

TEST REPORT

for

Cement Board Fabricators

2148 S. 41st Street
Louisville, KY 40211

Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Non-Load- Bearing Wall Assemblies Containing Combustible Components NFPA 285

Test Report No: EW-002
Assignment No: K-1239
Subject Material: Exterior Non-Loadbearing SILBONIT Panel Ventilated Wall System
Test Date: March 12, 2019
Report Date: March 18, 2019

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Revision Summary

DATE	SUMMARY
March 18, 2019	Original issue date. Original NGCTS report EW-002.

Table of Contents

Introduction	4
Test Assembly Description.....	4
Testing and Evaluation Methods	6
Test Results	8
Conclusion	11
Appendix A: Thermocouple Location Diagrams.....	12
Appendix B: Thermocouple Graphical Data	16
Appendix C: Construction Photographs	26
Appendix D: Test Photographs.....	32

Introduction

The NFPA 285 test apparatus is used to evaluate the fire propagation characteristics of exterior non-load-bearing wall assemblies and panels used as components of curtain wall assemblies that are constructed using combustible materials or that incorporate combustible components within the wall assemblies as specified in the following:

- A. The ability of the wall assembly to resist flame propagation over the exterior face of the wall assembly.
- B. The ability of the wall assembly to resist vertical flame propagation within the combustible core or within other combustible components from one story to the next.
- C. The ability of the wall assembly to resist vertical flame propagation over the interior surface of the wall assembly from one story to the next.
- D. The ability of the wall assembly to resist lateral flame propagation from the compartment of fire origin to adjacent compartments or spaces.

This report contains a description of the material evaluated, procedures used, and the test results. Note that the results listed apply only to specimens tested, in the manner tested, and not to the entire production of this or similar specimens.

Test Assembly Description

The test assembly was installed on a moveable frame constructed of steel I-beams and steel angles as specified per the NFPA 285 test standard.

CORE WALL

The core wall assembly consisted of 6 in. deep, 20-gauge galvanized steel studs fastened to 14 ft. length, 20-gauge galvanized steel track, every 24 in. on center. Two additional studs were installed in the wall to accommodate the prescribed window opening. All studs were connected to the track with #6 x 1/2 in. long self-drilling screws. Roxul AFB mineral wool insulation, 6 in. thick by 24 in. wide, was friction fit into the stud cavities of the core wall.

INTERIOR WALL CLADDING

The interior wall was clad with National Gypsum 5/8 in. thick Type X gypsum board fastened to the core wall with #10 x 1-1/4 in. long bugle head self-drilling drywall screws with a nominal spacing of 8 in. on center on the perimeter and 12 in. on center in the field. The gypsum board was installed, on both the first and second story floors, with the long dimension running perpendicular with the steel studs. All joints were treated with paper joint tape and joint compound. All screw heads were covered with joint compound.

WINDOW OPENING

A window opening was made from 20-gauge galvanized steel track and was centered on the vertical centerline of the wall assembly with the finished sill of the opening 30 in. above the first story floor line. The steel track sections were fastened to the core wall's steel stud framing with #6 x 1/2 in. long self-drilling screws. The steel track sections of the window opening were lined with strips of 5/8 in. thick Georgia-Pacific DensGlass® Sheathing. The window opening was finished with a coating of GE Elemax* 5000 Liquid Flashing, applied per manufacturers specification. The dimensions of the completed window opening were 78 in. wide x 30 in. tall, per the requirements of NFPA 285.

EXTERIOR SHEATHING

The exterior sheathing consisted of 5/8 in. thick Georgia-Pacific DensGlass® Sheathing that was applied horizontally and fastened to the stud wall with #10 x 1-1/4 in. long bugle head self-drilling screws with a nominal spacing of 8 in. on center.

AIR & WATER BARRIER

GE Elemax* 2600 AWB silicone membrane was applied over the full surface of the exterior sheathing with a medium nap roller. The application rate was verified to be 19 mils wet, per manufacturer's installation instructions.

Z-FURRING STRIPS

A series of 18-gauge Z-furring strips were applied to the exterior sheathing, first in the horizontal orientation and then in the vertical orientation. All Z-furring strips consisted of a "Z" profile and were nominally 1/2 in. deep by 3-1/4 in. wide. The horizontally applied strips were attached to the steel studs 24 in. on center using #14 x 2-1/4 in. long TEK screws. The vertically orientated strips were attached to the horizontal strips using #10 x 1/2 in. TEK screws. On one leg of the vertical Z-furring strips only, nominal 1-1/4 in. by 1/8 in. EPDM rubber strips were attached with spray adhesive.

EXTERIOR CLADDING PANELS

The exterior cladding panels consisted of 5/16 in. thick SILBONIT panels, provided in various sizes with pre-drilled holes for attachment. The SILBONIT panels were applied horizontally, over the full exterior surface of the assembly, directly to the vertical Z-furring strips using #10 x 1 in. PN-T20 screws. All vertical and horizontal panel gaps were nominally 3/8 inches. The configuration did not include a vertical joint over the window opening and in the area of the flame plume.

Testing and Evaluation Methods

Testing was performed on March 12, 2019 in accordance with test method NFPA 285, 2019 edition. The assembly was secured onto the laboratory's intermediate scale multi-story test apparatus (ISMA) and any gaps were filled with ceramic fiber blanket with a density of 128 kg/m³.

CALIBRATION INFO

The test apparatus was calibrated on May 24, 2018 and followed the procedure and practices outlined in NFPA 285, Chapter 7. The apparatus is under calibrated conditions when the time average heat flux readings and the time average temperatures obtained during a calibration test meet the requirements of Table 7.1.1 of NFPA 285. Table 1 shows the average heat flux and Table 2 shows the average temperature obtained during the calibration test. All values are within the allowable ranges as specified in Table 7.1.1 ($\pm 10\%$).

Time Interval (min)	Average Heat Flux @ 2 ft. (W/cm ²)	Average Heat Flux @ 3 ft. (W/cm ²)	Average Heat Flux @ 4 ft. (W/cm ²)
0:00-5:00	0.81	0.86	0.67
5:00-10:00	1.65	2.20	1.48
10:00-15:00	2.67	2.36	1.79
15:00-20:00	3.08	2.95	2.02
20:00-25:00	3.92	3.11	2.48
25:00-30:00	4.41	3.72	2.73

Table 1: Average Heat Flux Output Data from Calibration Test (5/24/18)

Time Interval (min)	Avg. Burn Room Temp. (°F)	Avg. Interior Wall Temp. (°F)	Avg. 1 ft. Temp. (°F)	Avg. 2 ft. Temp. (°F)	Avg. 3 ft. Temp. (°F)	Avg. 4 ft. Temp. (°F)	Avg. 5 ft. Temp. (°F)	Avg. 6 ft. Temp. (°F)
0:00-5:00	1139	1007	616	691	644	529	498	385
5:00-10:00	1333	1272	875	959	980	832	795	652
10:00-15:00	1468	1421	971	1042	1078	926	921	754
15:00-20:00	1561	1528	1049	1113	1165	990	1009	825
20:00-25:00	1590	1565	1086	1137	1199	1033	1073	875
25:00-30:00	1669	1651	1136	1190	1256	1102	1158	925

Table 2: Average Time-Temperature Values from Calibration Test (5/24/18)

THERMOCOUPLES

The test assembly/apparatus was fitted with a total of 54 Type-K thermocouples which were distributed as per Figures 6.1 of NFPA 285. Thermocouple locations diagrams are provided in Appendix A. The first story burn room ceiling was instrumented with five, 18-gauge Type K thermocouples, while the specimen was instrumented with forty-nine, 20-gauge Type K thermocouples. The specimen thermocouples included twenty-three in the cavity air space, thirteen on the exterior façade, and nine on the interior wall surface. The thermocouple data, which was recorded at approximate 3-4 second intervals by a Fluke 2680A data acquisition system.

ROOM and WINDOW BURNERS

The window burner was positioned in the center of the opening and 1 in. off the exterior face of the test specimen. The position of the window burner was determined during the calibration of the test apparatus on May 24, 2018.

Time Interval	During Calibration		During Test	
	Room Burner	Window Burner	Room Burner	Window Burner
0:00-5:00	37.8 SCFM	0 SCFM	37.8 SCFM	0 SCFM
5:00-10:00	37.9 SCFM	7.9 SCFM	37.8 SCFM	7.9 SCFM
10:00-15:00	42.7 SCFM	10.5 SCFM	42.7 SCFM	10.5 SCFM
15:00-20:00	45.8 SCFM	14.6 SCFM	45.8 SCFM	14.6 SCFM
20:00-25:00	45.8 SCFM	17.3 SCFM	45.8 SCFM	17.3 SCFM
25:00-30:00	49.9 SCFM	20.2 SCFM	49.9 SCFM	20.2 SCFM

*SCFM: Standard Cubic Feet per Minute

Table 3: Room Burner and Window Burner Gas Flow Data

Test Results

Recorded ambient conditions at the start of testing were 67°F and 34% relative humidity. An anemometer was used to verify that the airflow across the test assembly was less than 4 ft./sec., as specified in the test method. The test was commenced at 11:01 am with the room and window burners turned on for 30 and 25 minutes, respectively. After the burners were turned off, the specimen was monitored for an additional 10 minutes.

TEST OBSERVATIONS

The following observations were made during the fire test.

Test Time (min:sec)	Observations from Front (Exterior Face) of Test Specimen
0:00	Test start; ignition of the room burner
01:30	Light smoke from top of assembly
02:10	Initial audible cracking of exterior cladding panels
3:00	Light spalling of exterior cladding panel above window opening
4:27	Increased spalling of first panel above window opening
5:00	Ignition of window burner
5:11	Flaming of liquid flashing around window opening
5:30	Moderate-to-heavy smoke from top of assembly
6:58	Initial spalling of second panel above window opening
10:00	Continued sporadic spalling of first two panels above window opening
14:39	Initial spalling of third panel above window opening
20:00	Continued sporadic spalling of first three panels above window opening
28:01	Initial spalling of fourth panel above window opening
30:00	Test terminated and gas to burners shut off. Beginning of 10-minute observation period.
35:00	Test specimen stable.
40:00	End of the observation period; NFPA 285 testing completed.

CONDITIONS OF ACCEPTANCE

Performance Criteria	Test Observations	Pass/Fail
Flames emitting from the surface of the exterior face of the test specimen shall not reach a height of 10 ft. or greater above the top of the window opening	Flames did not reach 10 ft. above the window opening.	Pass
Flames emitting from the surface of the exterior face of the test specimen shall not reach a horizontal distance of 5 ft. or greater from the vertical centerline of the window opening.	Flames did not reach a lateral distance of 5 ft. from the vertical centerline.	Pass
Flames shall not occur in second-story test room.	There was no visible flaming in the second-story test room.	Pass
Flames shall not occur beyond the intersection of the test specimen and the side walls of the apparatus.	Flames did not reach beyond the intersection of the test specimen and the side walls.	Pass
Temperatures shall not exceed 1000°F as measured by thermocouples TC11 and TC14 through TC17.	TC11 and TC14 through TC17 did not exceed the 1000°F limit.	Pass
Temperatures in the combustible components shall not exceed 750°F above their temperature at the start of the test as measured by TC28 and TC31 through TC40.	TC28 and TC31 through TC40 did not exceed the maximum temperature of 817°F. (750°F + 67°F = 817°F)	Pass
Temperatures in the combustible components shall not exceed 750°F above their temperature at the start of the test as measured by TC18 and TC19.	TC18 and TC19 did not exceed the maximum temperature of 817°F. (750°F + 67°F = 817°F)	Pass
Temperatures measured 1 in. from the interior surface of the test specimen within the second-story test room shall not exceed 500°F above the ambient air temperature of the test facility at the start of the fire test as measured by TC49 through TC54.	TC49 through TC54 did not exceed the maximum temperature of 567°F. (500°F + 67°F = 567°F)	Pass

EXTENT OF DAMAGE

Interior Wall Cladding:

The interior gypsum was still intact after the test. The exposed gypsum in the first-story test room was heavily fatigued, showing signs of flame damage. The second-story interior gypsum was almost completely unblemished and showed no signs of flaming.

Z-Furring Strips:

The Z-furring strips located directly above the window opening were observed to have flame damage up to 5 ft. and discoloration up to the top of the assembly. The EPDM rubber strips on those Z-furring channels had melted away up to 5 ft. above the window opening.

Air & Water Barrier/Exterior Sheathing:

Charring of the GE Elemax* 2600 AWB and exterior sheathing was evident within the area of the flame plume up to 6 ft. above the window header. Lateral damage did not extend beyond the vertical plane of the window opening jambs. Discoloration of the AWB was evident up to the top of the assembly above the window opening header.

Exterior SILBONIT Cladding Panels:

Cracking and spalling of the SILBONIT cladding panels were evident up to and including the fourth panel above the window opening. Lateral damage was evident across the entire width of the first panel above the window opening, narrowing on the way up to the fourth panel. Charring of the panels was evident up to the third panel above the window header.

Conclusion

The Fire Testing Laboratory of NGC Testing Services conducted testing for Cement Board Fabricators on a SILBONIT Panel Ventilated Wall System assembly, to evaluate its fire propagation characteristics. Testing was conducted in accordance with the applicable requirements of, and following the standard methods of, NFPA 285 Standard Test Method for Evaluation of Fire Propagation Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components, 2019 Edition. This evaluation took place on March 12, 2019.

Based on the data and associated observations from this test, the test assembly described in this report met the conditions of acceptance of NFPA 285.

Appendix A
Thermocouple Location Diagrams

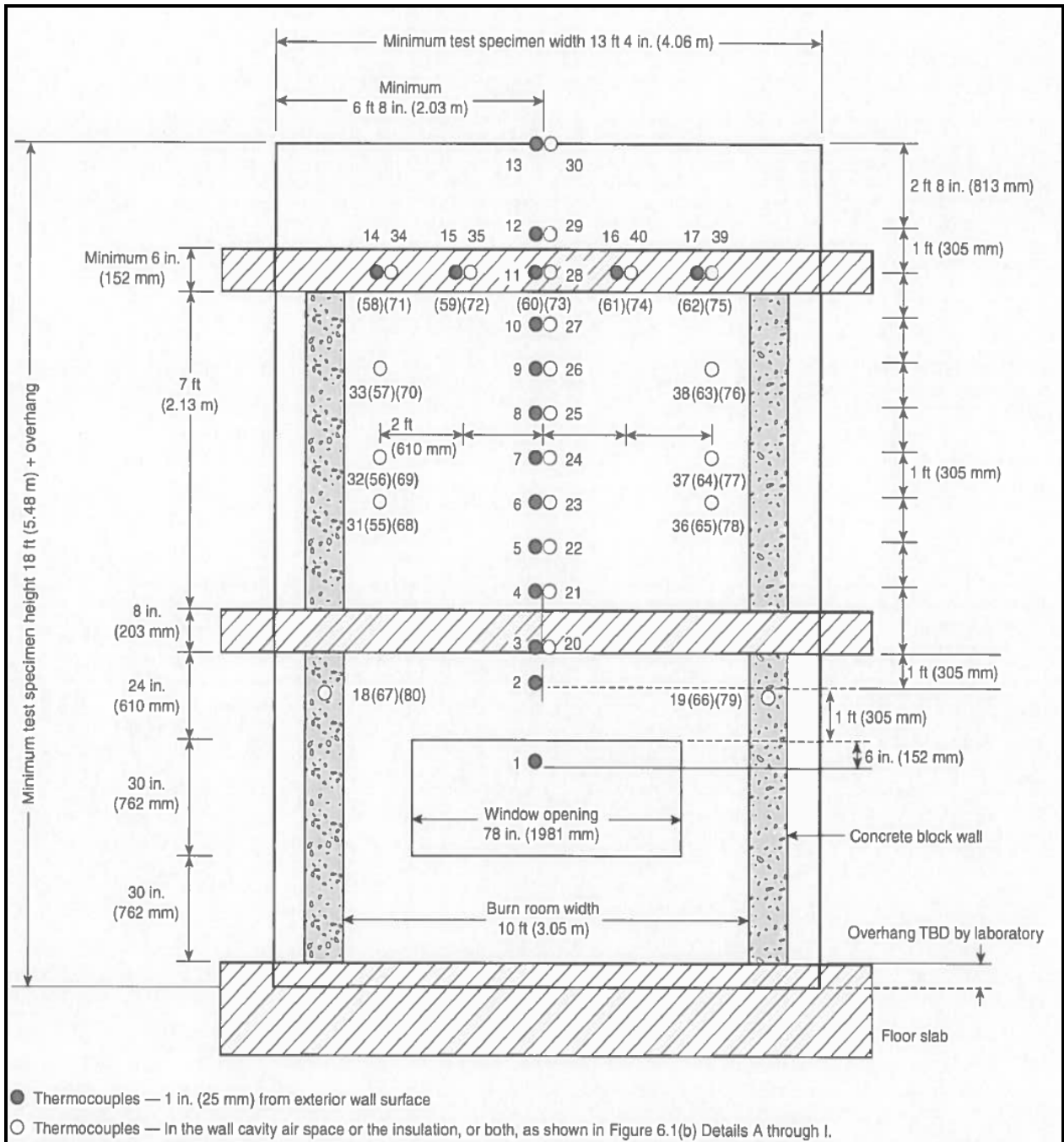


Figure 1: Thermocouple Locations on Exterior Wall Surface and in Cavity Air Space

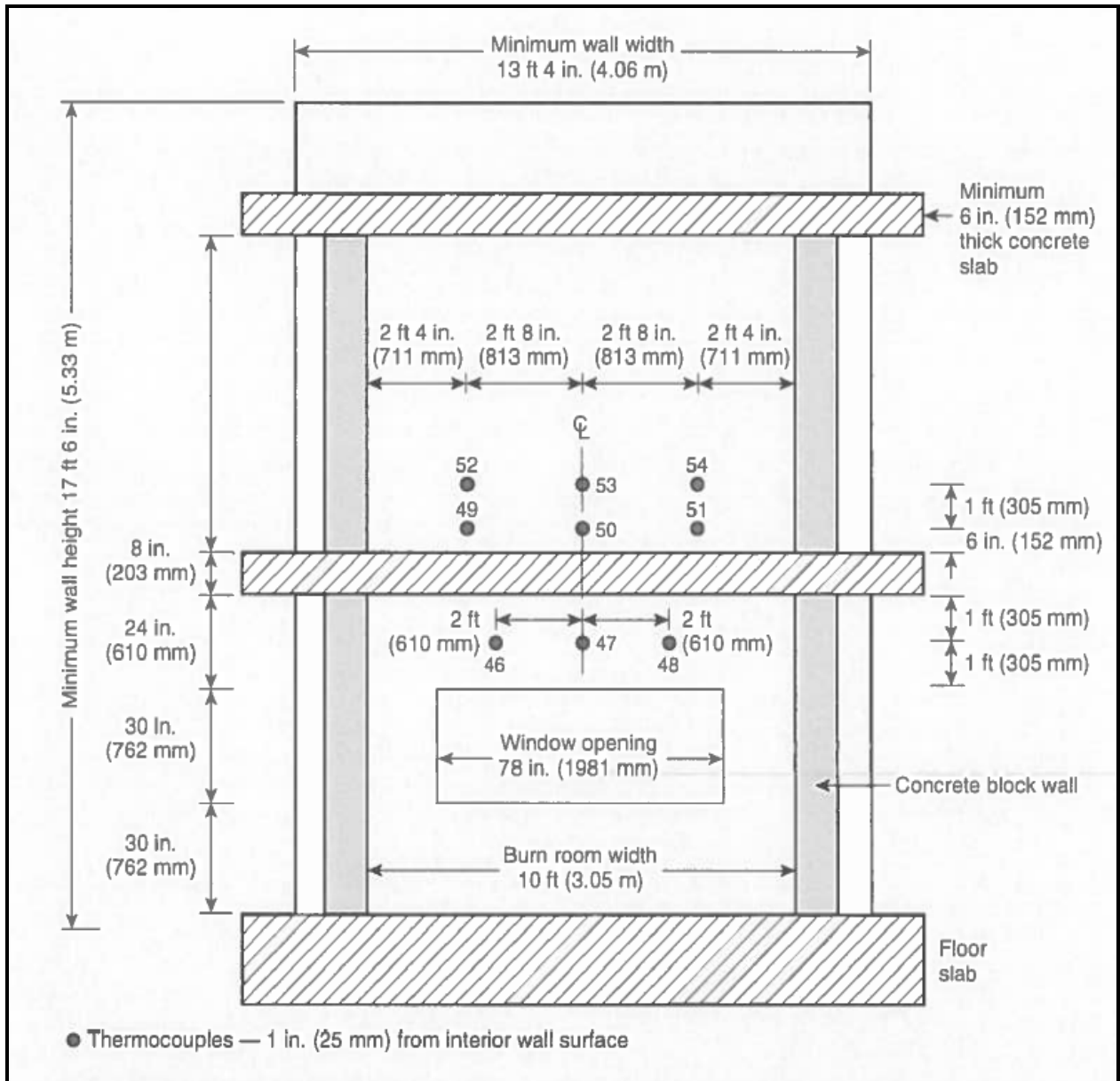


Figure 2: Thermocouple Locations on Interior Wall Surface

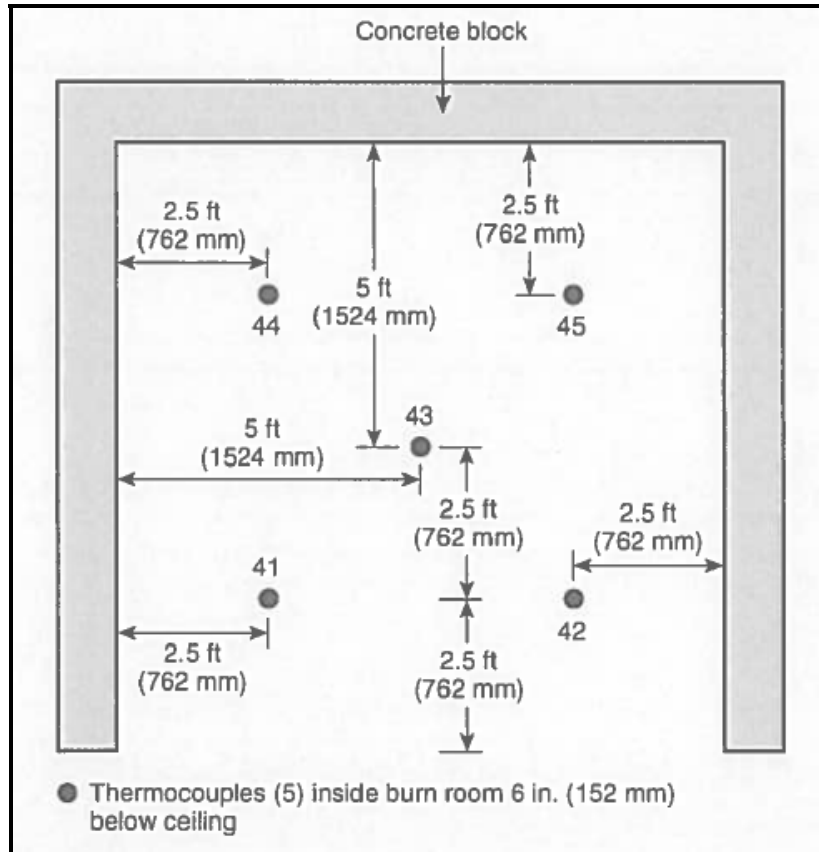


Figure 3: Thermocouple Locations Inside First Story Burn Room (Top View)

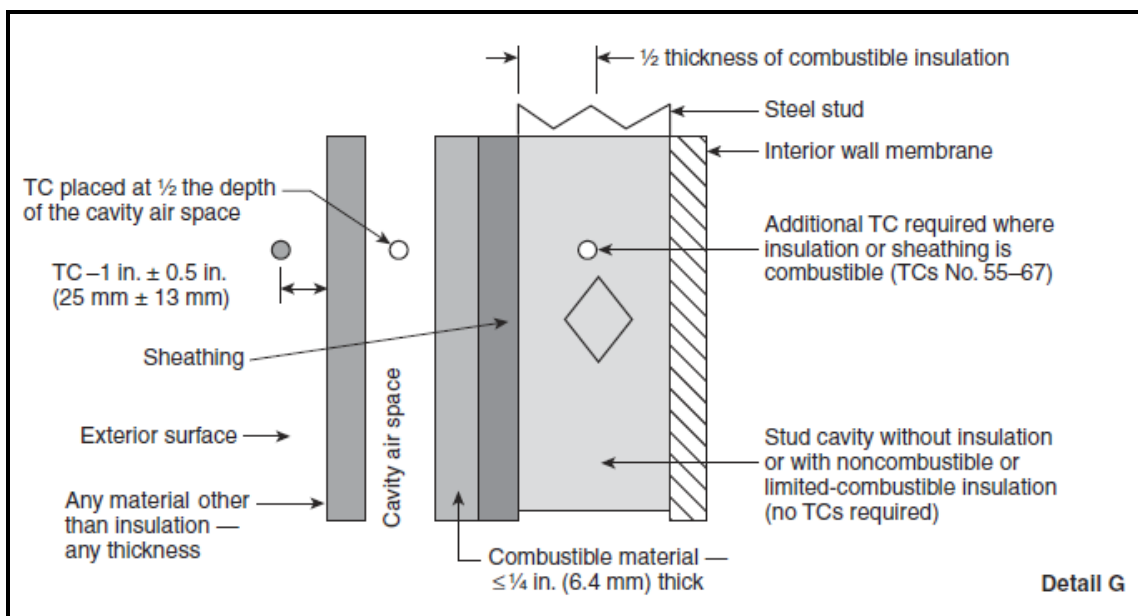
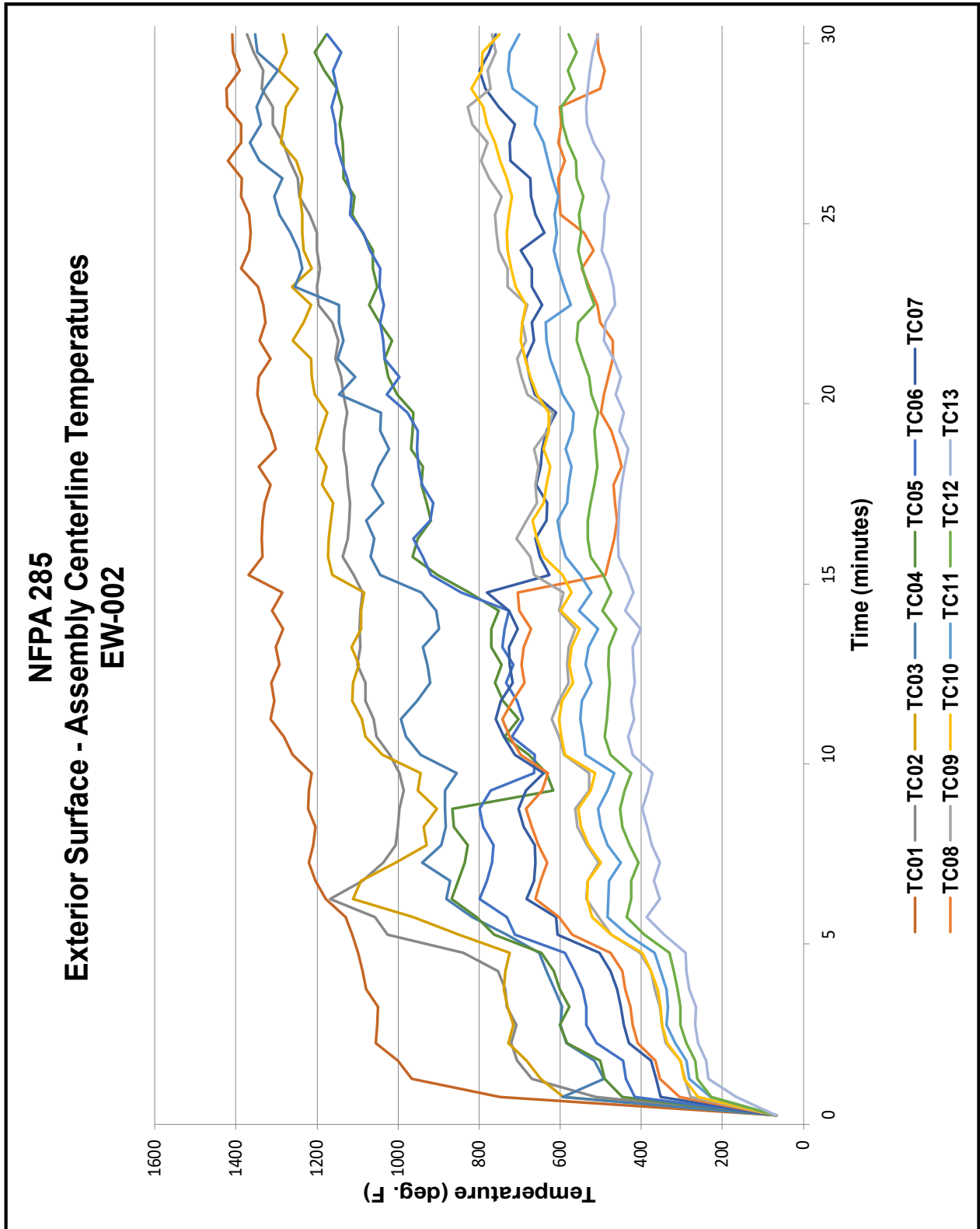
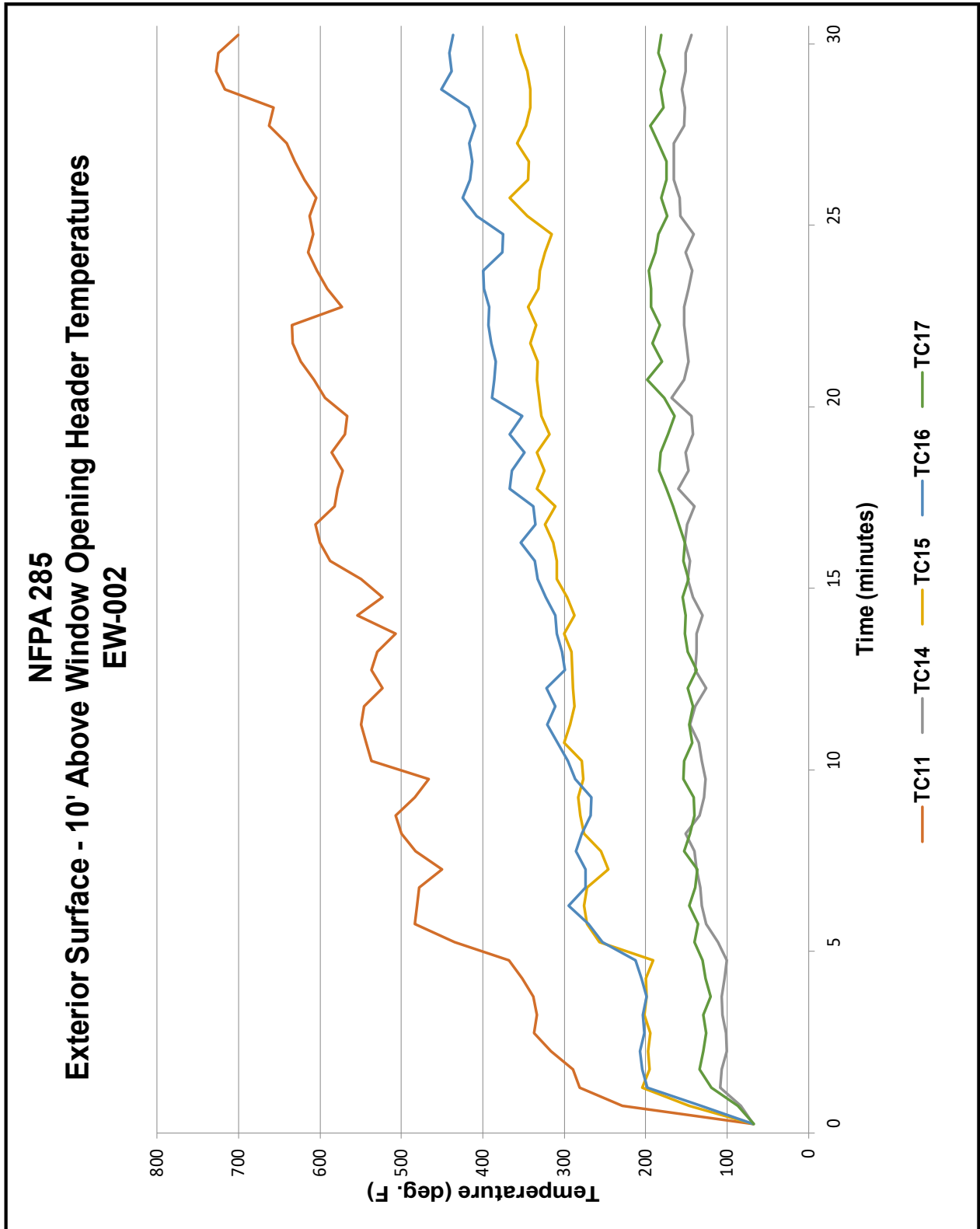


Figure 4: Thermocouple Depth Specifications per Figure 6.1(b) Detail G of NFPA 285 Standard

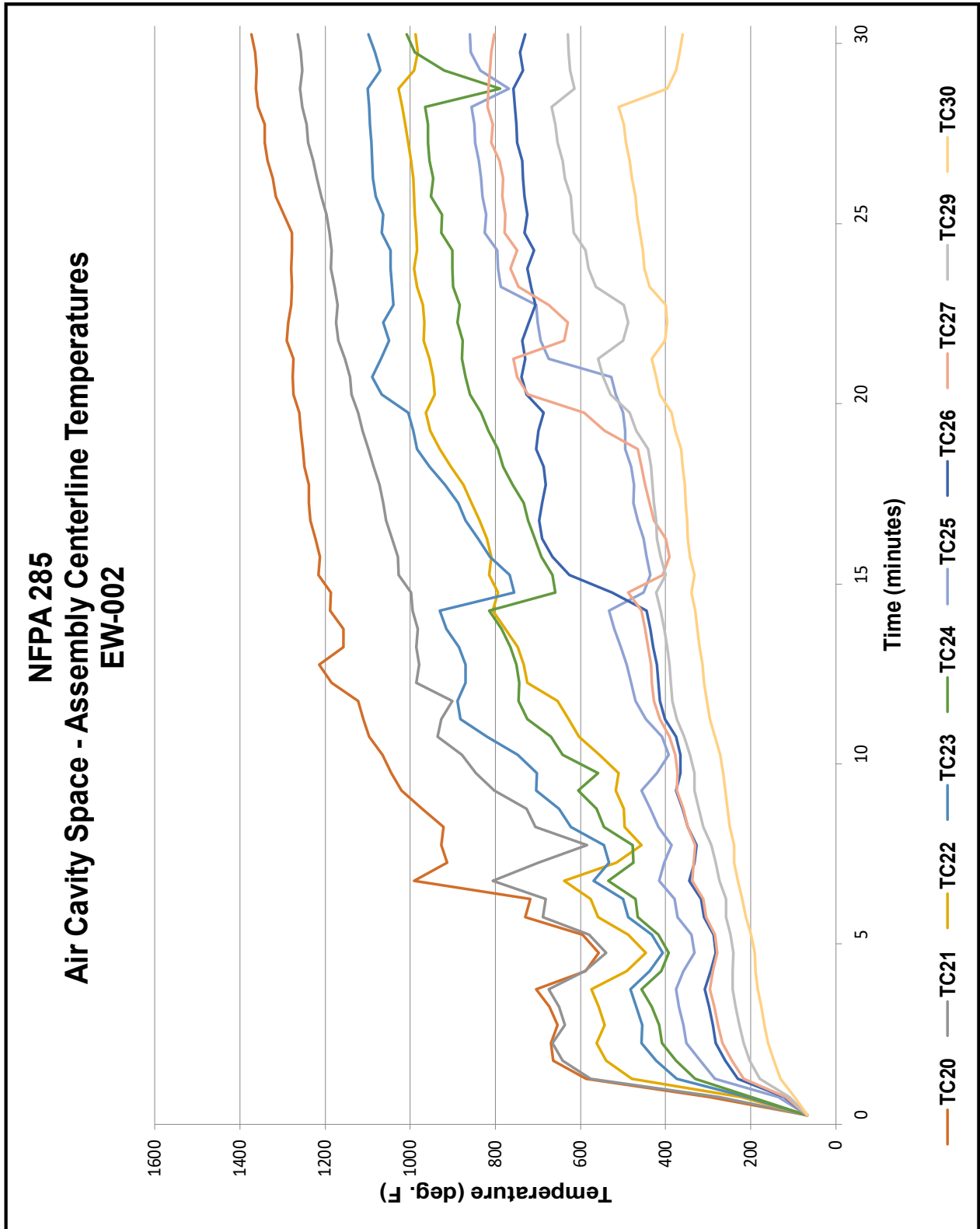
Appendix B
Thermocouple Graphical Data



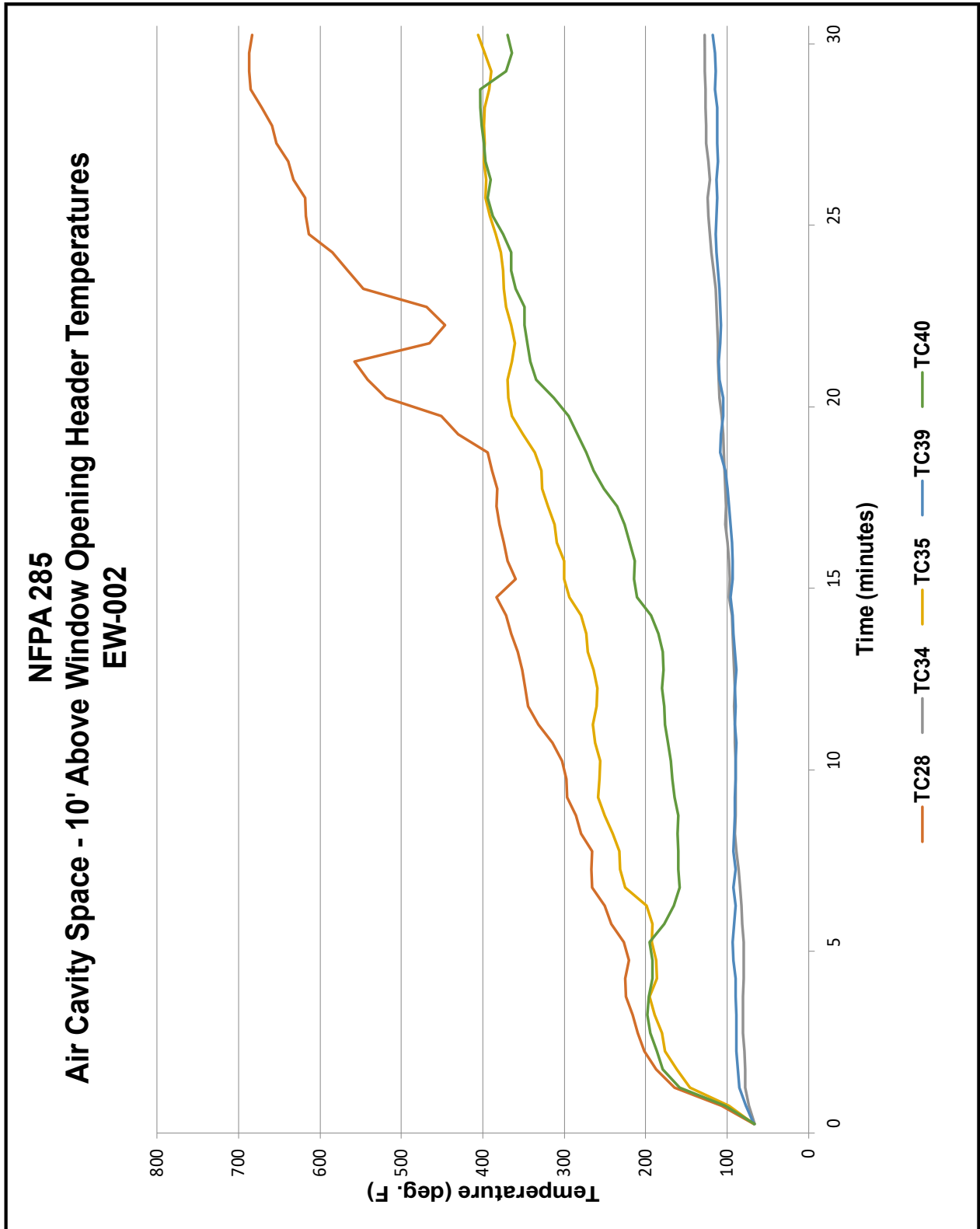
Graph 1: Exterior Surface - Assembly Centerline Temperatures (TC01 – TC13)



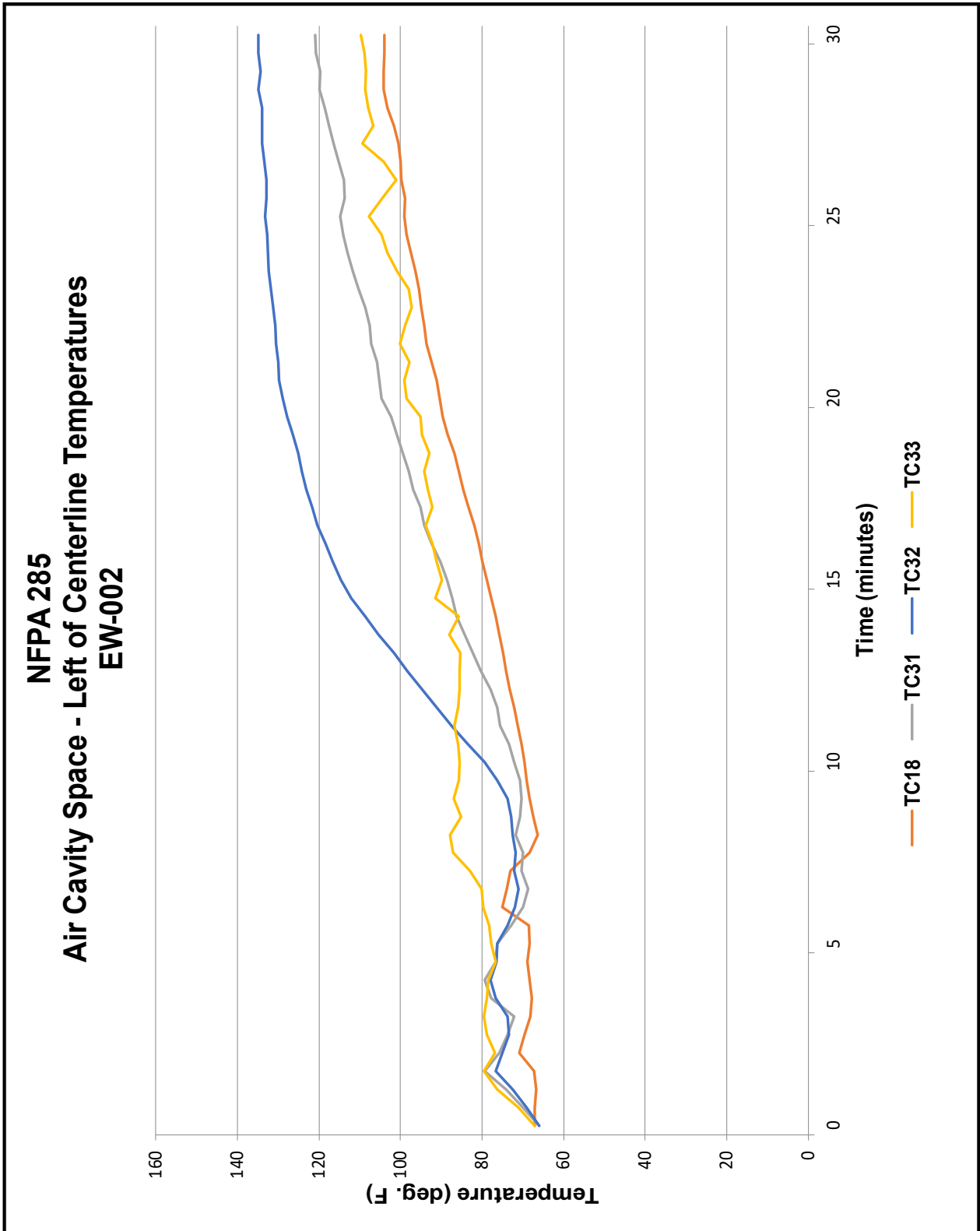
Graph 2: Exterior Surface - 10' Above Window Opening Temperatures (TC11, TC14–TC17)



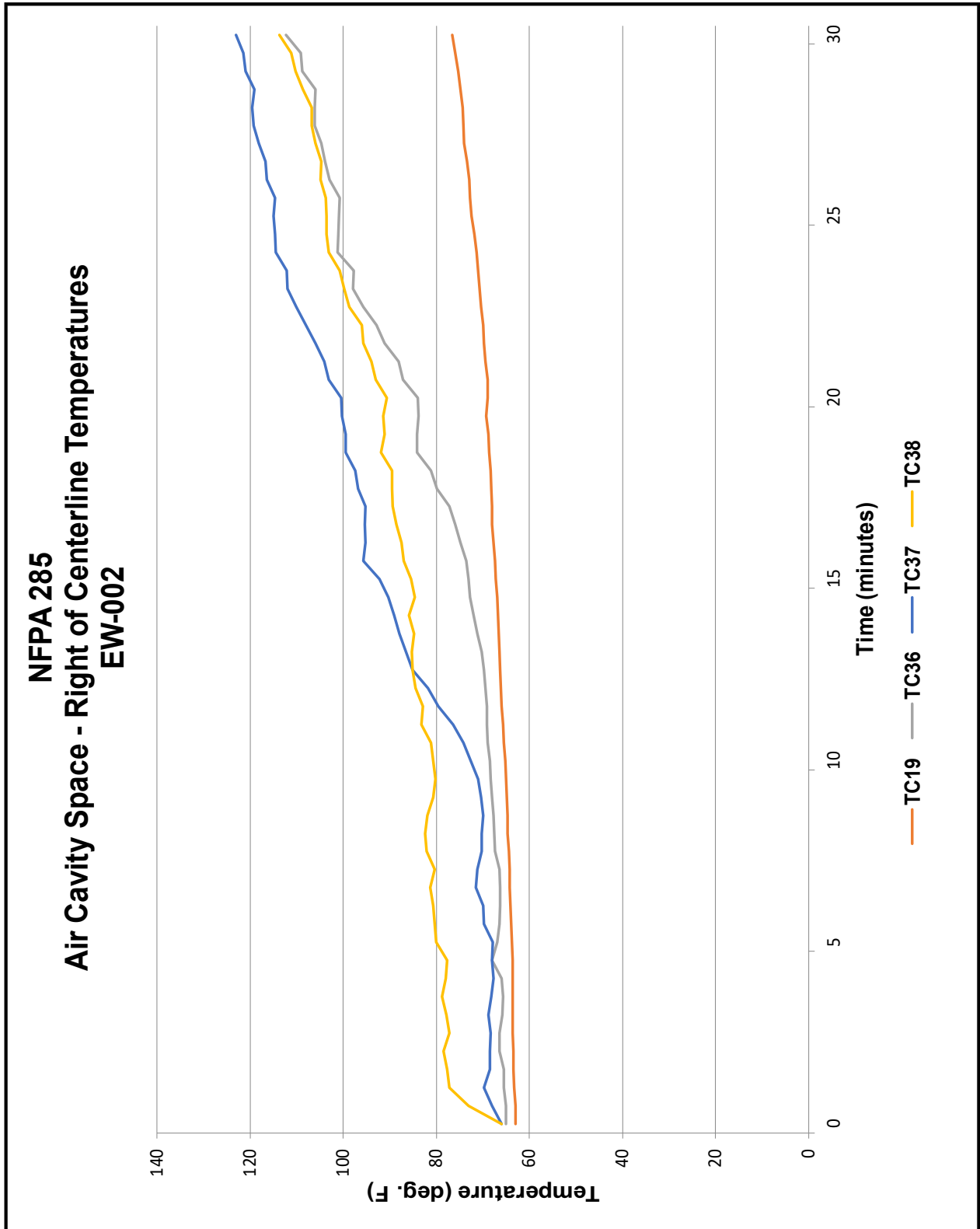
Graph 3: Air Cavity Space - Assembly Centerline Temperatures (TC20–TC30)



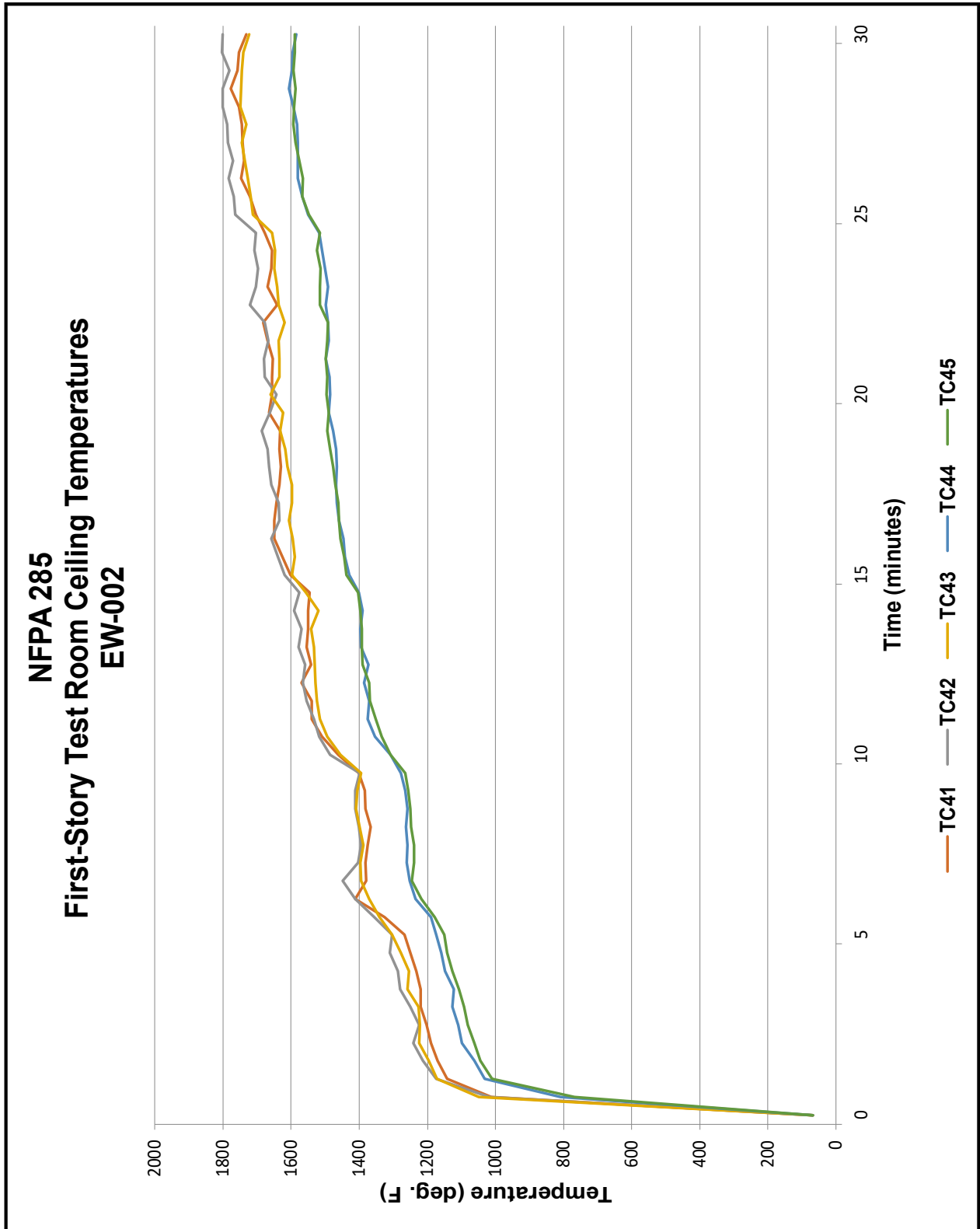
Graph 4: Air Cavity Space – 10' Above Window Opening Temperatures (TC28, TC34-35, TC39–TC40)



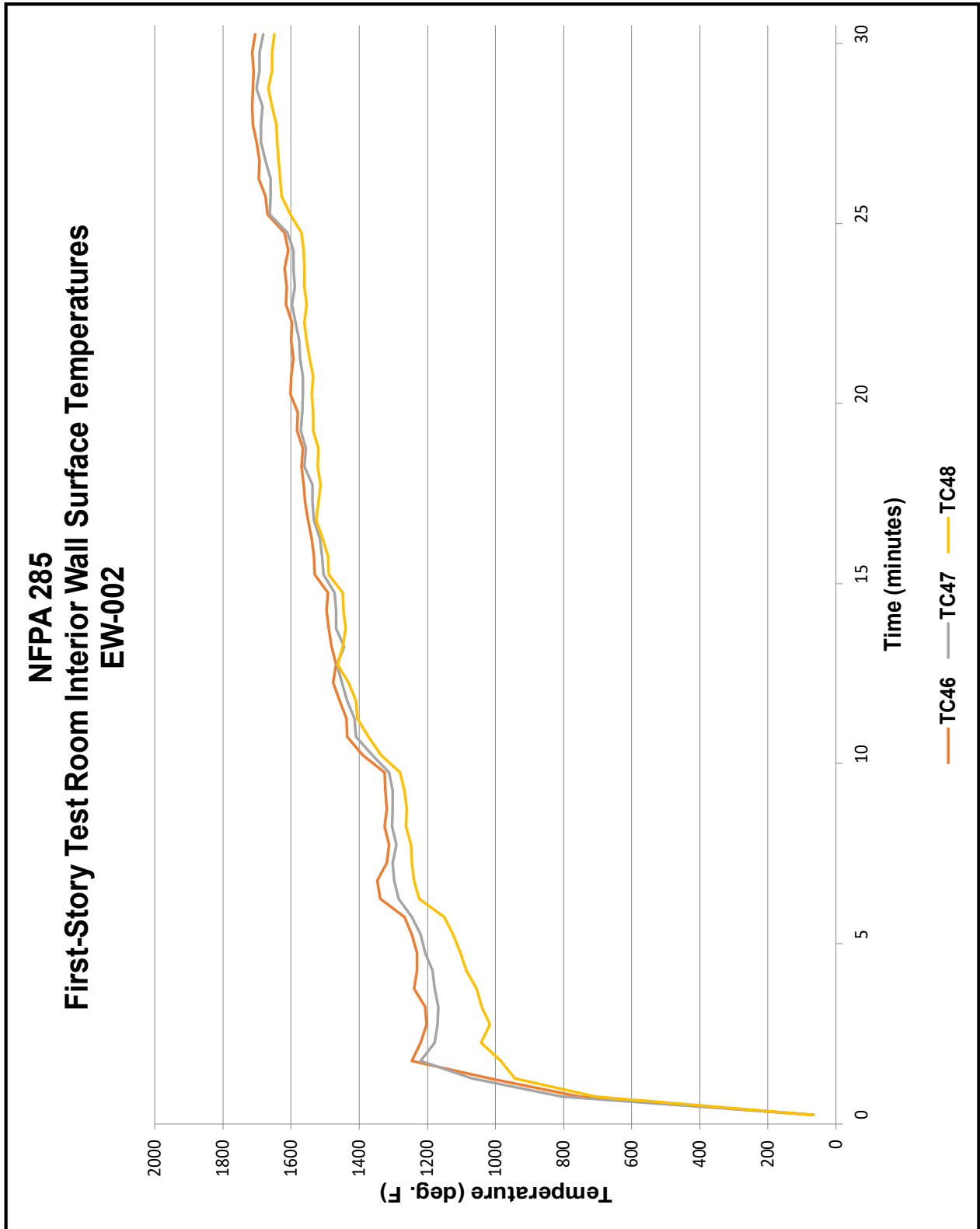
Graph 5: Air Cavity Space – Left of Assembly Centerline Temperatures (TC18 and TC31–TC33)



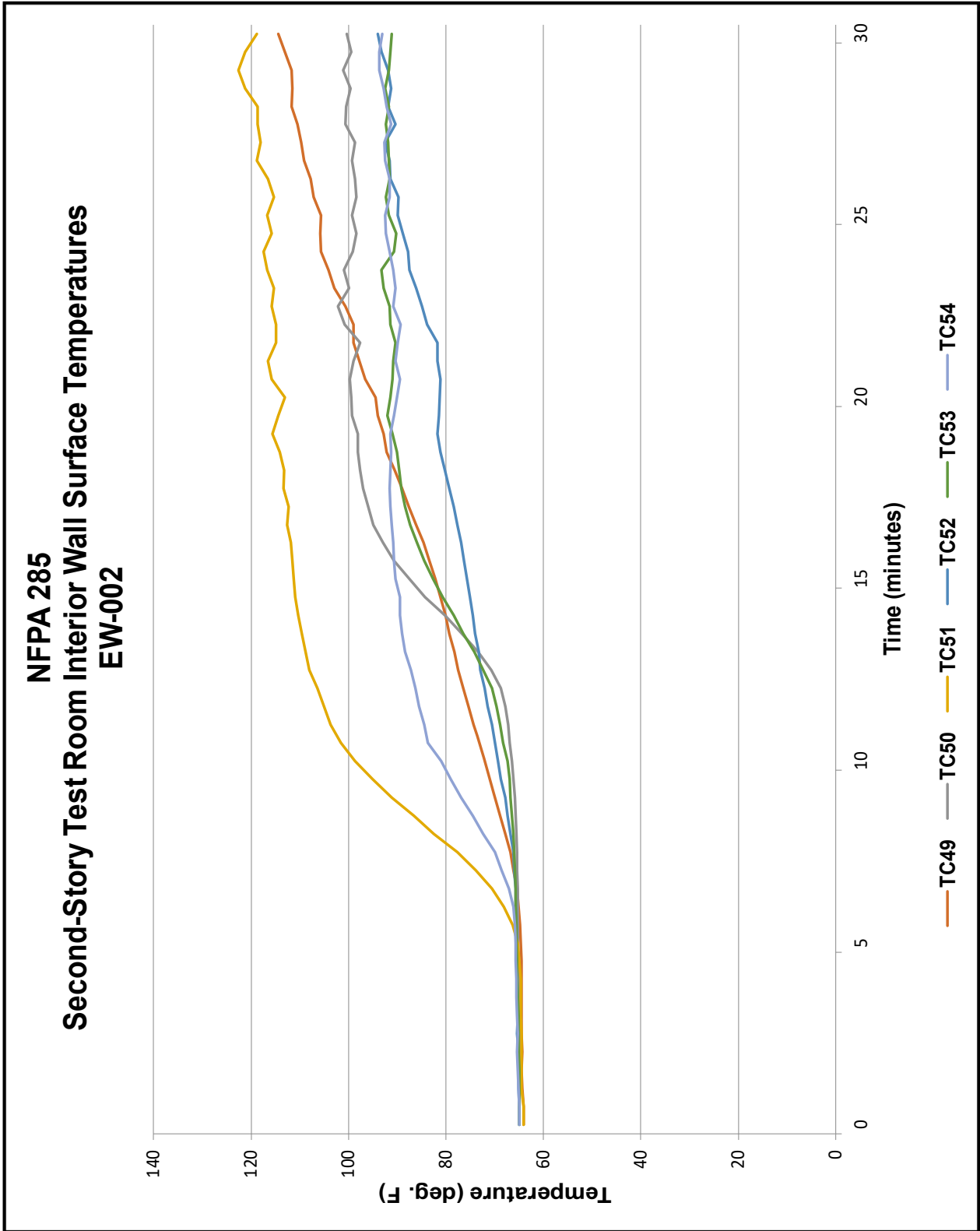
Graph 6: Air Cavity Space – Right of Assembly Centerline Temperatures (TC19 and TC36–TC38)



Graph 7: First-Story Test Room Ceiling Temperatures (TC41–TC45)



Graph 8: First-Story Test Room Interior Wall Surface Temperatures (TC46–TC48)



Graph 8: Second-Story Test Room Interior Wall Surface Temperatures (TC49–TC54)

Appendix C
Construction Photographs



Photo 1: Core Wall Construction



Photo 2: GE Elemax* 2600 AWB Applied to Exterior Sheathing



Photo 3: Horizontal and Vertical Z-Furring Strips and Start of SILBONIT Panel Installation



Photo 4: Complete SILBONIT Panel Installation



Photo 5: Complete Interior First-Story Test Room



Photo 6: Complete Interior Second-Story Test Room

Appendix D

Test Photographs



Photo 1: Test Specimen After Ignition of Room Burner



Photo 2: Test Specimen after Ignition of Window Burner



Photo 3: Cracking and Spalling of SILBONIT Panels



Photo 4: Test Specimen After Burners Extinguished



Photo 5: "Burn" Pattern of SILBONIT Panels

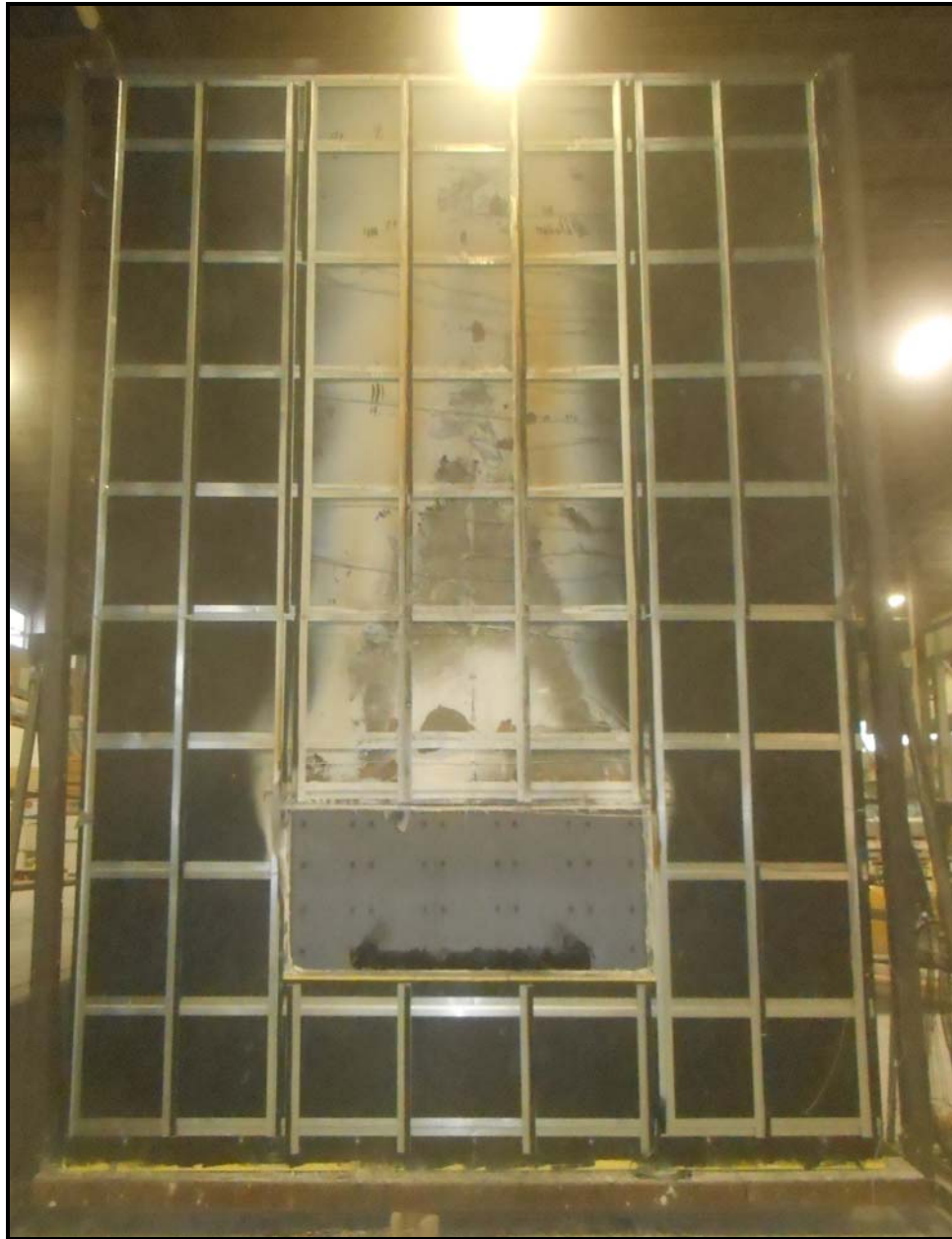


Photo 6: Burn Pattern of AWB After SILBONIT Panels Removed



Photo 7: Interior Second-Story Test Room – Post-Test