of gypsum board was fastened to the wall framing with #6 x 2 in. long, bugle head, self-drilling screws with a nominal spacing of 8 in. around the board perimeter and 12 in. in the field with a 1 in. offset. Drywall orientation of the third layer of gypsum board consisted of three pieces oriented vertically to the wall framing, with the run edge running parallel with the framing and the cut edge perpendicular to the framing. All joints on the third layer of gypsum board were offset 16 in. from the first layer of vertical gypsum joints. All joints of all layers were taped with USG Sheetrock® Brand paper joint tape and spackled with USG Sheetrock® Brand joint compound. All fastener heads were spackled with USG Sheetrock® Brand joint compound.

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SECTION 8

TEST RESULTS

FIRE-RESISTANCE TEST OBSERVATIONS	
Time (Min:Sec)	Observations
Pre-test	Load applied for a duration of 5 minutes prior to start of fire resistance test.
00:00	Ignition of furnace burners. Fire-resistance test begins.
02:15	Gypsum paper flash.
11:56	Screw heads exposed on exposure side of first layer of gypsum.
31:47	Crack in gypsum board of exposed face / off gassing vapors igniting from crack.
48:11	1/4 in. deflection at center point of assembly in towards the furnace.
1:31:24	Ignition of vapors through more cracks in gypsum board of exposed surface.
1:39:39	Second time of reducing load pressure due to expansion of steel studs.
1:46:54	First layer of exposed gypsum opening up and exposing second layer at joints.
2:00:00	Burners shut off. Conclusion of fire-resistance test.

HOSE STREAM TEST OBSERVATIONS	
Time (Min:Sec)	Observations
00:00	Prescribes water pressure achieved at the hose stream apparatus. Test begins
02:30	Hose stream test concluded.

VARIABLE	DESCRIPTION	VALUE	UNITS
C	Correction Factor	-45	seconds
I	Indicated FR Period	120	minutes
A	Area under Indicated FR Period for first 3/4 of test period	131462	°F*min
As	Area under Standard E119 Time vs. Temp. Curve for first 3/4 of test period	132749	°F*min
L	Lag Correction	3240	°F*min
FR Period	Fire-Resistance Period	120	minutes

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SECTION 9

PHOTOGRAPHS

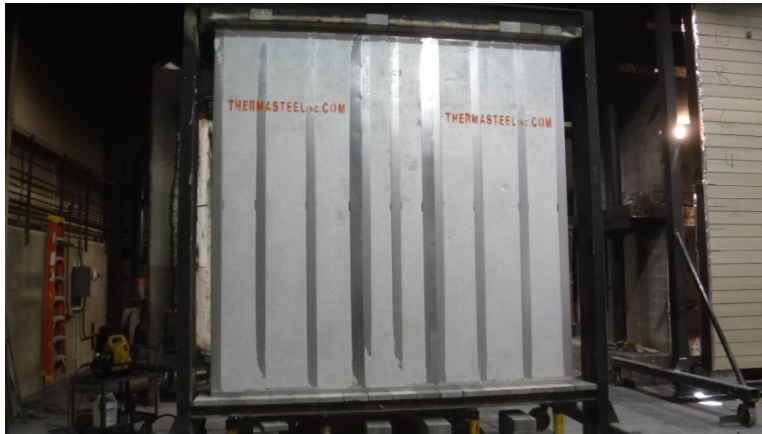


Photo No. 1
ThermaSteel Wall Panel Assembly Unexposed Face

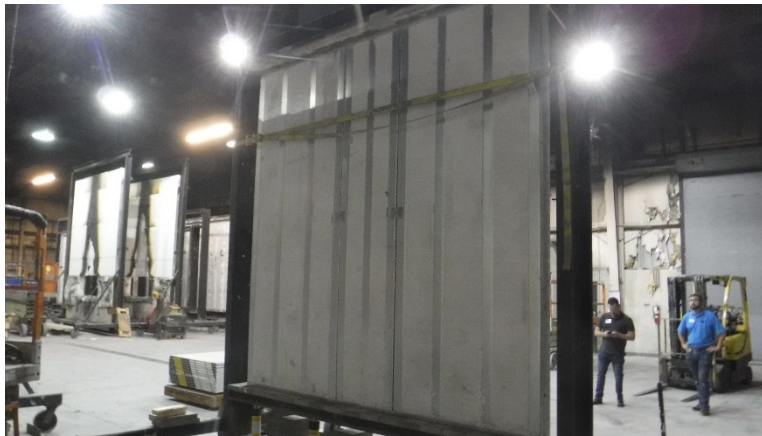


Photo No. 2
ThermaSteel Wall Panel Assembly Exposed Face

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SECTION 9 (CONTINUED) PHOTOGRAPHS



Photo No. 3

Joint compound and joint tape applied to steel track and panel joints (Unexposed Face)



Photo No. 4

Joint compound and joint tape applied to steel track and panel joints (Exposed Face)

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Photo No. 5

First layer Vertical Orientation Gypsum Installed (Unexposed Face)



Photo No. 6

First Layer Vertical Orientation Gypsum Installed (Exposed Face)

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Photo No. 7

Second Layer Horizontal Orientation Gypsum Installed (Unexposed Face)



Photo No. 8

Second Layer Horizontal Orientation Gypsum Installed (Exposed Face)

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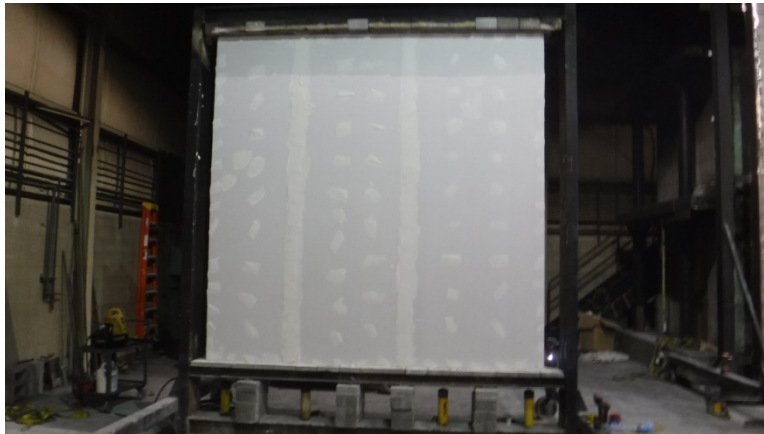


Photo No. 9

Third Layer Vertical Orientation Gypsum Installed (Unexposed Face)



Photo No. 10

Third Layer Vertical Orientation Gypsum Installed and Ready to Test (Unexposed Face)

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Photo No. 11
Assembly Ready to Test (Unexposed Face)



Photo No. 12
Conclusion of Fire Resistance Test (Unexposed Face)

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Photo No. 13

Conclusion of Fire Resistance Test (Exposed Face)



Photo No. 14

Specimen Prior to Hose Stream Test (Unexposed Face)

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Photo No. 15

Specimen Prior to Hose Stream Test (Exposed Face)



Photo No. 16

Specimen at Conclusion of Hose Stream Test (Unexposed Face)

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Photo No. 17

Specimen at Conclusion of Hose Stream Test (Exposed Face)



Photo No. 18

Phenolic Plates in Stud Cavity Post Fire Resistance and Hose Stream Test

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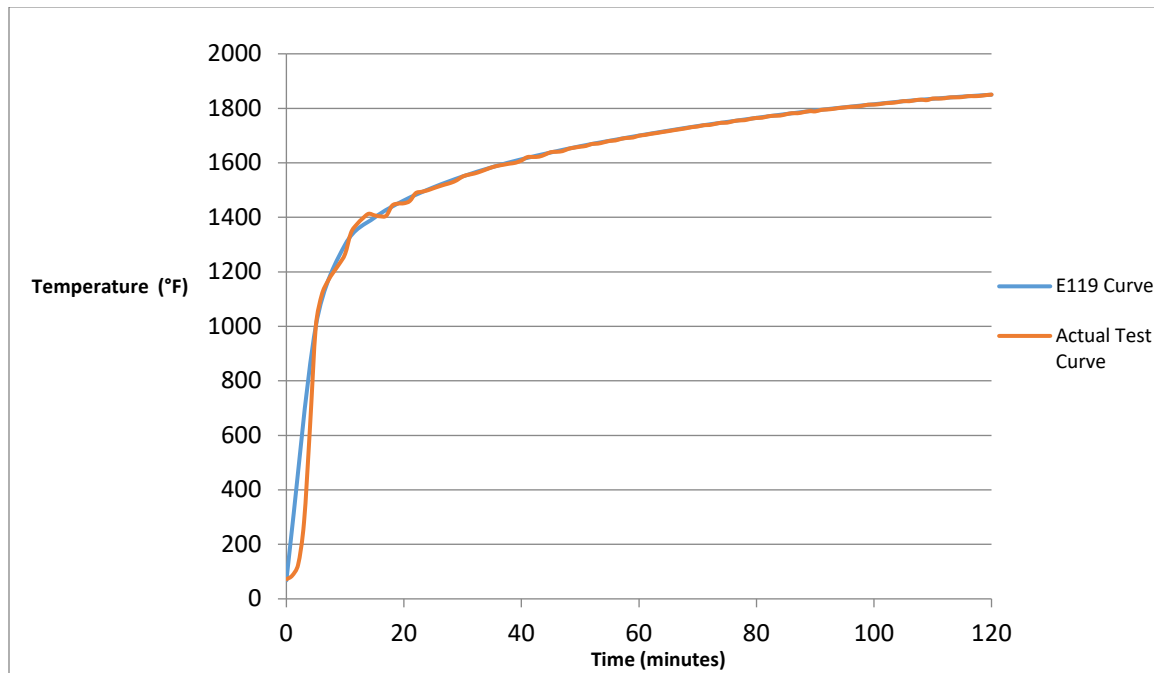
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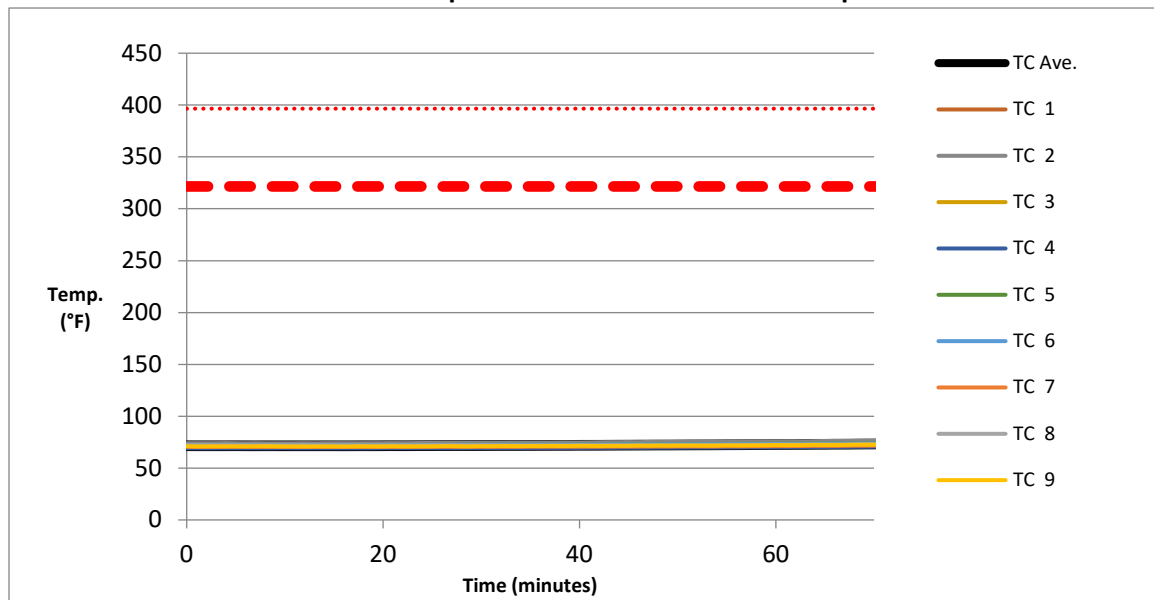
SECTION 10

GRAPHS



Graph No. 1

Furnace Time-Temperature vs. Standard Time-Temperature



Graph No. 2

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Unexposed Surface Temperatures

SECTION 11

NUMERICAL DATA

TIME (Hr:Min:Sec)	AVG. FURNACE TEMP. (°F)
0:00:00	72
0:01:00	86
0:02:00	126
0:03:00	281
0:04:00	624
0:05:00	998
0:06:00	1114
0:07:00	1164
0:08:00	1198
0:09:00	1229
0:10:00	1266
0:11:00	1344
0:12:00	1375
0:13:00	1396
0:14:00	1413
0:15:00	1407
0:16:00	1404
0:17:00	1406
0:18:00	1443
0:19:00	1450
0:20:00	1452
0:21:00	1460
0:22:00	1489
0:23:00	1494
0:24:00	1499
0:25:00	1507
0:26:00	1514
0:27:00	1521
0:28:00	1527
0:29:00	1536
0:30:00	1550

TIME (Hr:Min:Sec)	AVG. FURNACE TEMP. (°F)
0:31:00	1556
0:32:00	1561
0:33:00	1568
0:34:00	1576
0:35:00	1584
0:36:00	1589
0:37:00	1593
0:38:00	1597
0:39:00	1600
0:40:00	1609
0:41:00	1621
0:42:00	1622
0:43:00	1623
0:44:00	1630
0:45:00	1639
0:46:00	1640
0:47:00	1643
0:48:00	1651
0:49:00	1656
0:50:00	1659
0:51:00	1662
0:52:00	1669
0:53:00	1670
0:54:00	1675
0:55:00	1680
0:56:00	1682
0:57:00	1688
0:58:00	1691
0:59:00	1693
1:00:00	1700



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TIME (Hr:Min:Sec)	AVG. FURNACE TEMP. (°F)
1:01:00	1702
1:02:00	1706
1:03:00	1709
1:04:00	1713
1:05:00	1716
1:06:00	1720
1:07:00	1723
1:08:00	1727
1:09:00	1731
1:10:00	1733
1:11:00	1738
1:12:00	1739
1:13:00	1743
1:14:00	1747
1:15:00	1747
1:16:00	1753
1:17:00	1756
1:18:00	1757
1:19:00	1761
1:20:00	1765
1:21:00	1766
1:22:00	1771
1:23:00	1773
1:24:00	1773
1:25:00	1778
1:26:00	1782
1:27:00	1782
1:28:00	1786
1:29:00	1790
1:30:00	1789

TIME (Hr:Min:Sec)	AVG. FURNACE TEMP. (°F)
1:31:00	1794
1:32:00	1796
1:33:00	1798
1:34:00	1801
1:35:00	1803
1:36:00	1806
1:37:00	1807
1:38:00	1809
1:39:00	1813
1:40:00	1814
1:41:00	1816
1:42:00	1819
1:43:00	1820
1:44:00	1823
1:45:00	1827
1:46:00	1826
1:47:00	1830
1:48:00	1832
1:49:00	1830
1:50:00	1836
1:51:00	1836
1:52:00	1837
1:53:00	1840
1:54:00	1840
1:55:00	1841
1:56:00	1845
1:57:00	1845
1:58:00	1846
1:59:00	1848
2:00:00	1850

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TIME (Hr:Min:Sec)	T/C AVG.	T/C 1	T/C 2	T/C 3	T/C 4	T/C 5	T/C 6	T/C 7	T/C 8	T/C 9	T/C 10
0:00:00	72	72	74	71	69	72	72	71	72	71	72
0:01:00	72	72	74	71	69	72	72	70	72	71	72
0:02:00	72	72	74	71	69	72	72	70	72	71	72
0:03:00	72	72	74	71	69	72	72	70	72	71	72
0:04:00	72	72	74	71	69	72	72	70	72	71	72
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0:06:00	71	72	74	71	69	72	72	70	72	71	71
0:07:00	71	72	74	71	69	72	72	70	72	71	71
0:08:00	72	72	74	71	69	72	72	70	72	71	72
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0:16:00	71	72	74	71	69	72	72	70	72	71	71
0:17:00	71	72	74	71	69	72	72	70	72	71	71
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0:32:00	72	72	74	71	69	73	72	71	72	71	72
0:33:00	72	72	75	71	69	73	72	71	72	71	72

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TIME (Hr:Min:Sec)	T/C AVG.	T/C 1	T/C 2	T/C 3	T/C 4	T/C 5	T/C 6	T/C 7	T/C 8	T/C 9	T/C 10
0:34:00	72	73	75	71	69	73	72	71	72	71	72
0:35:00	72	73	75	71	69	73	72	71	72	71	72
0:36:00	72	73	75	71	69	73	73	71	72	71	72
0:37:00	72	73	75	71	69	73	73	71	72	71	72
0:38:00	72	73	75	71	69	73	73	71	72	71	72
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TIME (Hr:Min:Sec)	T/C AVG.	T/C 1	T/C 2	T/C 3	T/C 4	T/C 5	T/C 6	T/C 7	T/C 8	T/C 9	T/C 10
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1:59:00	80	82	85	80	77	80	80	78	80	79	80
2:00:00	80	82	85	80	77	80	80	78	80	79	80



Total Quality. Assured.

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Facsimile: 717-764-4129
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SECTION 12

DRAWINGS


The test specimen drawings which follow have been reviewed by Intertek B&C and are representative of the test specimen(s) reported herein. Test specimen construction was verified by Intertek B&C per the drawings included in this report. Any deviations are documented herein or on the drawings.

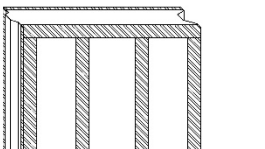
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<p>EXTERIOR WALL PANEL ASSEMBLY DRAWINGS FOR THE:</p> <h1 style="text-align: center;">2021 Intertek Fire Test</h1> <p>General Notes:</p> <ul style="list-style-type: none"> * The drawings herein are manufacturing and assembly drawings. The contractor/owner shall be solely responsible for verifying all dimensions, site conditions and all state and local code requirements are met. * ThermoSteel wall panels are to be 5 1/2" thick with 362S162-43 @ 16" O.C., unless noted. * All walls are to receive metal track, top & bottom, per engineering specs. * All door and window openings are per contractor / owner. * All rough openings are to have metal surrounds. * All engineering of the structure, including the ThermoSteel specifications, is to be completed and/or approved by the Project Engineer/Engineer of Record. If buyer decides not to use engineering and structural design services (which have an additional fee), buyer shall assume all responsibility and liability for the structure and the seller shall have no liability in relation thereto. * Contractor is to confirm that all rough openings meet local egress and minimum light and ventilation requirements. * Contractor is to refer to the architectural prints for all information not provided by ThermoSteel. * ThermoSteel will provide reasonable technical assistance as requested with regards of the use of the ThermoSteel Building System. * ThermoSteel will provide panel layout drawings (shop drawings) for the installation of panels, special panel requirements (if any), requirements for attachment and connection details for ThermoSteel panels. * ThermoSteel shop drawings are based on the architectural prints provided by the customer. * All electrical, plumbing, HVAC, additional mechanical systems, exterior and interior finished and etc, is the responsibility of the contractor/owner. * For panel properties visit http://thermosteelinc.com/content/revpanel-system 	 <p>THERMASTEEL™ ADVANCED PANEL SYSTEMS</p> <p>WALLFRAME SYSTEM</p>	<p>ThermaSteel Inc. 609 West Rock Road Radford, VA 24141 540-633-5000</p>
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Drawing 1

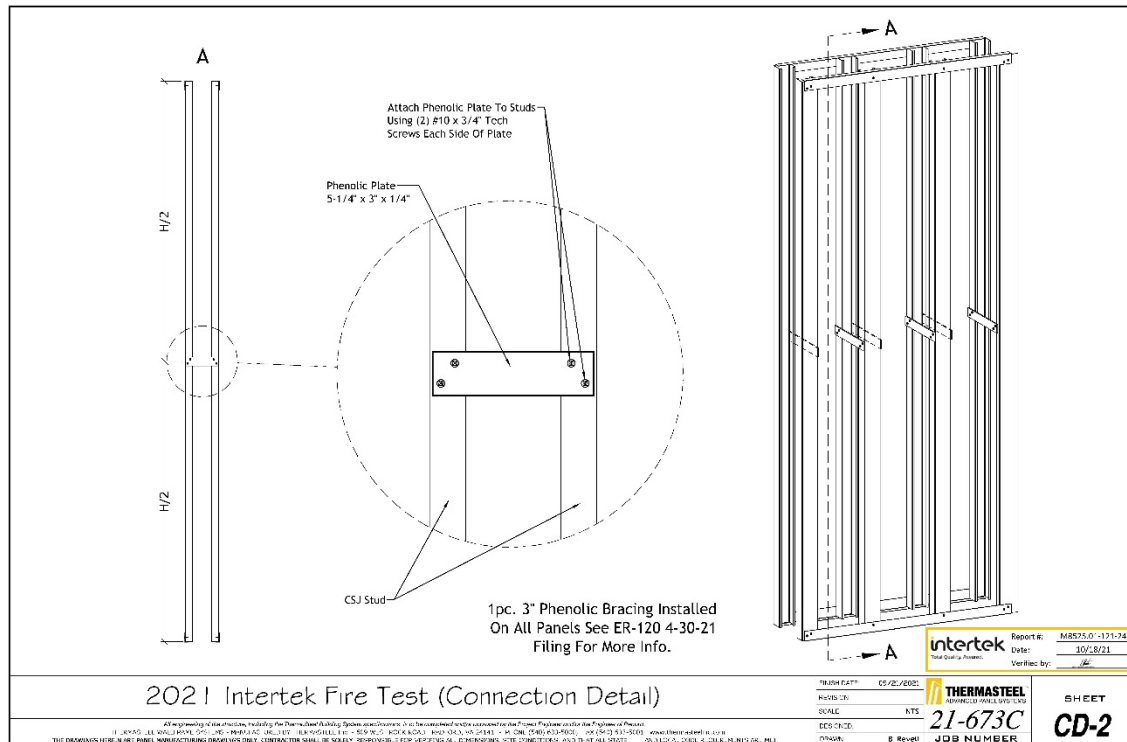
Thermasteel Wall Panel Assembly

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Drawing 2

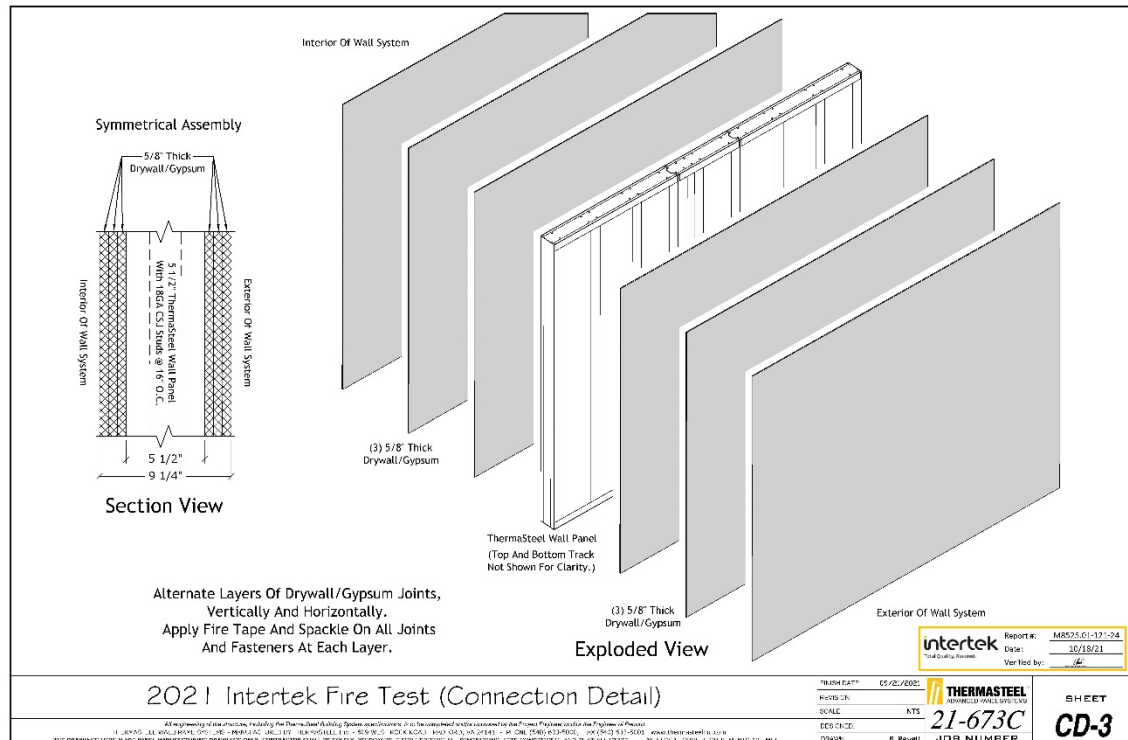
Thermasteel Panel Assembly Stud and Phenolic Bracing

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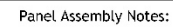
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Drawing 3

Thermasteel Panel Assembly Gypsum and Panel Layers

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- Install 5-1/2" 18GA Top And Bottom Track With 1-1/4" Legs Attach Using (2) #10 Self Drilling Tech Screws Per Stud Typical Interior And Exterior
- Exterior Panel To Panel Connection, Attach Leading Edge To Next Panel Using (1) #10 Self Drilling Tech Screw At 12" On Center
- Interior Panel To Panel Connection, Install (1) 3"x5" Attachment Plate Across Panel Seam At Approximate Center Of Panel, Attach Using (3) #10 Self Drilling Screws Each Side Of Seam

5 1/2" PANELS
362S162-43 @ 16" O.C.
(1.0PSF EPS DENSITY)

intertek
Total Quality Assurance

Report #: M8525.01 121-24
Date: 10/18/21
Verified by:

THIN CAT®	05/21/2021	 THERMASTEELE ADVANCED PANEL SYSTEM 21-673C JOB NUMBER
REVIS: 03		
SCALE	NTS	
DESIGNED:		
DRAWN:	B. Revetti	

SHEET

1

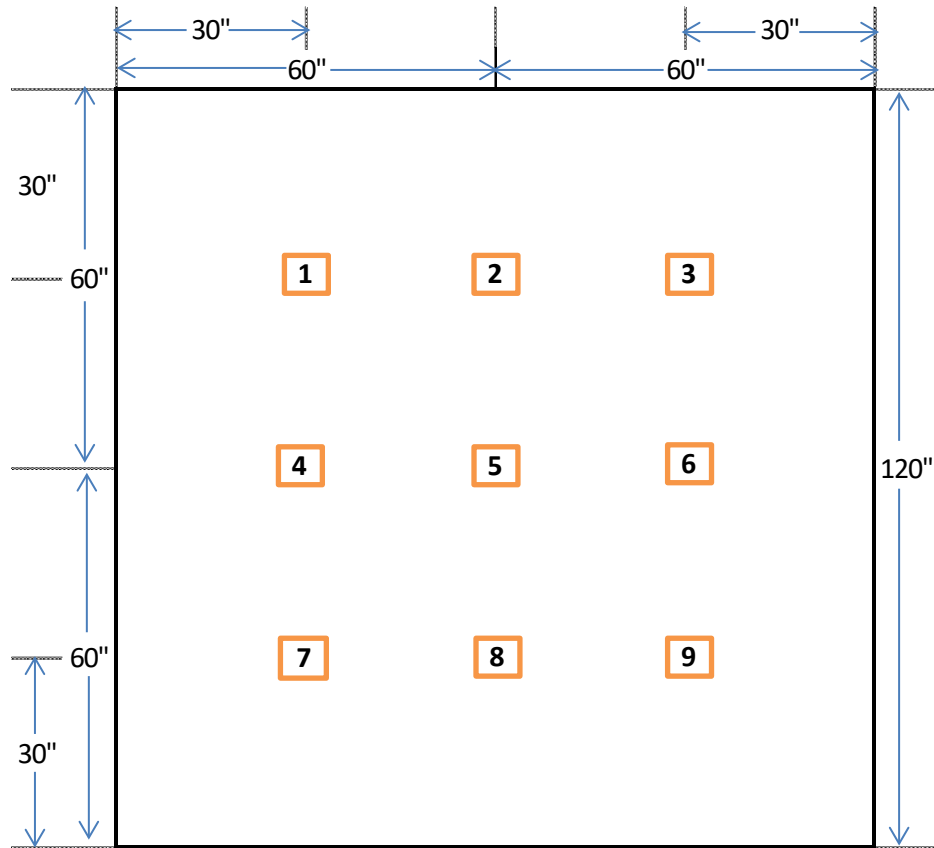
Thermasteel Panel Assembly Panel Layout

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Drawing 5

Thermocouple Layout for Surface of Unexposed Face

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SECTION 13

REVISION LOG

REVISION #	DATE	PAGES	REVISION
0	10/18/21	N/A	Original Report Issue
1	10/19/2021	3, 26-29	Corrected Title of ASTM E119 Standard, Signed Client Drawings