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FIRE PERFORMANCE EVALUATION TESTED IN ACCORDANCE WITH NFPA 285, *STANDARD FIRE TEST METHOD FOR EVALUATION OF FIRE PROPAGATION CHARACTERISTICS OF EXTERIOR NONLOAD-BEARING WALL ASSEMBLIES CONTAINING COMBUSTIBLE COMPONENTS*, 2012 EDITION

TRADE NAME: ***RB240FR REYNOBOND 6MM FR PANELS***

FINAL REPORT
Consisting of 46 Pages

SwRI® Project No. 01.16668.05.001
Test Date: July 19, 2013
Report Date: October 28, 2013

Prepared for:

Alcoa Architectural Products
50 Industrial Blvd.
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ABSTRACT

Southwest Research Institute's (SwRI) Fire Technology Department, located in San Antonio, TX, conducted an Intermediate-Scale Multistory Test Apparatus fire performance evaluation test for Alcoa Architectural Products, located in Eastman, GA. Testing was conducted on July 19, 2013, on a wall assembly utilizing Alcoa Architectural Products's, *RB240FR Reynobond 6mm FR panels*, DuPont™ Tyvek® Fluid Applied WB, DuPont™ Tyvek® Fluid Applied Flashing and Joint Compound, DuPont™ Tyvek® Commercial Wrap, Hunter Panels Xci Class A Polyisocyanurate Insulation, and other construction materials.

Testing was performed in accordance with the National Fire Protection Association 285, *Standard Fire Test Method for Evaluation of Fire propagation Characteristics of Exterior Nonload-Bearing Wall Assemblies Containing Combustible Components*, 2012 Edition. The wall assembly **met** the acceptance criteria stated in the standard.

This report contains a description of the test procedure followed, assembly tested, and the results obtained. The results apply specifically to the specimens tested, in the manner tested, and not to similar materials, nor to the performance when used in combination with other materials.

1.0 INTRODUCTION

Southwest Research Institute's (SwRI) Fire Technology Department, located in San Antonio, TX, conducted an Intermediate-Scale Multistory Test Apparatus (ISMA) fire performance evaluation test for Alcoa Architectural Products, located in Eastman, GA, on July 19, 2013. Testing was performed in accordance with the National Fire Protection Association (NFPA) 285, *Standard Fire Test Method for Evaluation of Fire propagation Characteristics of Exterior Nonload-Bearing Wall Assemblies Containing Combustible Components,* 2012 Edition. The wall assembly successfully **met** the acceptance criteria stated in the standard.

This report contains a description of the test procedure followed, assembly tested, and the results obtained. The results apply specifically to the specimens tested, in the manner tested, and not to similar materials, nor to the performance when used in combination with other materials.

2.0 SCOPE

NFPA 285 provides a method of determining the flammability characteristics of exterior, non-load bearing wall assemblies, which contain combustible components.

The test method is intended to simulate the "full-scale" fire performance of the wall assembly being evaluated. The primary performance characteristics evaluated in this test are the capability of the test wall assembly to resist the following:

1. Flame propagation over the exterior face of the system,
2. Vertical flame spread within the combustible core components from one story to the next,
3. Vertical flame spread over the interior (room side) surface of the combustible core components one story to the next, and
4. Lateral flame spread from the compartment of fire origin to adjacent spaces.

The above are assessed through visual observations and temperature data obtained during the test.

3.0 TEST ASSEMBLY

SwRI received the test materials from Alcoa Architectural Products, on June 14, 18, and 19, 2013. Mr. Jerry Ingles was retained by SwRI Fire Technology Department's Listing, Labeling, and Follow-Up Inspections Services Section, as a third party inspector, to select the test materials from stock at the Alcoa Architectural Products facility located in Eastman, GA, on March 12, 2013. Upon receipt, the inspector's initials were verified to be present on the samples. A copy of the surveillance report is on file at SwRI and can be obtained by authorized Alcoa personnel.

The *RB240FR Reynobond 6mm FR panels* were a nominal 0.24-in. (6-mm) thick panel consisting of a polymeric compound FR core with aluminum skins. The core was nominally 0.20 in. (5 mm) thick with a 0.20-in. (0.5-mm) thick skin on each side of the core. The panels had a nominal weight of 2.0 lb/ft^2.

A base wall assembly was constructed by SwRI personnel, consisting of 18-ga, 3-5/8-in., C-channel steel studs framed vertically 16 in. on center with one at the vertical centerline of the assembly. Additional studs were included at the window jambs for formation of the window opening. The interior face of the wall was sheathed with 5/8-in. Type "X" gypsum wallboard. The interior face gypsum joints were finished with 2-in. tape and treated with joint compound compliant to ASTM C475, *Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board*. The exterior face of the wall was sheathed with 5/8-in. Densglass® Gold sheathing. The base wall assembly included 4-in. thick, 4-pcf, mineral wool insulation sheets placed within the stud cavity at each floor line and was held in place by "Z" clips. The mineral wool insulation was installed in multiple layers to cover the full thickness of the floor line, which was nominally 8 in. thick.

Following construction of the base wall assembly, DuPont Tyvek Fluid Applied Flashing and Joint Compound was applied over all exterior sheathing joints and fastener heads. Following the application of the DuPont Tyvek Fluid Applied Flashing and Joint Compound, DuPont Tyvek Fluid Applied Weather Barrier was applied by roller to a wet thickness of 25 mil. The application was allowed to dry overnight prior to the installation of any additional materials.

Following the installation of the Fluid Applied DuPont products, a 24-ga galvanized steel window header flashing piece was installed which provided a horizontal drip edge that came flush with the exterior surface of the panel system. The window jambs and sill received 16-ga galvanized steel flashing.

Following the installation of the window flashing pieces, 16-ga galvanized steel Z-girts were installed on the exterior surface of the assembly over the fluid applied weather barrier. The Z-girts had 2-in. vertical legs, were 3-9/16 in. deep, and 6 in. wide. The Z-girts were installed over each stud location across the width of the wall using one #12 – 14 Drill-Flex® fastener per Z-girt. The Z-girts were installed such that the front flanges corresponded with the locations of horizontal joints in the system. This resulted in Z-girts located along the bottom edge of the wall assembly, flush with the window header and sill to the sides of the window opening, along the top and bottom edge of the window the Z-girts butted up against the window flashing, and 4 ft on center above the window opening (refer to Figure A-6 and B-3). Following the installation of the Z-girts, 3-9/16-in. thick Hunter Panels Xci Class A Polyisocyanrate Insulation was installed underneath the voids formed by the flanges of the Z-girts. The edges of the polyisocyanurate panels that were not held in place by the Z-girt flanges had two WindDevil #10 × 4-3/8-in. fasteners along the bottom edge of each insulation panel such that the fasteners were located over studs. A layer of DuPont Tyvek Commercial Wrap was then installed over the insulation boards, which was held in place by staples.

The *RB240FR Reynobond 6mm FR panels* were installed with an aluminum extrusion system provided by Elward Systems Corporation. The aluminum extrusion system is identified by Elward Systems Corporation as the *Enwall Wet 138 System*, which consists of interlocking extrusions which are riveted to the inner edges of the panel returns. The bottom row of panels had a J-channel which secured to the front faces of the Z-girts, and the extrusion along the bottom edge of the bottom row of panels sat within the J-channel. The extrusion along the top edges of the panels were secured directly to the faces of the Z-girts.

The top edges and J-channels were secured to the Z-girts using #12 – 14 Drill-Flex® fasteners. The panels were installed from left to right, bottom to top, as the panels interlocked with each other requiring no additional fasteners once the top edge of the previous panel was secured to the wall. The panels were installed such that a 1/2-in. gap was maintained between adjacent panels. Following the installation of the panels, Dow Corning 795 caulking was installed at the panel joints with a 5/8-in. diameter open cell polyurethane backer rod.

Refer to Appendix A for Client-provided construction drawings and Appendix B for photographs of each step of the wall assembly construction.

4.0 CALIBRATION

NFPA 285, Section 7-2, requires the apparatus to be calibrated (a) initially, prior to the first wall assembly test, (b) when significant changes to the gas flow system are made, (c) within 1 year prior to the test on an actual product wall assembly, or (d) whenever ceramic blanket covering more than 50% of the wall or ceiling surface in the burn room is replaced.

SwRI conducted an ISMA calibration test on October 29, 2012, with the burner regime shown in Table 1. This calibration confirmed the burner regime necessary to reach the required temperatures and heat flux levels.

Table 1. Burner Regime.

Time Interval (min:s)	Room Burner SCFM	Room Burner kW (Btu/min)	Window Burner SCFM	Window Burner kW (Btu/min)
00:00–05:00	39.7	697 (39,700)	–	–
05:00–10:00	41.2	724 (41,200)	7.0	123 (7,000)
10:00–15:00	45.3	796 (45,300)	10.3	181 (10,300)
15:00–20:00	51.2	900 (51,200)	13.0	228 (13,000)
20:00–25:00	51.3	901 (51,300)	13.0	228 (13,000)
25:00–30:00	52.0	914 (52,000)	14.3	251 (14,300)

Table 2 compares the average heat flux data obtained during the calibration test with the allowable heat flux ranges specified in Table 7-1.8 of NFPA 285 for the indicated period.

Table 2. Heat Flux Values for ISMA Calibration (Average Values for Time Period Indicated).

Time (min)		0–5	5–10	10–15	15–20	20–25	25–30
Calorimeter 1 (2 ft above Window, W/cm²)	Range	0.7–1.1	1.5–2.3	2.0–3.0	2.3–3.5	2.7–4.1	3.0–4.6
	Actual	**1.1**	2.2	2.9	**3.5**	3.6	3.8
Calorimeter 2 (3 ft above Window, W/cm²)	Range	0.8–1.2	1.6–2.4	2.1–3.1	2.6–3.8	3.0–4.4	3.2–4.8
	Actual	1.0	2.1	2.9	3.6	3.7	3.9
Calorimeter 3 (4 ft above Window, W/cm²)	Range	0.6–1.0	1.2–1.8	1.6–2.4	2.0–3.0	2.4–3.6	2.7–4.1
	Actual	0.9	1.8	2.3	2.8	2.9	3.1

Notes: Window Burner placed 1 in. away from face of wall assembly.

Table 3 compares the average temperature data obtained during the calibration test with the allowable temperature range specified in Table 7-1.8 of NFPA 285 for the indicated time period. The allowable temperature range is ± 10% of the temperature values specified in Table 7-1.8.

Table 3. Average Temperature Values for ISMA Calibration (Average Values for Time Period Indicated).

Time (min)		0–5	5–10	10–15	15–20	20–25	25–30
Burner Room Average of 5 TCs (ºF)	Range	1036–1266	1211–1481	1334–1630	1440–1760	1437–1757	1483–1813
	Actual	1181	1328	1459	1589	1635	1665
Interior Wall Surface Average of 3 TCs (ºF)	Range	959–1172	1168–1428	1290–1576	1420–1736	1418–1734	1490–1821
	Actual	1083	1264	1425	1573	1625	1664
1 ft above Window (ºF)	Range	542–662	782–957	857–1047	893–1091	941–1151	970–1186
	Actual	623	889	1007	**1092**	1108	1127
2 ft above Window (ºF)	Range	611–747	914–1117	1009–1233	1065–1301	1121–1370	1166–1426
	Actual	623	1004	1132	1234	1247	1276
3 ft above Window (ºF)	Range	581–711	874–1068	986–1206	1057–1291	1121–1370	1183–1445
	Actual	605	938	1089	1194	1205	1234
4 ft above Window (ºF)	Range	519–635	772–944	884–1080	957–1169	1022–1249	1102–1346
	Actual	566	882	1042	1148	1163	1184
5 ft above Window (ºF)	Range	469–573	689–842	788–963	854–1044	906–1108	995–1217
	Actual	477	756	925	1020	1045	1065
6 ft above Window (ºF)	Range	425–519	621–759	708–866	770–942	822–1004	909–1111
	Actual	445	691	853	**947**	978	999

Notes: Window Burner placed 1 in. away from face of wall assembly. Values in bold are outside the required range.

In summary, the calibration test provides documented evidence that SwRI's ISMA successfully demonstrated the ability to achieve the fire exposure conditions specified in NFPA 285, and that the facility can perform the fire evaluation described in NFPA 285.

5.0 INSTRUMENTATION

A Type H instrumentation layout, as illustrated in Figure 6.1(b) of NFPA 285, was used for the assembly constructed as described in this report. The wall was instrumented such that TCs were installed 1 in. off the exterior face of the wall assembly, at the midpoint of the air gap between the interior surface of the panels and exterior surface of the rigid insulation, and TCs were embedded within the Polyisocyanurate insulation such that the measuring junction of the TC was 1 in. away from the air gap. The TC locations for this test are summarized by the following diagrams:

- Exterior face and within the combustible insulation as shown in Figures A-2.
- Interior face of test wall assembly in both the burn room and the second-floor observation room, as shown in Figure A-3.

- Burn room ceiling area as shown in Figure A-4.
- Section view of the TCs on the exterior face and within the combustible insulation as shown in Figure A-5.

The temperature measurements were made using 18-ga, Type “K” TCs in the burn room and 20-ga, Type “K” TCs in all other locations. All data was recorded at intervals not exceeding 15 s. Flow rate of natural gas to each of the burners was monitored and recorded using turbine meters and frequency converters.

6.0 TEST PROCEDURE

Testing was conducted on July 19, 2013, in accordance with NFPA 285. Prior to testing, instrumentation connections were verified, and the window burner was positioned such that the vertical centerline of the window burner was flush with the exterior face of the test wall assembly. The test conditions were recorded as an ambient temperature of 81 °F and a relative humidity of 74.3% on July 19, 2013. The airflow across the exterior face of the test assembly was less than 4 ft/s as determined by an anemometer placed at right angles to the exterior face.

Documentation for the test consisted of digital photographs taken of the test wall assembly during the test, and during post-test to include dissection of the test assembly. Color video of the exterior face of the test wall assembly was taken prior to, during, and post-test. Color video of the test wall/floor intersection in the second-floor level was taken during the test period. Information from the second-floor video is used to assist in determination of flame penetration and/or smoke development.

7.0 TEST RESULTS

The ISMA performance evaluation test for Alcoa Architectural Products was performed on July 19, 2013. Present to witness the test was Mr. Thomas Rogers, representing Alcoa Architectural Products. Visual observations made during the test appear in Tables 4 and 5. Flame propagation observations are based on sustained flames on the surface of the wall. Intermittent flaming above the sustained flames is not considered for estimating the extent of flame propagation. The following sections outline the performance of the wall assembly with respect to the conditions of acceptance detailed in NFPA 285.

Table 4. Test Observations of Front Wall.

Time (min:s)	Observations of Front Wall
0:00	Start of test.
3:00	Ripples in window header causing separation of metal flashing from silicone caulk.
5:00	Window burner positioned in burn location.
10:00	Exteriors of panels are wrinkling. No visible flame attachment to exterior surface of wall. Smoking from upper corners of assembly.
10:30	Burning is originating at the window header at the location of the separation of the metal flashing from the caulk.

Table 4. Test Observations of Front Wall (continued).

Time (min:s)	Observations of Front Wall
13:00	No major contribution of wall material to exterior flame. Flaming around 3–4 ft above window header.
15:00	Burning continues at the window header. Discoloration of the exterior panel surface is developing. No flame attachment of burning this panel skins is visible.
17:30	Thicker smoke continues to come over the top corners of the test assembly. From the area of flame impingement lighter smoke is emitting.
21:30	The panels are bowing outward into the flame.
25:00	Flaming on exterior face increasing slightly. Flaming around 4–5 ft above window header.
27:00	Exterior skin of first panel above window header has opened up. No major contribution to flaming on exterior face of wall assembly. Flaming around 4–5 ft above window header.
Post-Test Observations	After termination of burners there is residual flaming at window header gap along the full width of the window. There is intermittent flaming at the center joint of the wall assembly starting around 32 min. This intermittent flaming becomes continuous flaming around 33 min for the duration of the observation period. This flaming is local to the 3-ft mark and does not climb or spread throughout the observation period.

Table 5. Test Observations of Second-Floor Room.

Time (min:s)	Observations of Second-Floor Room
0:00	Start of test. 100% visibility.
10:00	No changes to amount of smoke in second-floor observation room. 100% visibility.
20:00	No changes to amount of smoke in second-floor observation room. 100% visibility.
25:00	No changes to amount of smoke in second-floor observation room. 100% visibility.
30:00	No changes to amount of smoke in second-floor observation room. 100% visibility. No flaming present in second-floor room at any point during test.
Post-Test Observations	No changes to visibility or smoke in second-floor room during observation period.

7.1.1 Flame Propagation, Exterior Face of Wall Assembly:

1. TCs 11 and 14–17 did not exceed 1000 °F at any time during the test.
2. Flames emitting from the surface of the exterior face did not reach a vertical elevation of 10 ft above the top of the window opening at any time during the test.
3. Flames emitting from the surface of the exterior face did not reach a lateral distance of 5 ft from the vertical centerline of the window opening any time during the test.

7.1.2 Vertical Flame Propagation, Combustible Components, and Insulation:

1. The temperatures within the air gap as measured by TCs 28 and 31–40 did not exceed 1000 °F any time during the test.

2. The temperatures within the combustible insulation as measured by TCs 55–65 did not exceed 750 °F above their temperature measured immediately after the start of the test at any time during the test.

7.1.3 Horizontal Flame Propagation, Combustible Components, and Insulation:

1. The lateral temperatures within the air gap as measured by TCs 18 and 19 did not exceed 1000 °F any time during the test.
2. The lateral temperatures within the combustible insulation as measured by TCs 66 and 67 did not exceed 750 °F above their temperature measured immediately after the start of the test at any time during the test.

7.1.4 Flame Propagation, Beyond First-Floor Test Room:

1. Flames did not occur over the surface of the exterior face beyond the concrete block walls or beyond the intersection of the test wall assembly, and the concrete block fixture walls.
2. The temperatures within the combustible insulation as measured by TCs 18 and 19 did not exceed 750 °F above their temperature measured immediately after the start of the test at any time during the test.

7.1.5 Temperatures in Second-Floor Test Room:

1. Temperatures 1 in. from the interior surface of the wall assembly within the second-floor test room, as measured by TCs 49–54, did not exceed 500 °F above the ambient temperature at any time during the test.

7.1.6 Flames in Second-Floor Test Room:

1. Review of the pertinent TC data, second-floor videotape, and post-test inspection indicated that flame propagation did not occur in the second floor at any time during the test.

7.1.7 Flame Propagation to Adjacent Horizontal Spaces

1. Flames did not occur beyond the intersection of the test specimen and the side walls of the test apparatus.

Appendix A contains Client-provided drawings of the wall assembly. See Appendix B for photographic documentation of the construction, test, and post-test inspection. Graphical temperature data can be located in Appendix C.

8.0 CONCLUSION

SwRI's Fire Technology Department, located in San Antonio, TX, conducted an ISMA fire performance evaluation test for Alcoa Architectural Products, located in Eastman, GA. The test performed on July 19, 2013, was conducted on a wall assembly utilizing Alcoa Architectural Products's, *RB240FR Reynobond 6mm FR panels*, DuPont™ Tyvek® Fluid Applied WB, DuPont™ Tyvek® Fluid Applied

Flashing and Joint Compound, DuPont™ Tyvek® Commercial Wrap, Hunter Panels Xci Class A Polyisocyanurate Insulation, and other construction materials. Using the methods described in this report on the wall constructed as described in this report, it was shown that the wall assembly **met** the acceptance criteria stated in the NFPA 285 standard.

APPENDIX A

TEST ASSEMBLY DRAWINGS AND INSTRUMENTATION LAYOUT

(CONSISTING OF 15 PAGES)

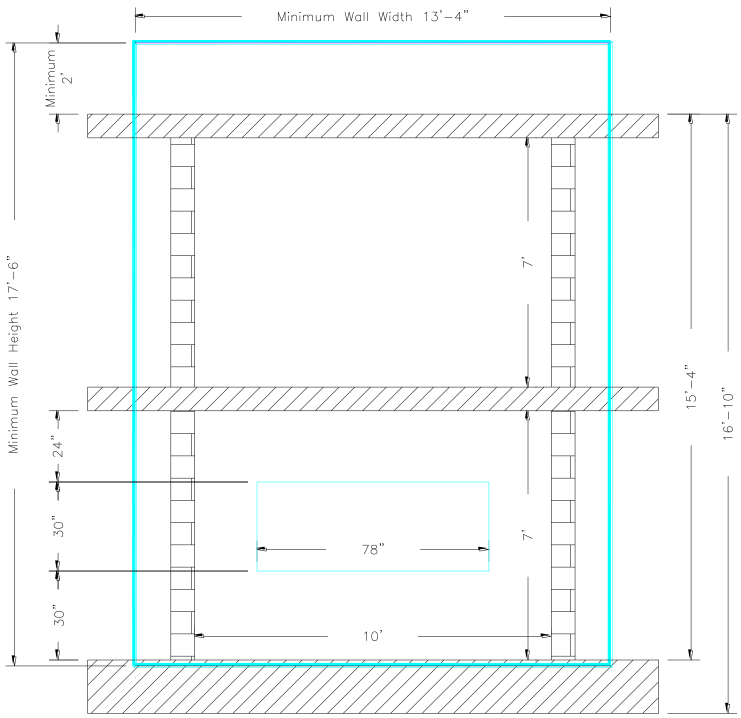

Figure A-1. Front View of Wall System in Place on Test Structure.

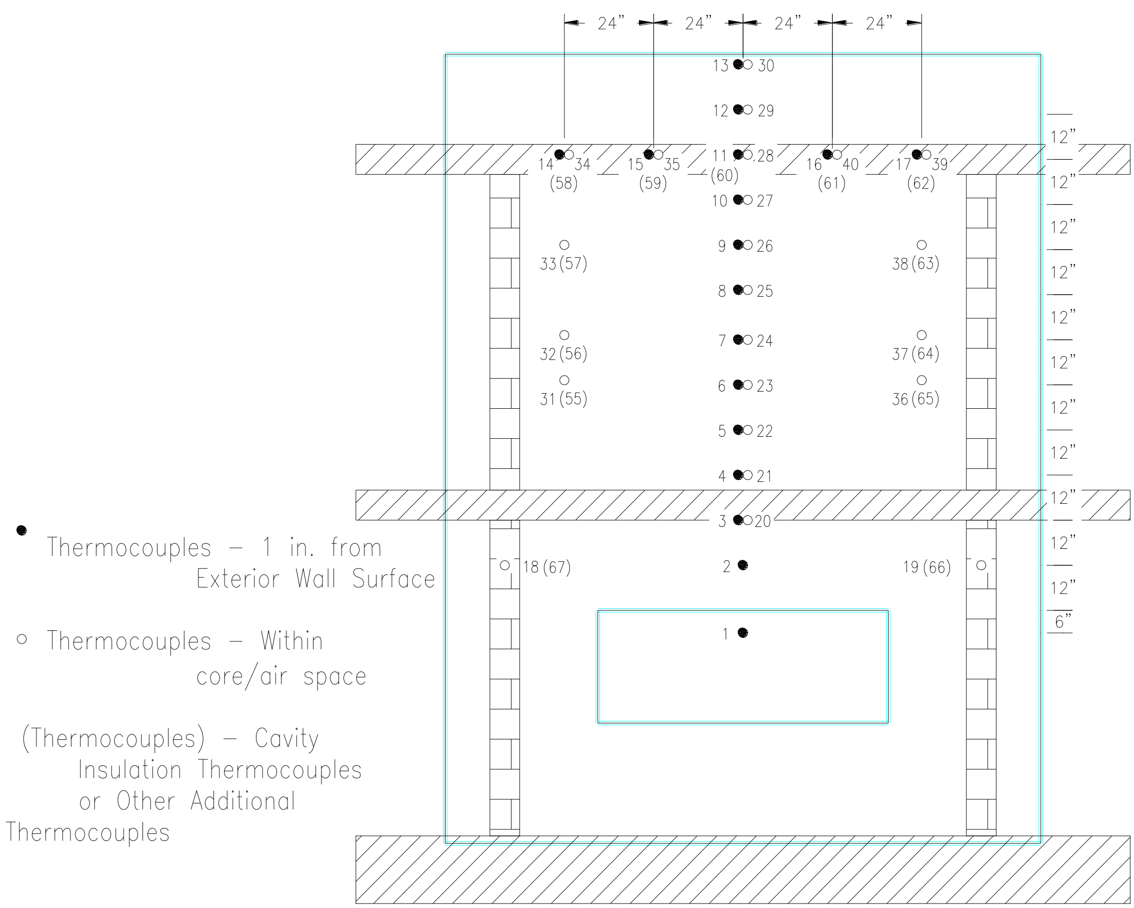

Figure A-2. Instrumentation Arrangement (Exterior Face and Air Cavity).

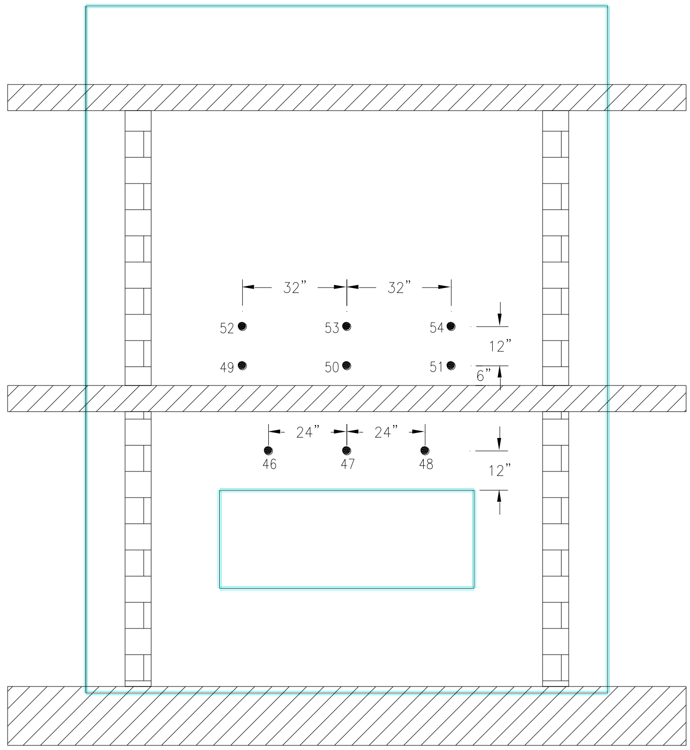

Figure A-3. Instrumentation Arrangement (Interior Face of Wall Assembly on Second-Floor Room and Burn Room).

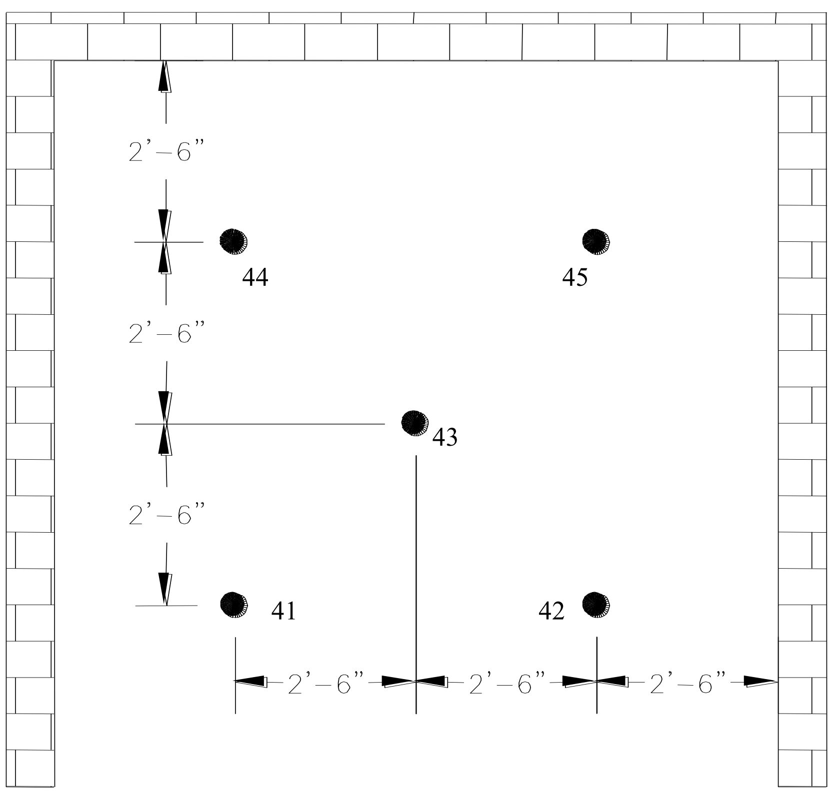

Figure A-4. Instrumentation Arrangement (Burn Room Ceiling).

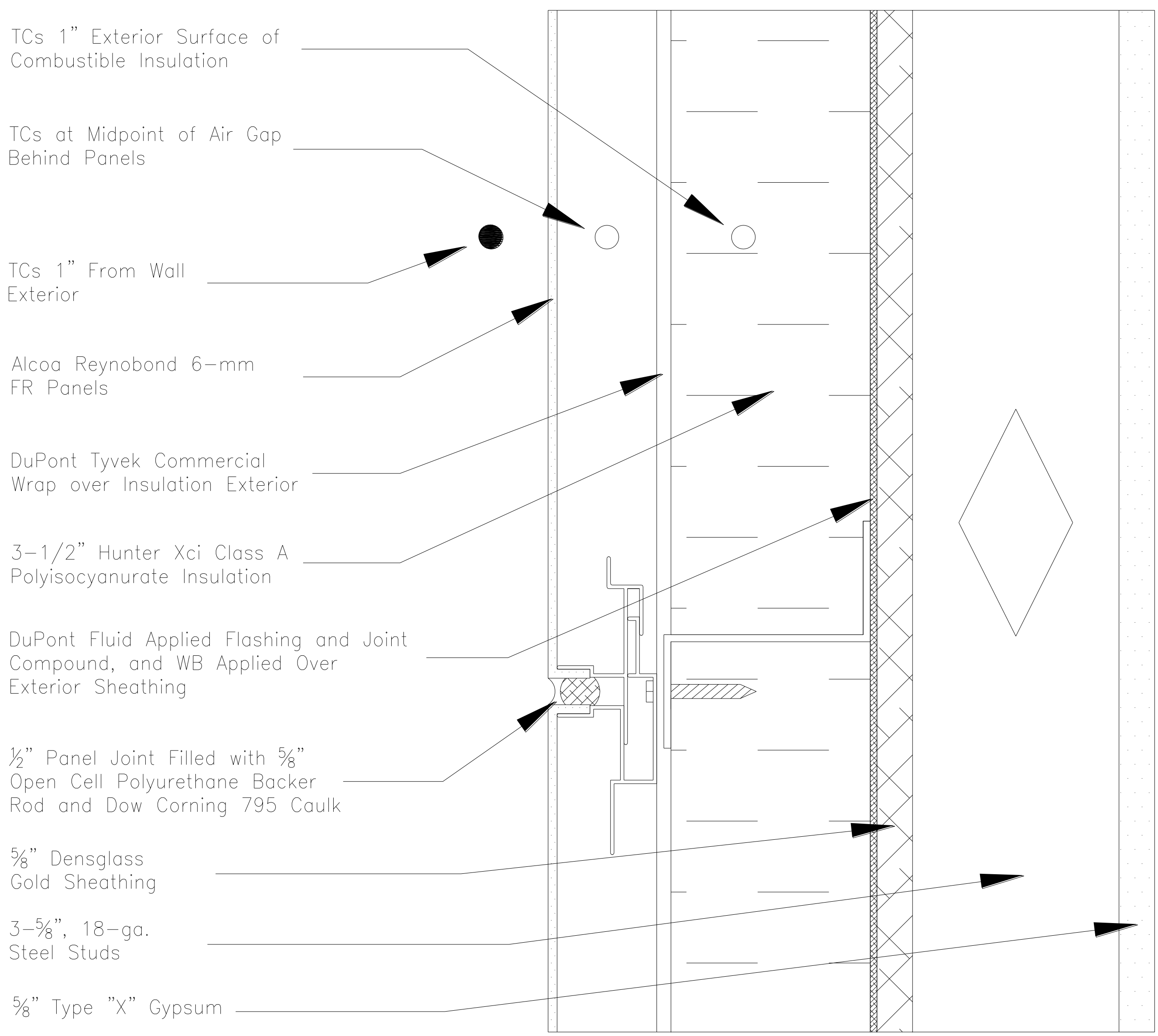

Figure A-5. Instrumentation Arrangement – Section View of System (Exterior Face, Air Gap, and Embedded within Combustible Insulation).

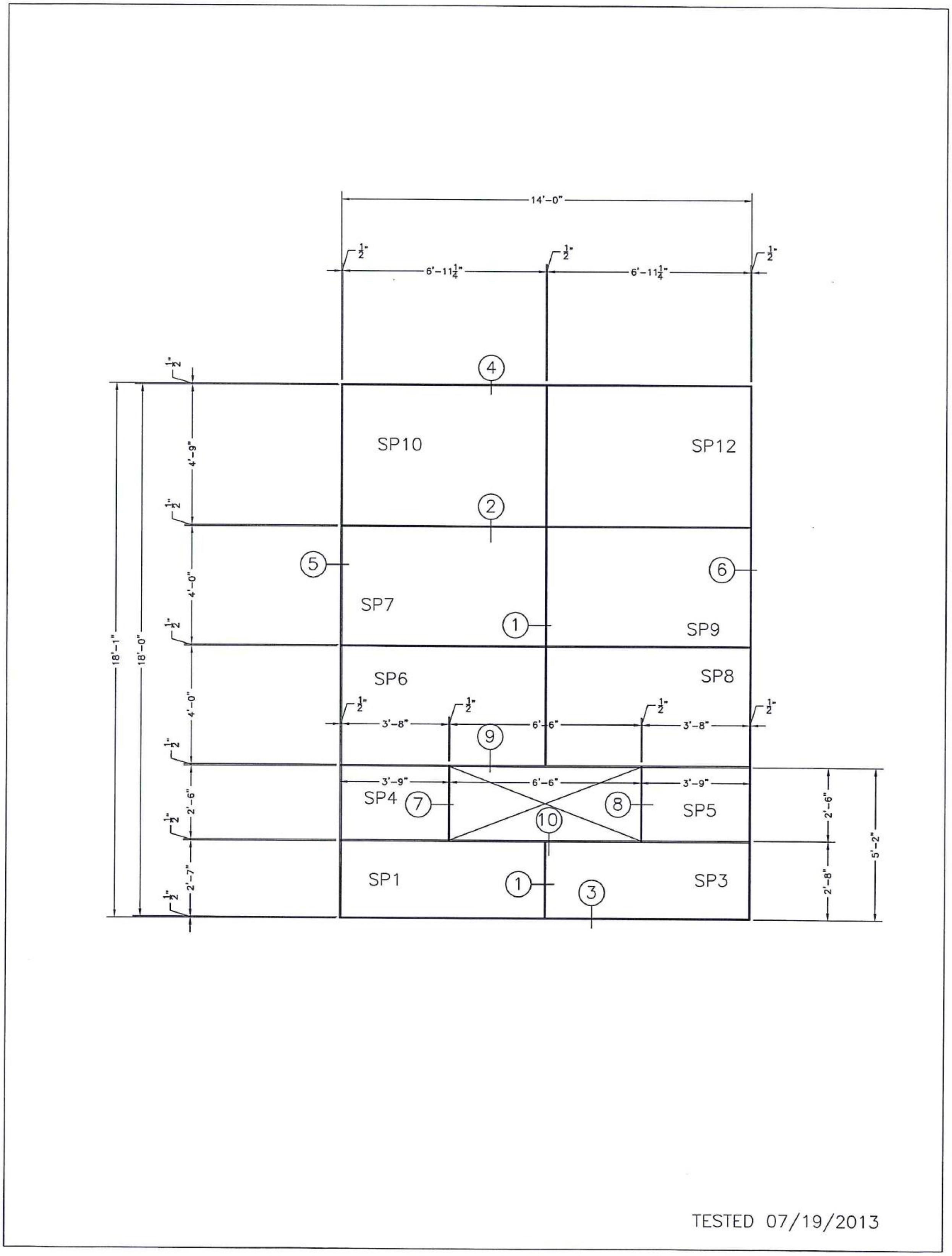

Figure A-6. Client-Provided Drawing.

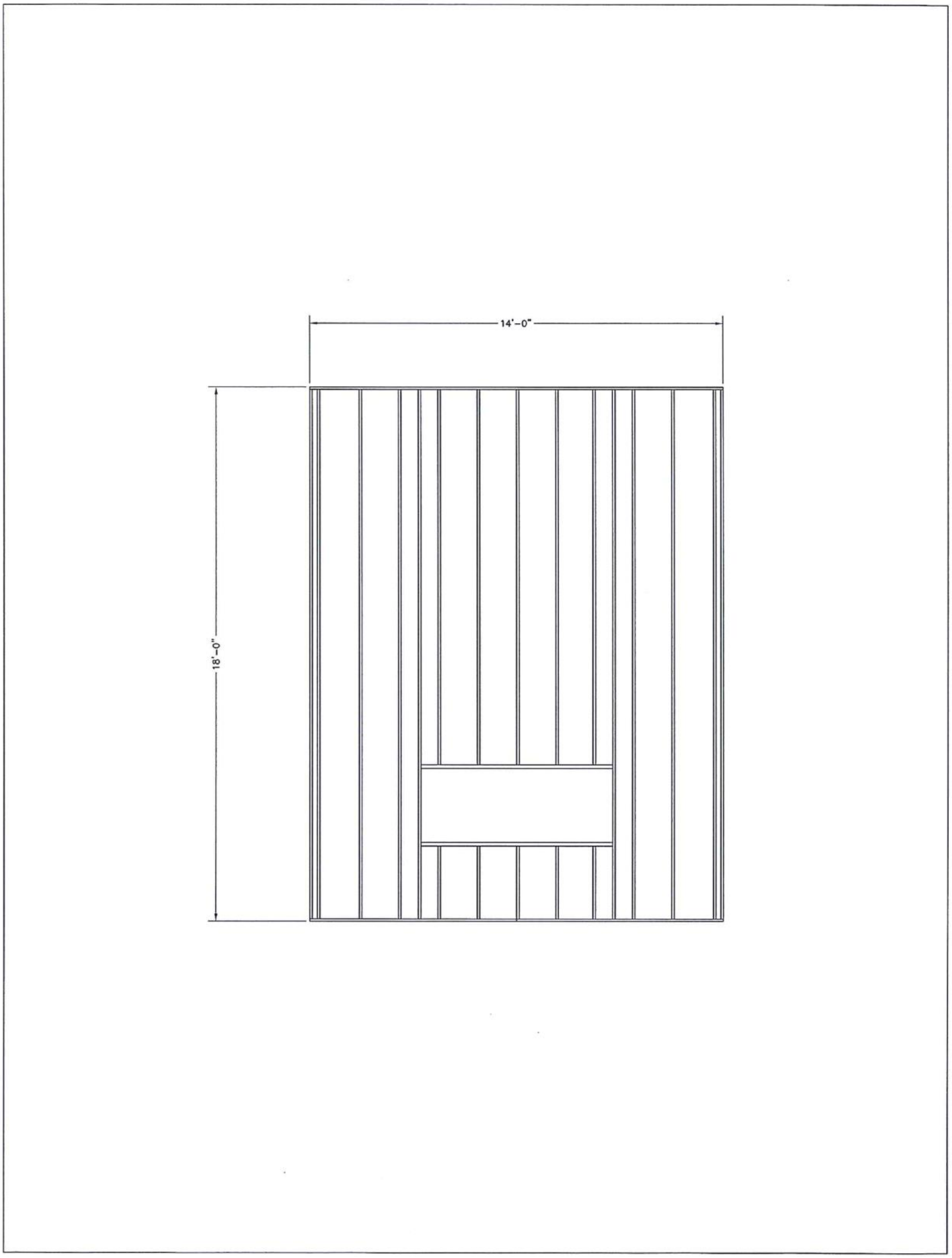

Figure A-7. Client-Provided Drawing.

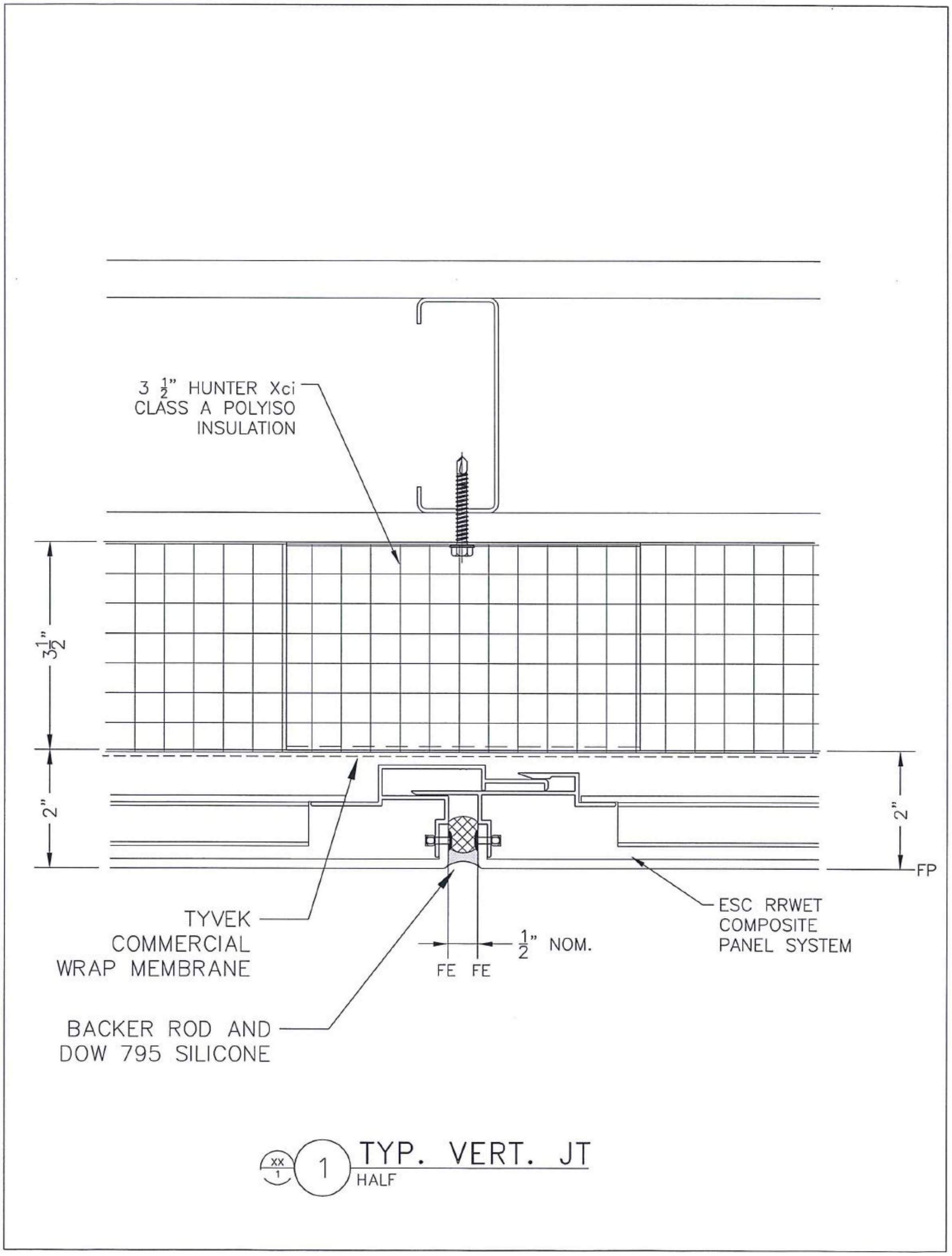

Figure A-8. Client-Provided Drawing.

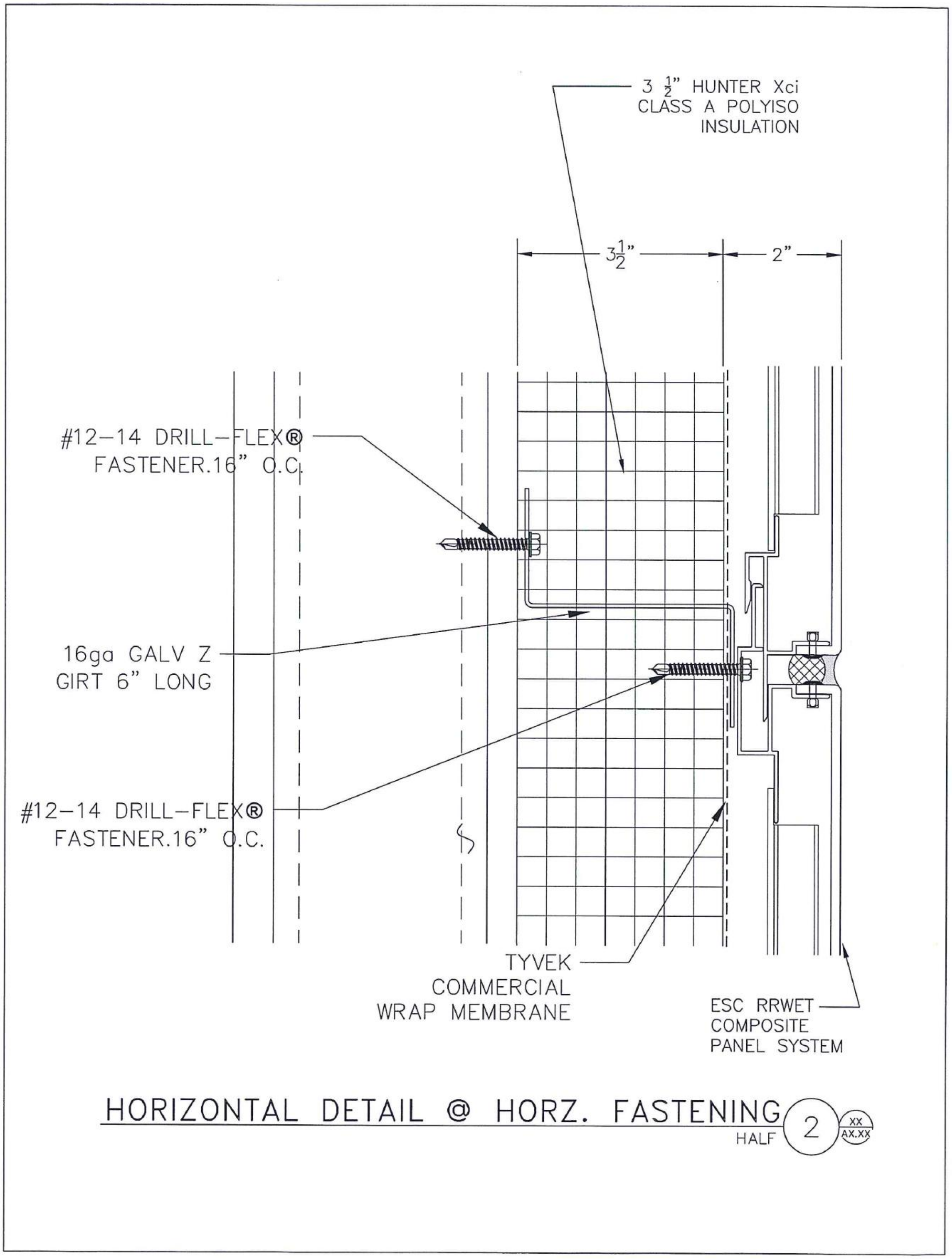

Figure A-9. Client-Provided Drawing.

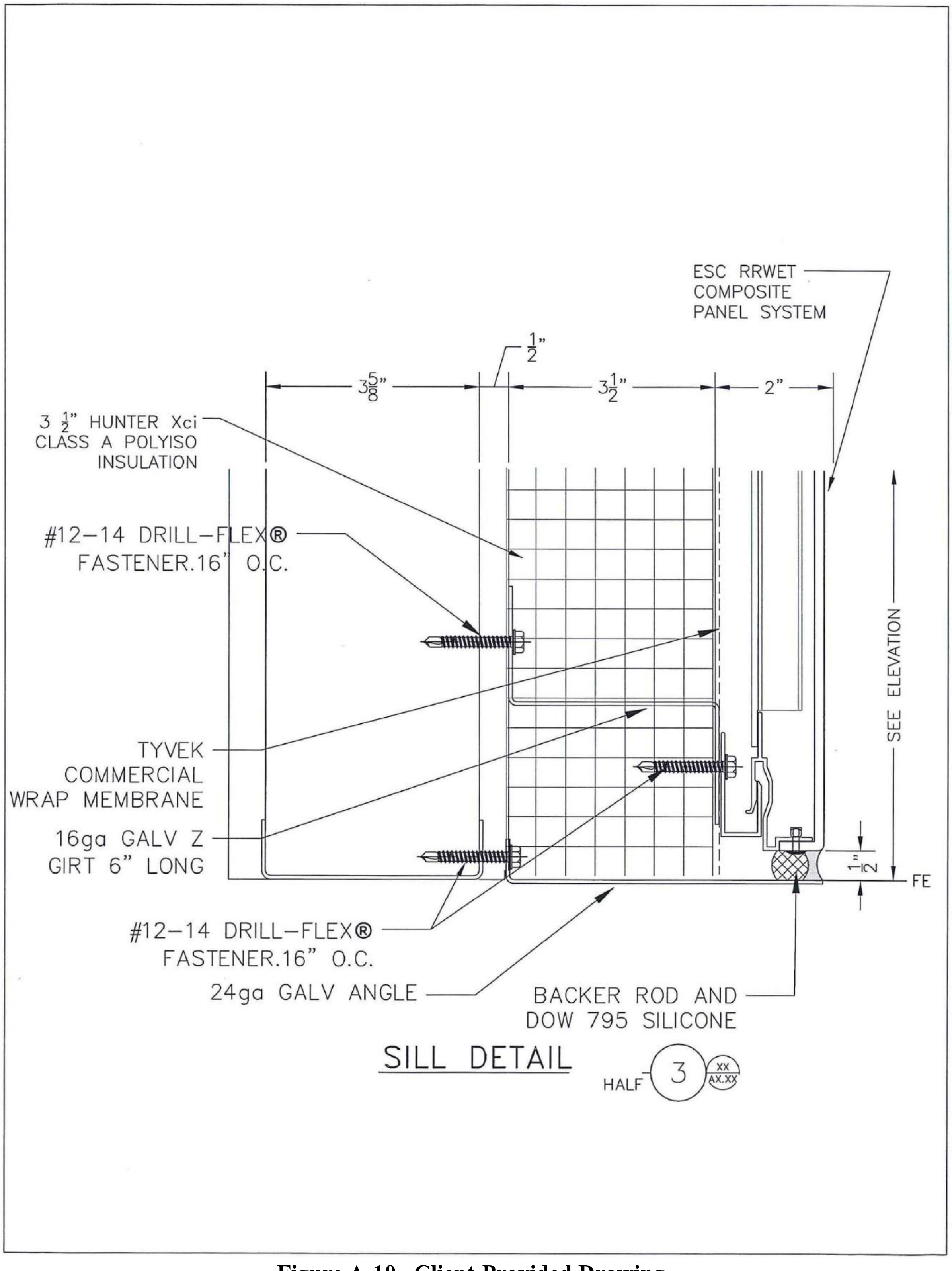

Figure A-10. Client-Provided Drawing.

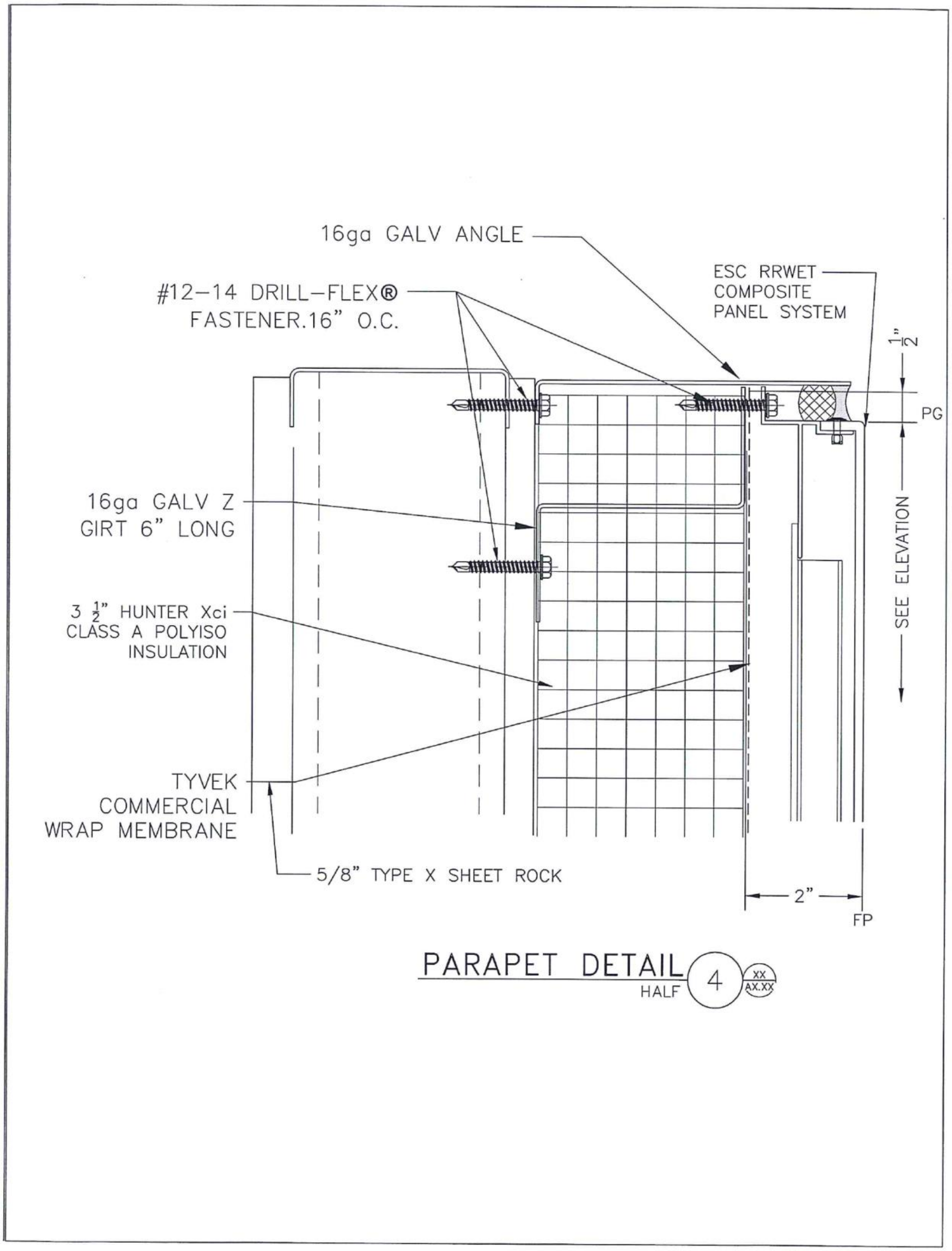

Figure A-11. Client-Provided Drawing.

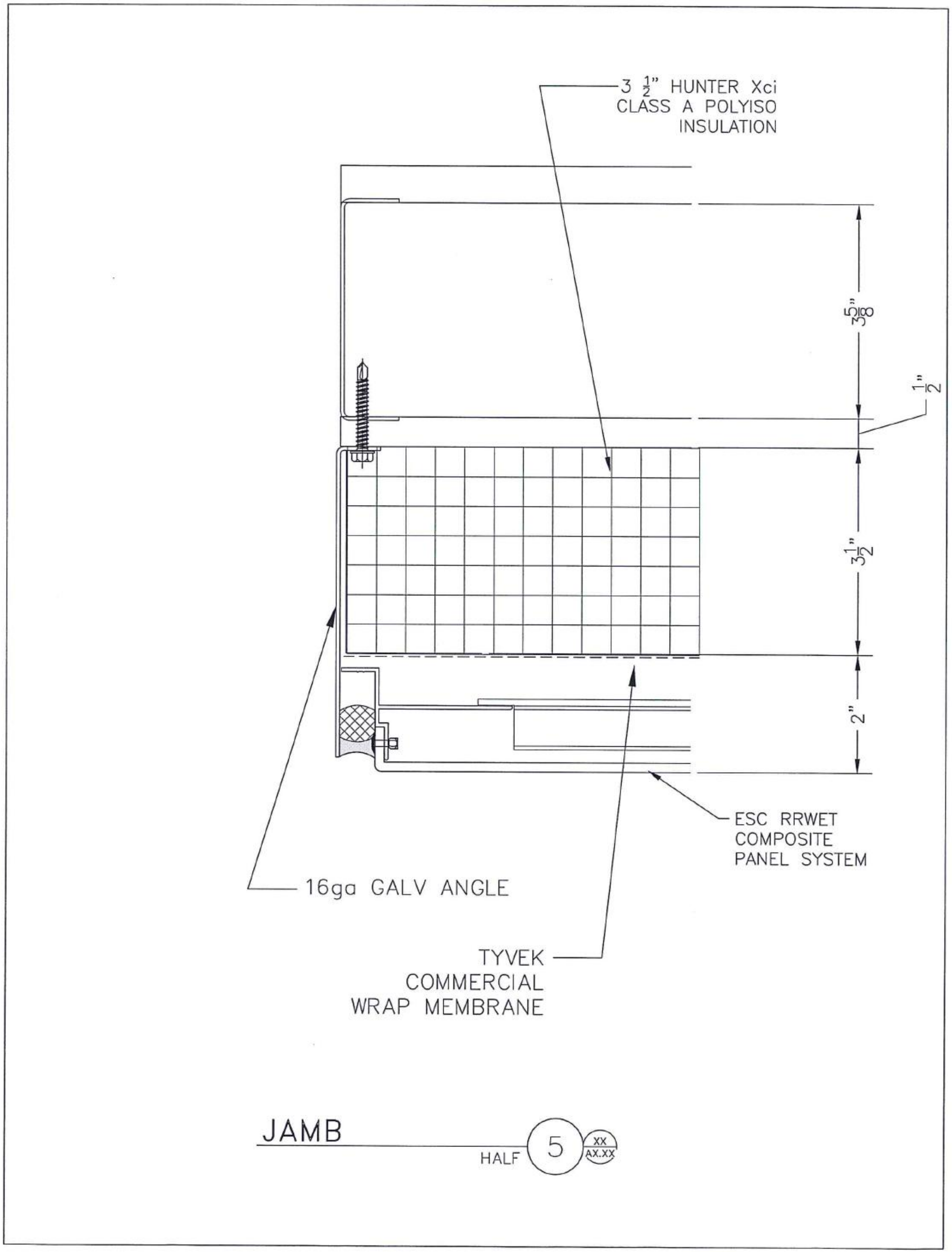

Figure A-12. Client-Provided Drawing.

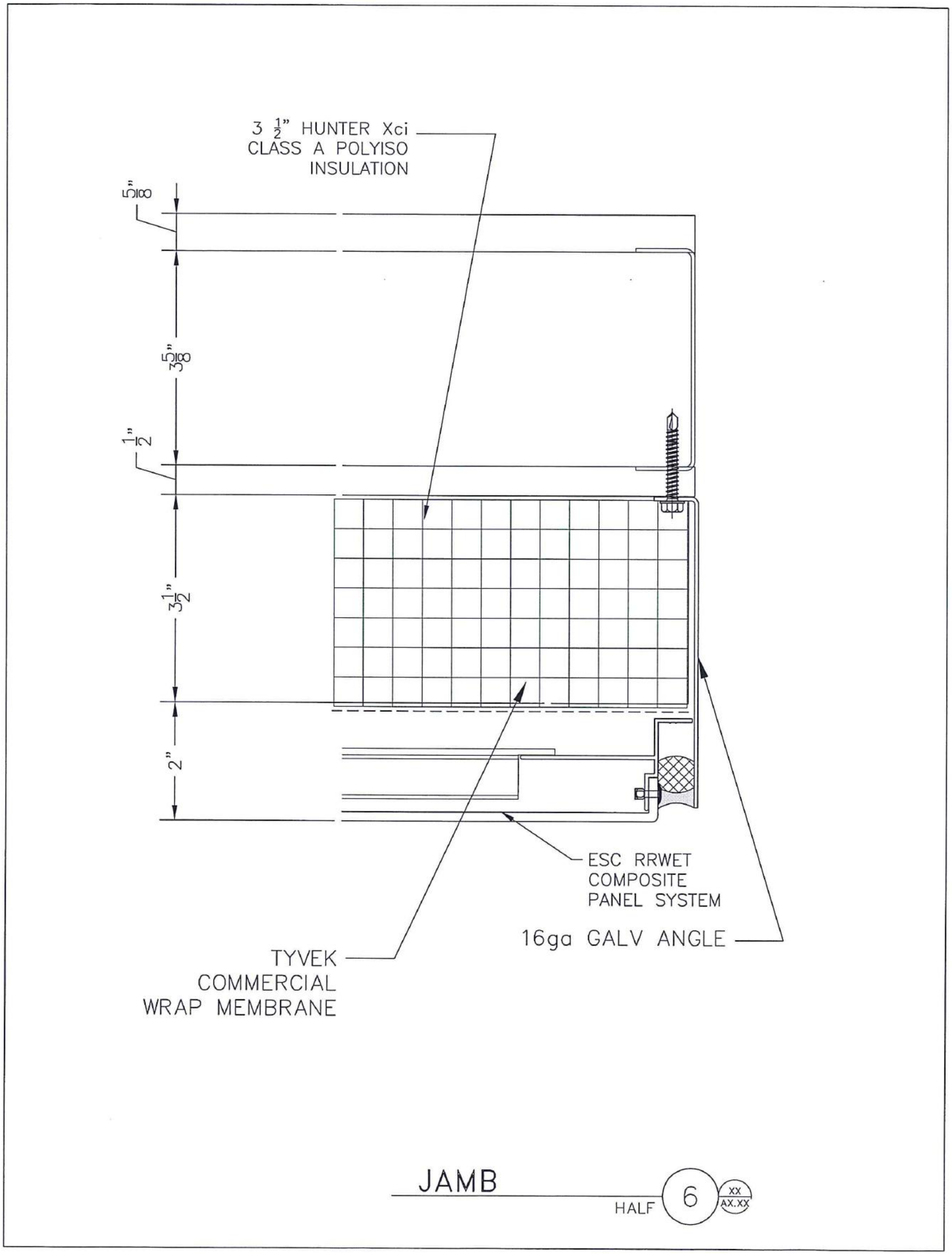

Figure A-13. Client-Provided Drawing.

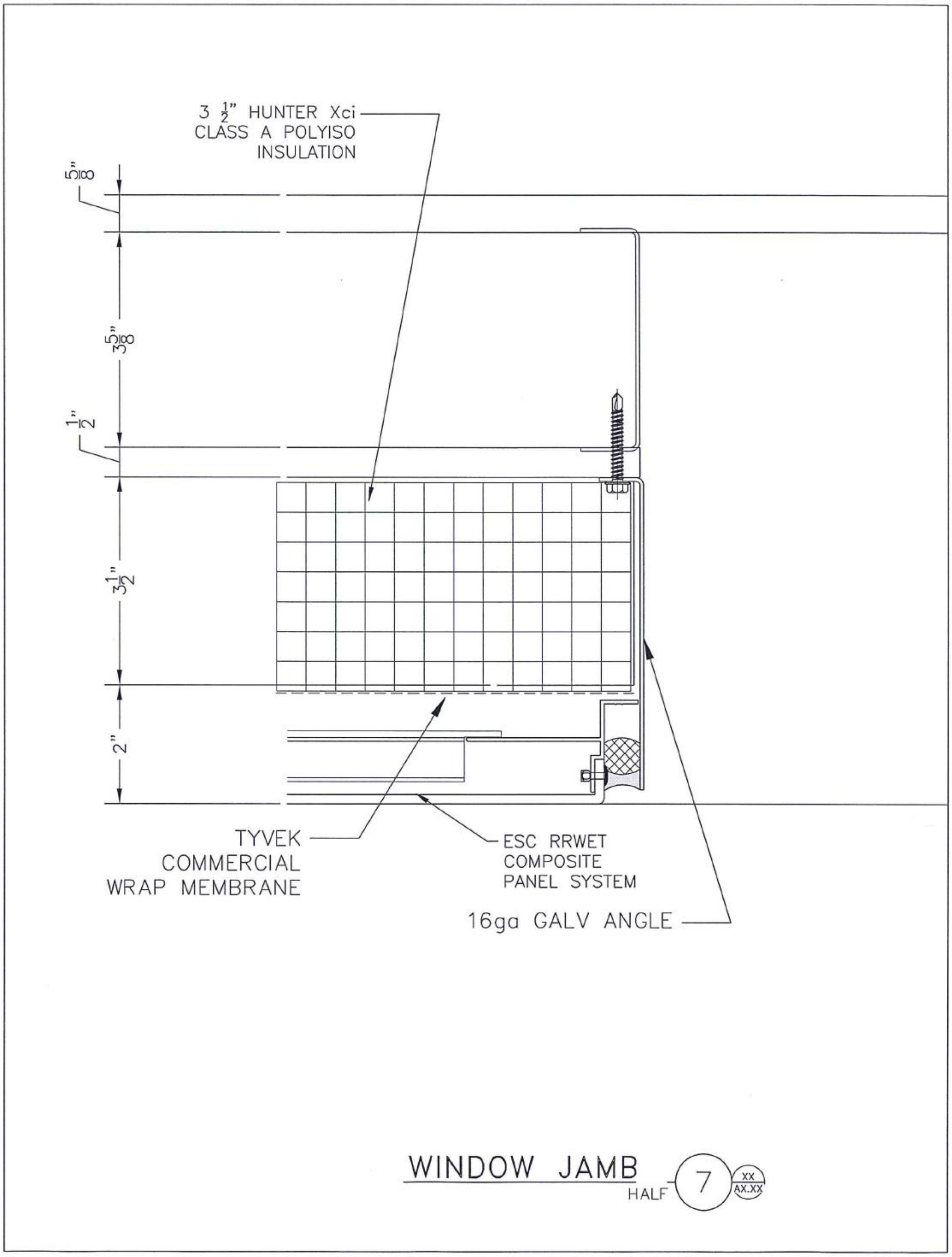

Figure A-14. Client-Provided Drawing.

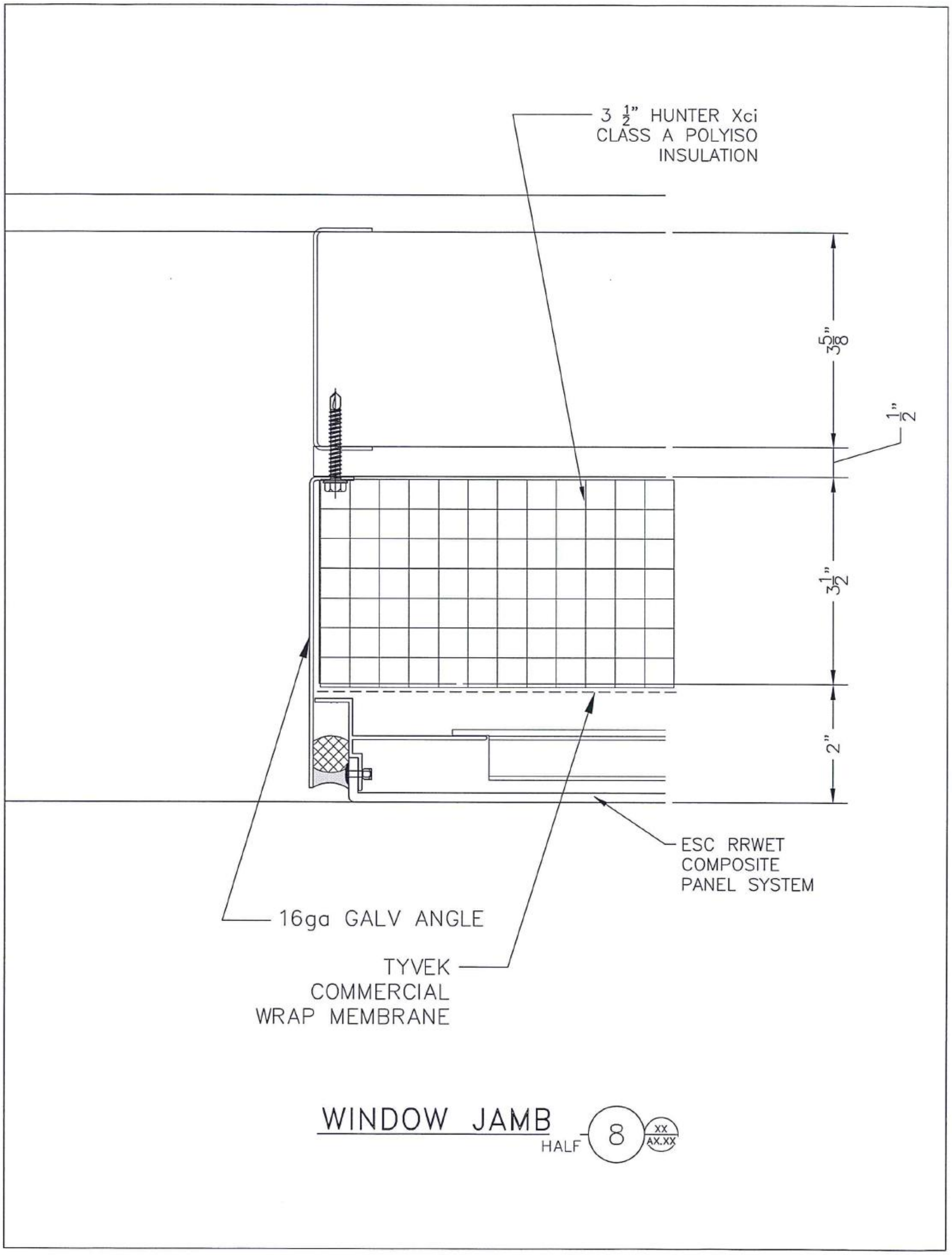

Figure A-15. Client-Provided Drawing.

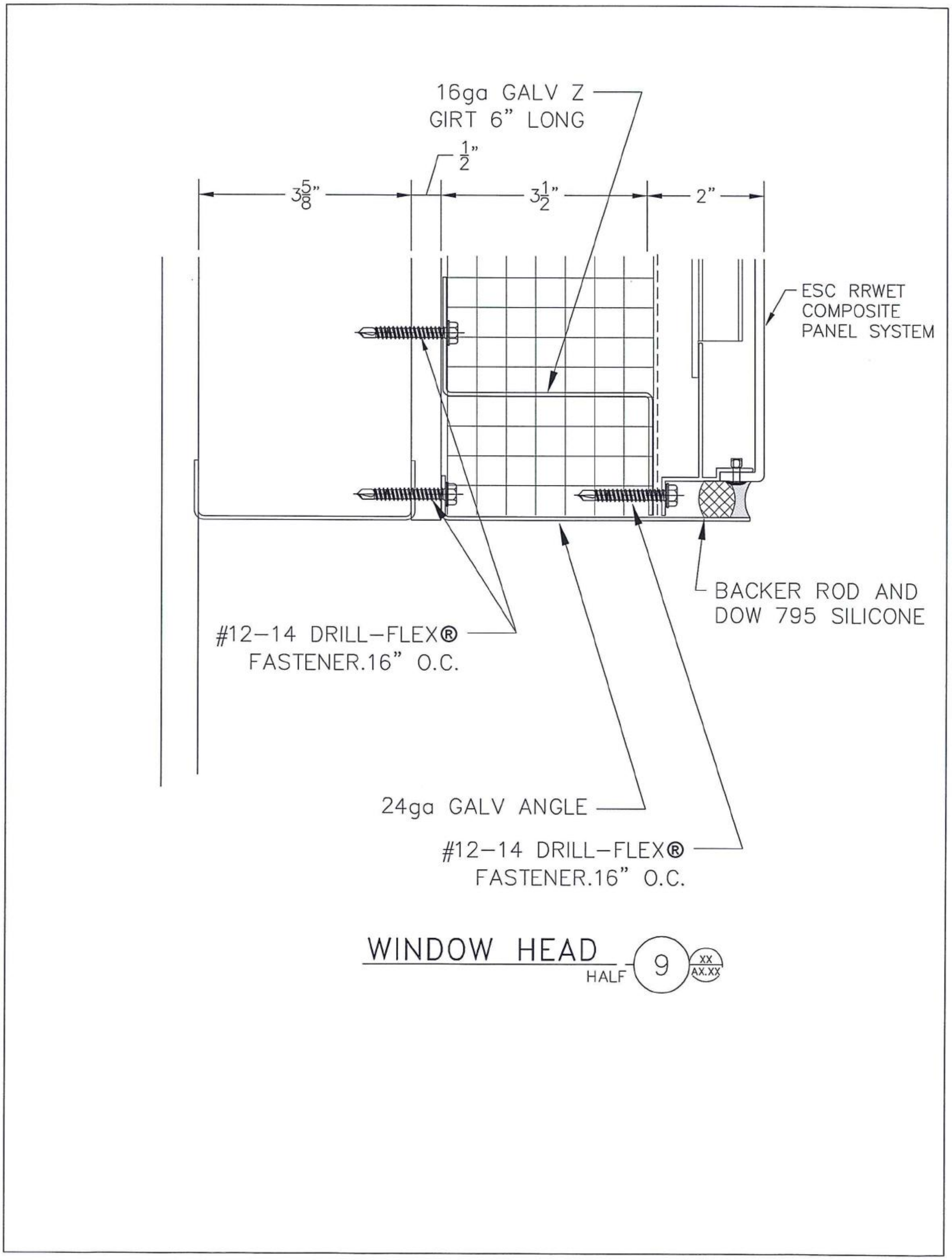

Figure A-16. Client-Provided Drawing.

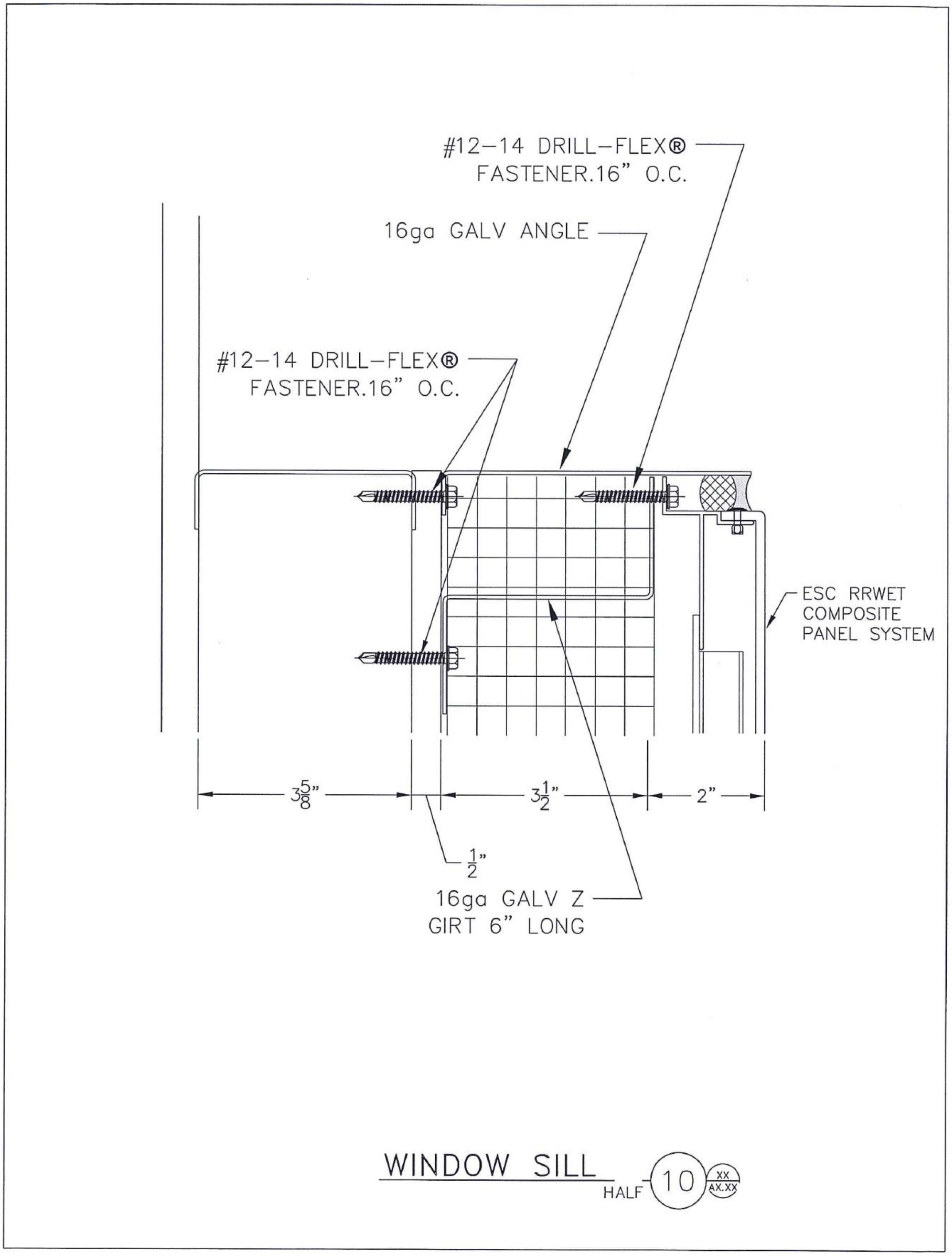

Figure A-17. Client-Provided Drawing.

APPENDIX B

PHOTOGRAPHIC DOCUMENTATION

(CONSISTING OF 11 PAGES)

Figure B-1. Base Wall with Application of DuPont™ Tyvek® Fluid Applied Flashing and Joint Compound over Sheathing Joints and Fastener Heads.

Figure B-2. Wall Assembly following Application of DuPont™ Tyvek® Fluid Applied WB.

Figure B-3. Installation of Z-Girts prior to Installation of Polyisocyanurate Insulation.

Figure B-4. Insulation installed Under Z-Girts.

Figure B-5. Installation of DuPont™ Tyvek® Commercial Wrap over Polyisocyanurate Insulation.

Figure B-6. Installation of Alcoa Architectural Products Reynobond 6-mm FR Panels.

Figure B-7. Completed Assembly prior to Test.

Figure B-8. Interior View of Second-Floor Observation Room prior to Test.

Figure B-9. Exterior View of Wall Assembly at 5 min 18 s.

Figure B-10. Exterior View of Wall Assembly at 11 min 20 s.

Figure B-11. Flaming from Panel Joint at Window Header Flashing at 13 min.

Figure B-12. Exterior View of Wall Assembly at 16 min 41 s.

Figure B-13. Exterior View of Wall Assembly at 20 min 26 s.

Figure B-14. Exterior View of Wall Assembly at 25 min 8 s.

Figure B-15. Interior View of Second-Floor Observation Room at 27 min 30 s.

Figure B-16. Exterior View of Wall Assembly at 30 min.

Figure B-17. Exterior View of Wall Assembly during Observation Period. Residual Flaming at Header.

Figure B-18. Exterior View of Wall Assembly at End of Observation Period. Residual Flaming at Header and Central Vertical Panel Joint.

Figure B-19. Close-Up Exterior View of Panels following Observation Period.

Figure B-20. Post-Test Assembly Dissection: Back Face of Panels following Test.

Figure B-21. Post-Test Assembly Dissection: Exterior Face of Polyisocyanurate Insulation following Test.

Figure B-22. Post-Test Assembly Dissection: Polyisocyanurate Insulation above Window Removed to Show Condition of Fluid Applied WB Underneath.

APPENDIX C

GRAPHICAL TEMPERATURE DATA

(CONSISTING OF 7 PAGES)

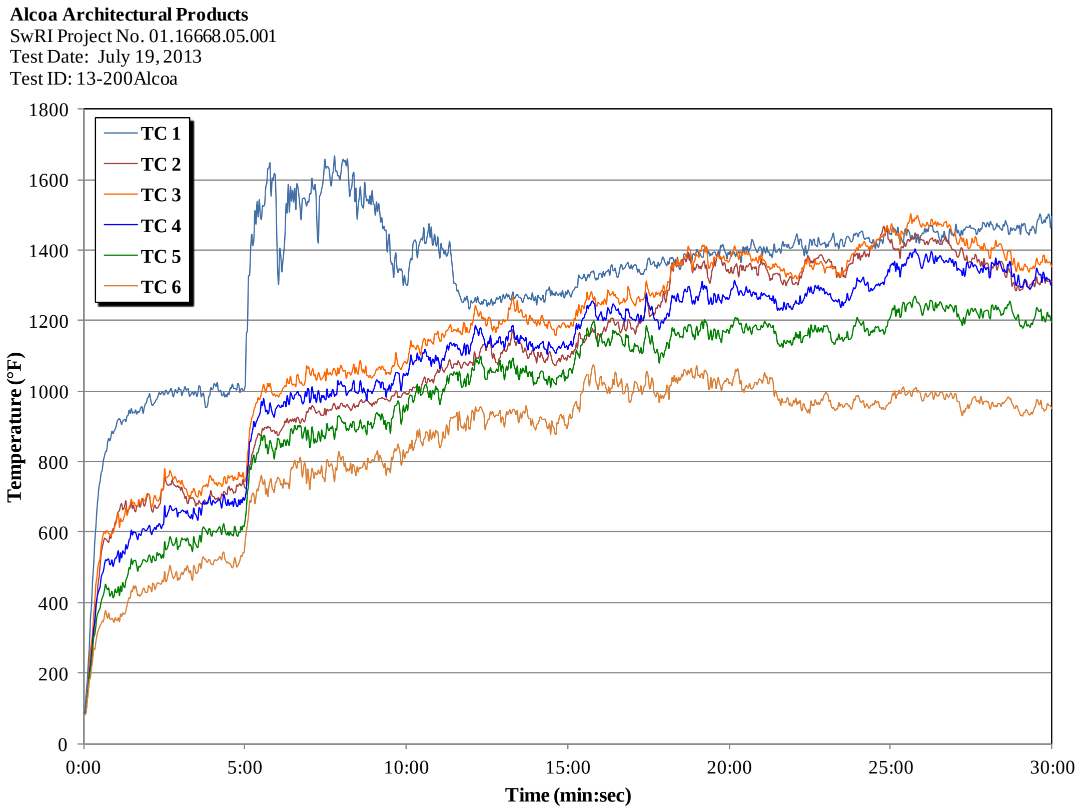

Figure C-1. Exterior Wall Temperatures (TCs 1–6).

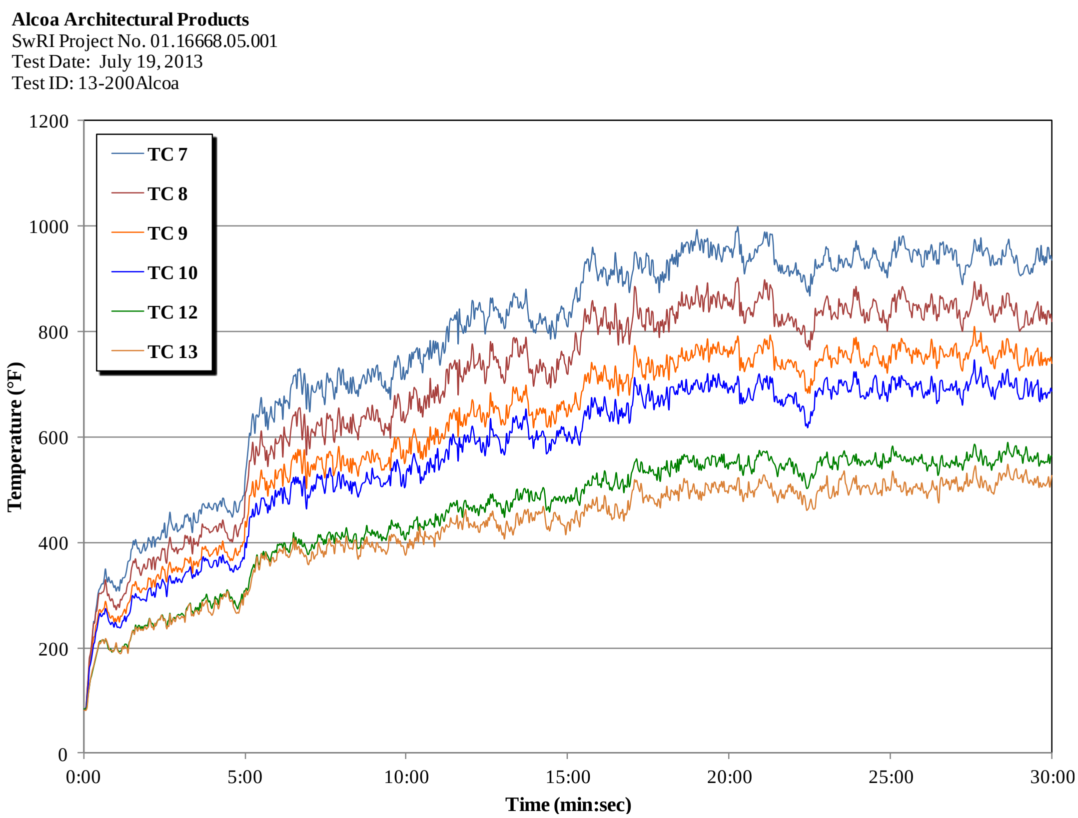

Figure C-2. Exterior Wall Temperatures (TCs 7–10, 12, and 13).

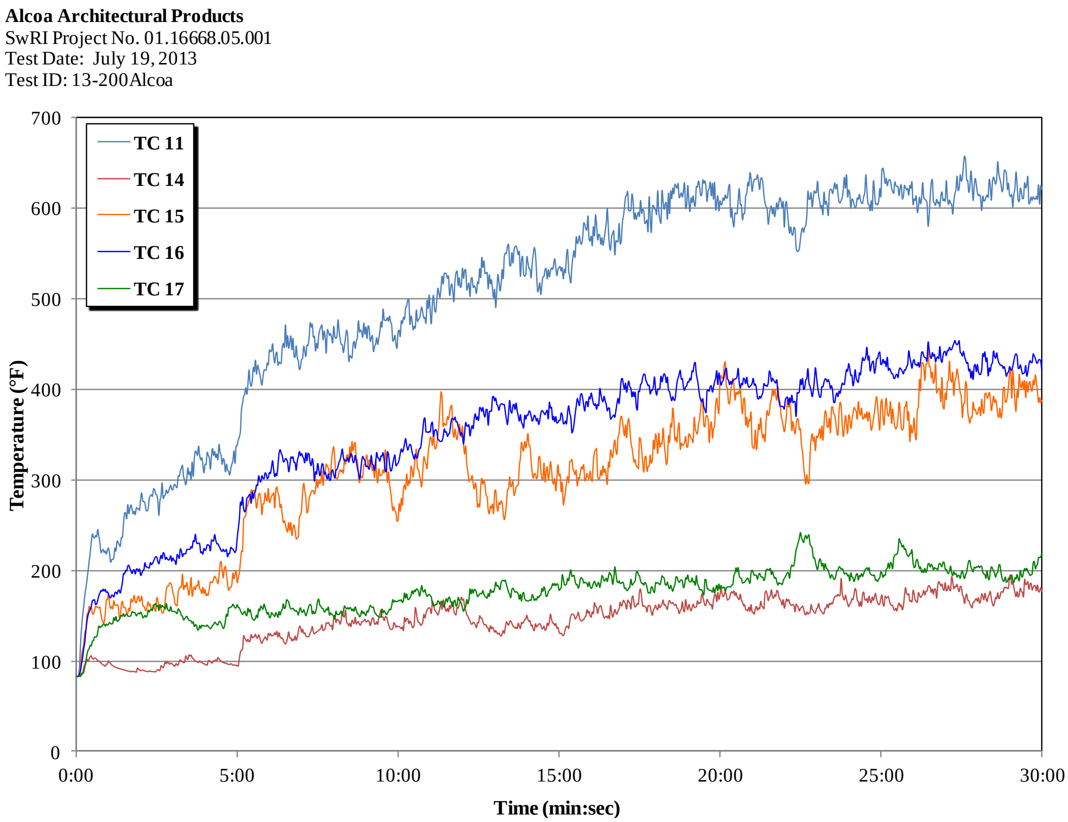

Figure C-3. Exterior Wall Temperatures (TCs 11 and 14–17).

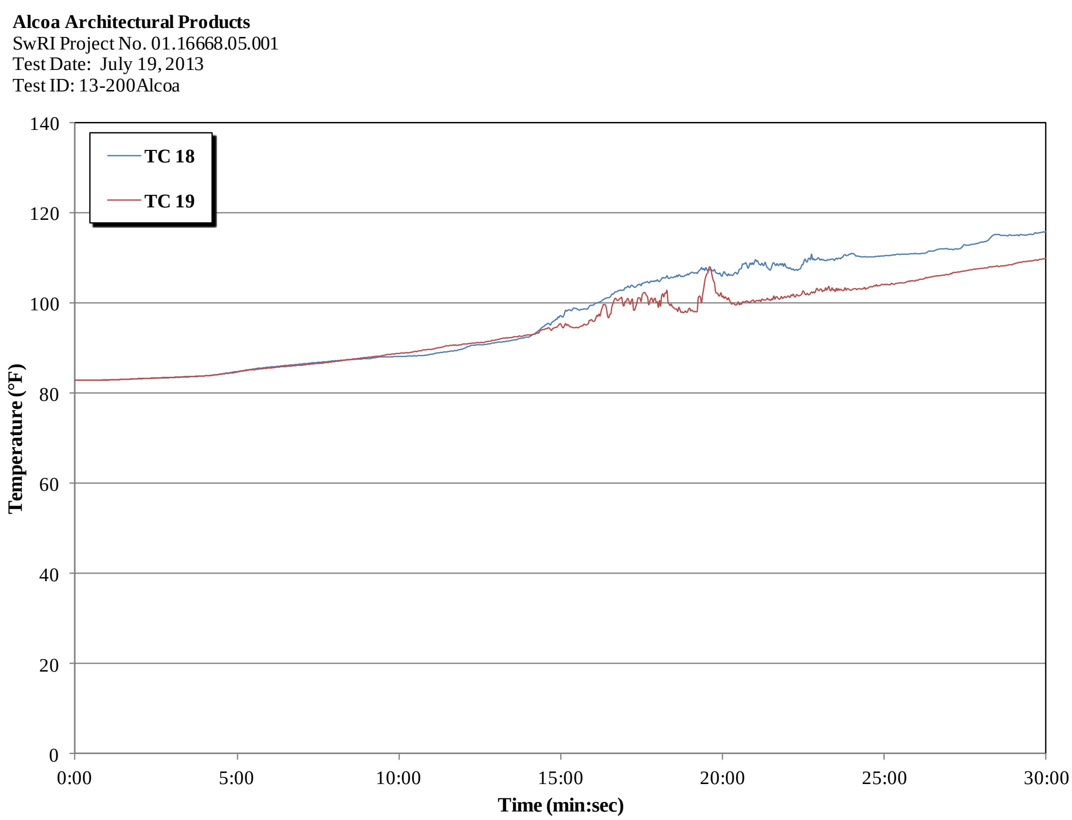

Figure C-4. Lateral Core Temperatures (TCs 18 and 19).

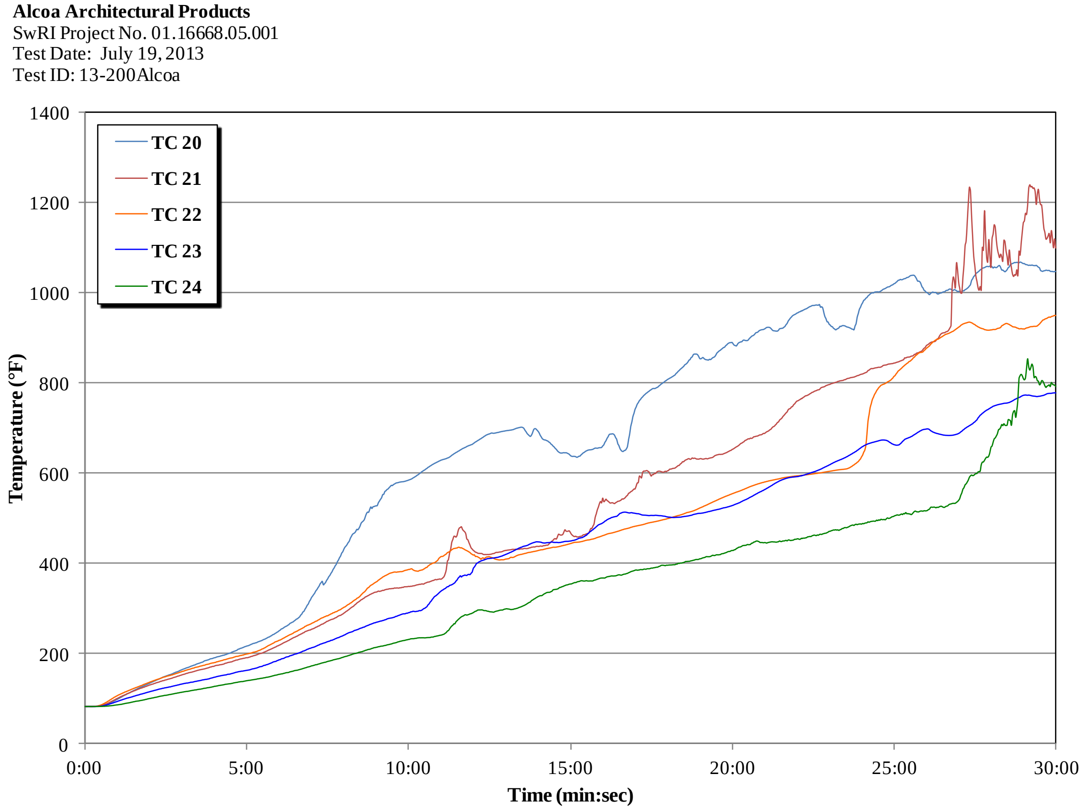

Figure C-5. Core Temperatures (TCs 20–24).

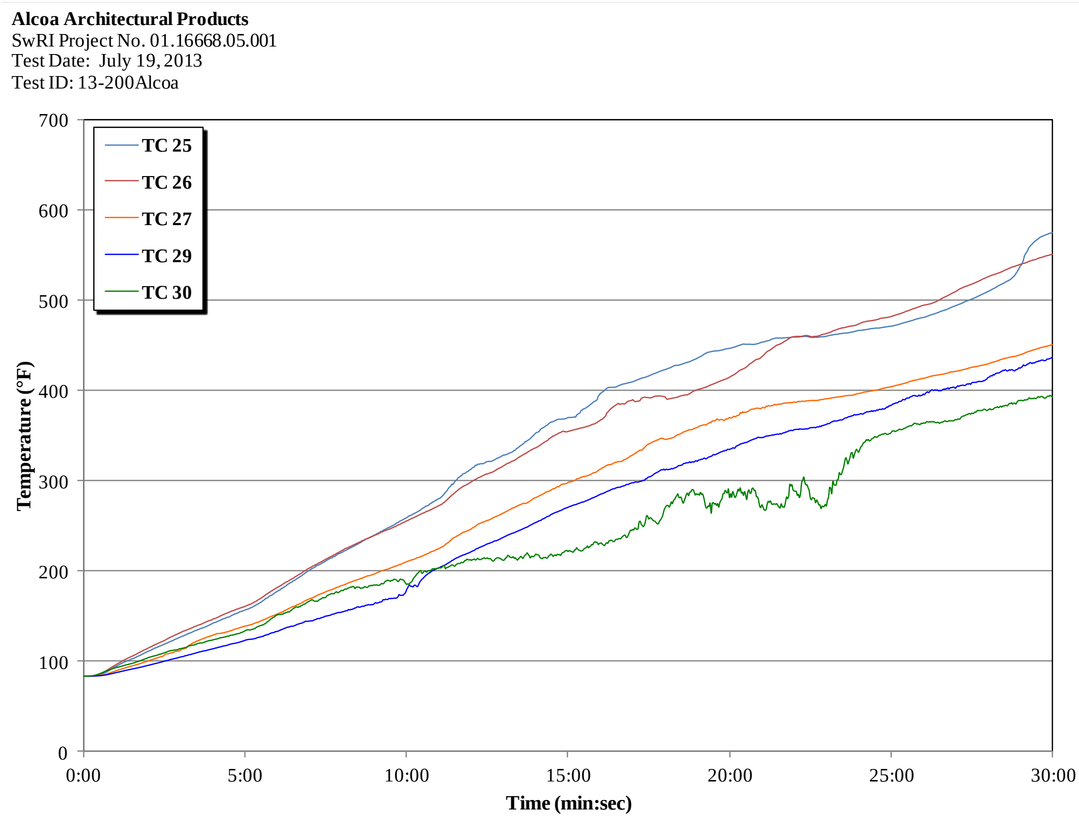

Figure C-6. Core Temperatures (TCs 25–27, 29, and 30).

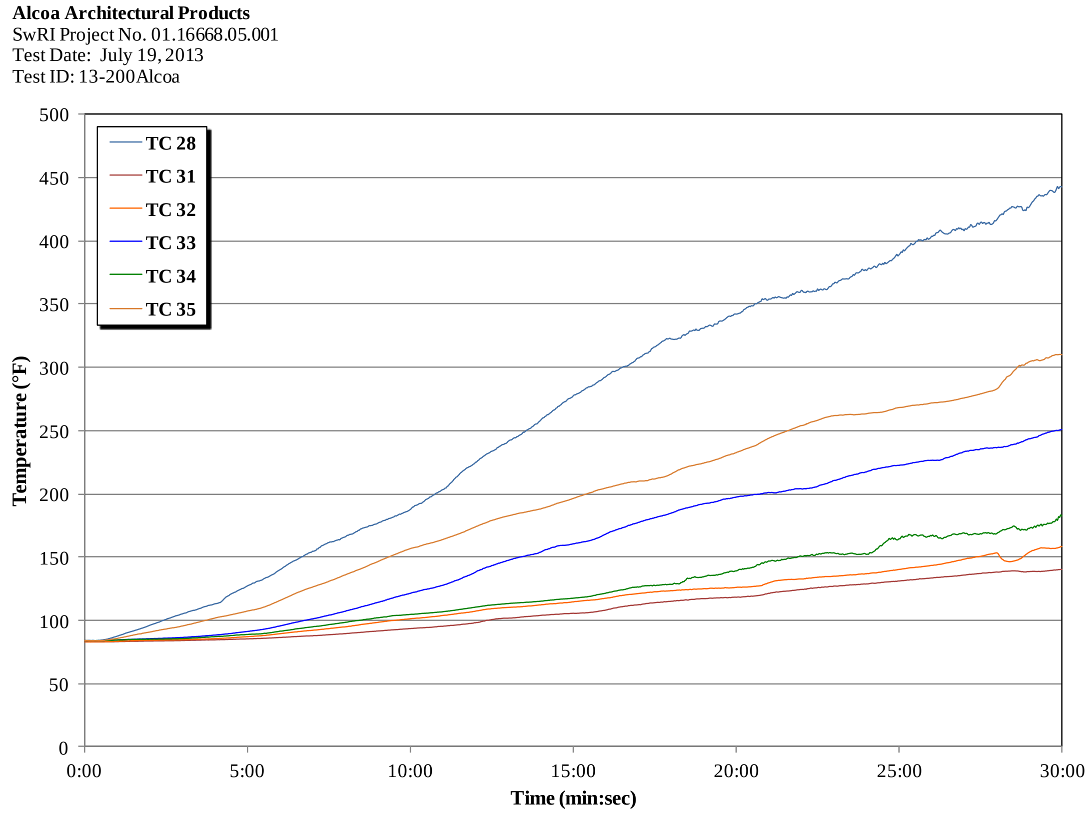

Figure C-7. Core Temperatures (TCs 28 and 31–35).

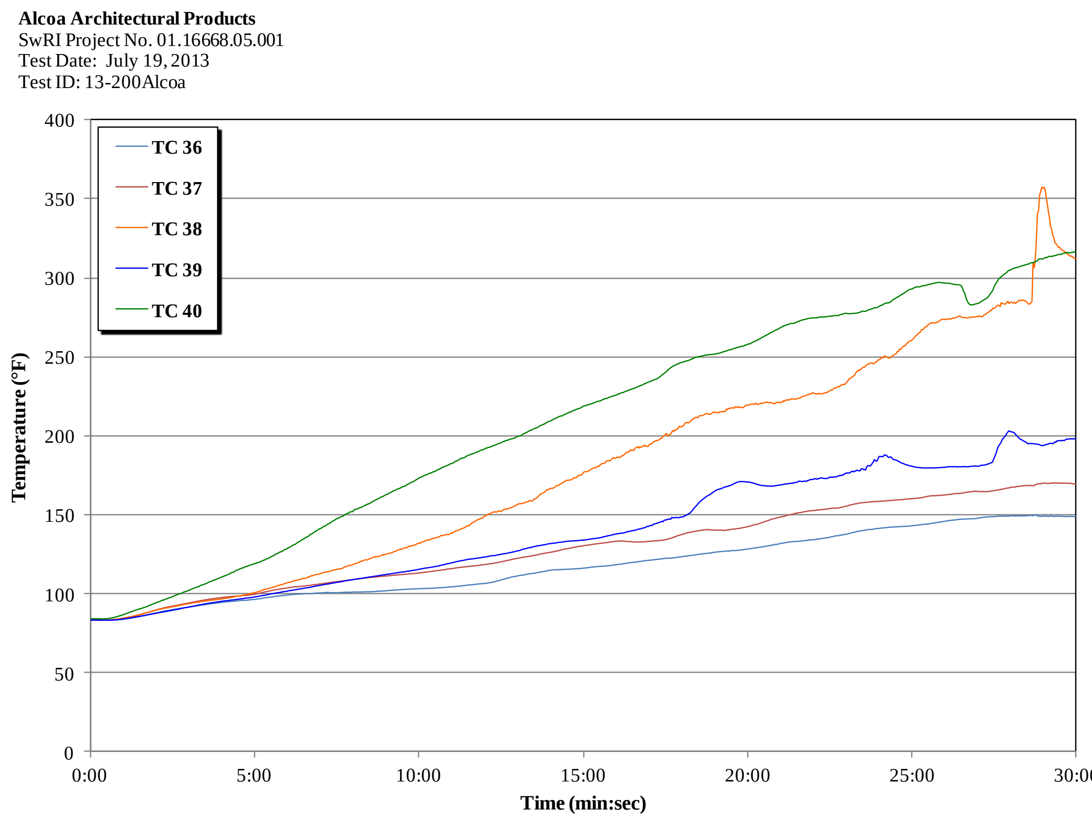

Figure C-8. Core Temperatures (TCs 36–40).

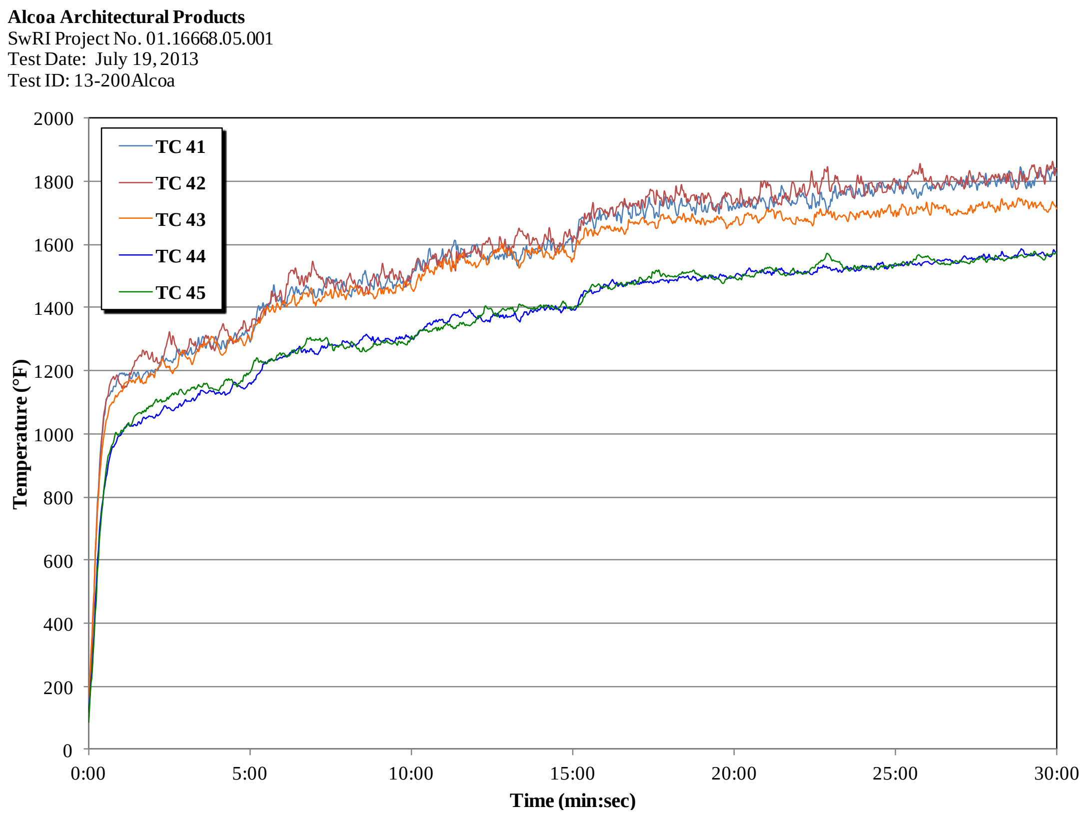

Figure C-9. Burn Room Temperatures (TCs 41–45).

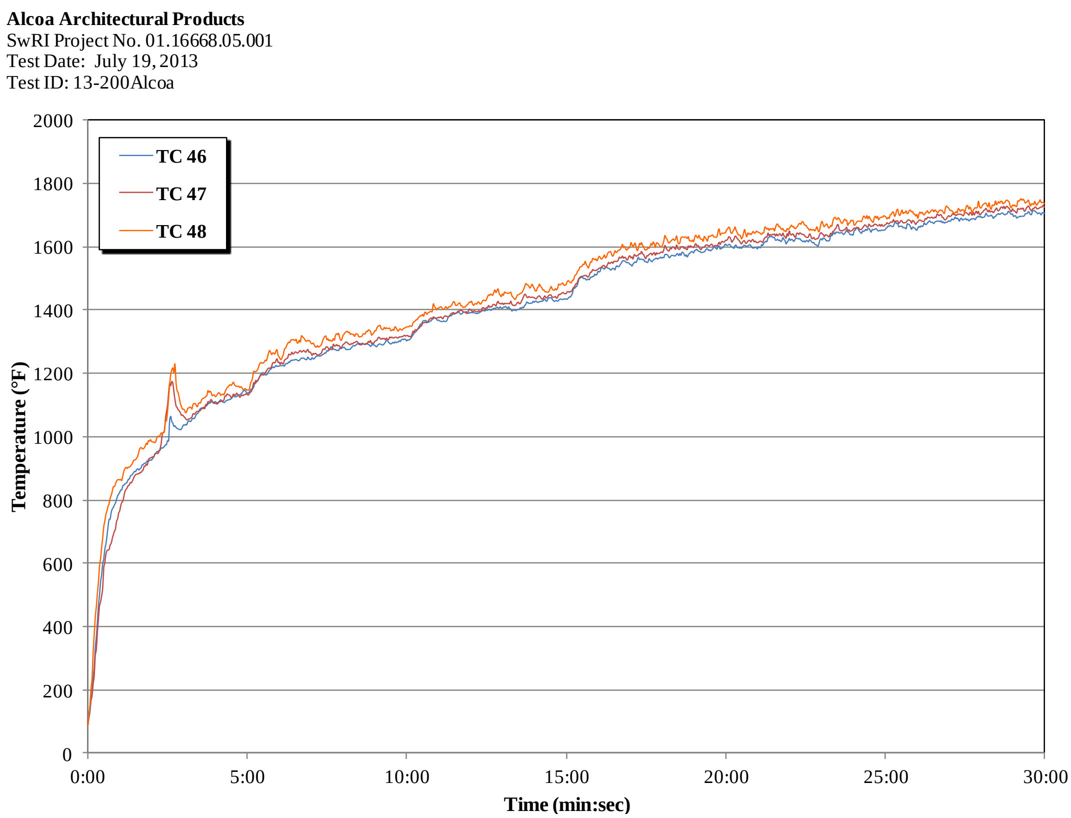

Figure C-10. Burn Room Temperatures (TCs 46–48).

Alcoa Architectural Products
SwRI Project No. 01.16668.05.001
Test Date: July 19, 2013
Test ID: 13-200Alcoa

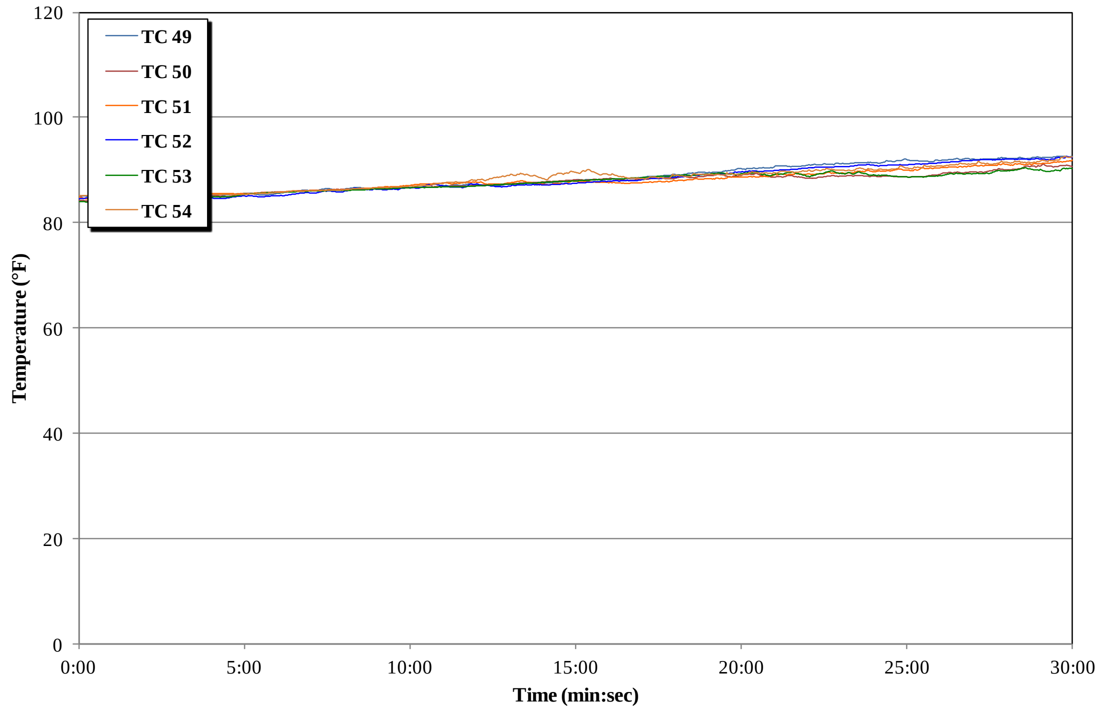

Figure C-11. Second-Floor Temperatures (TCs 49–54).

Alcoa Architectural Products
SwRI Project No. 01.16668.05.001
Test Date: July 19, 2013
Test ID: 13-200Alcoa

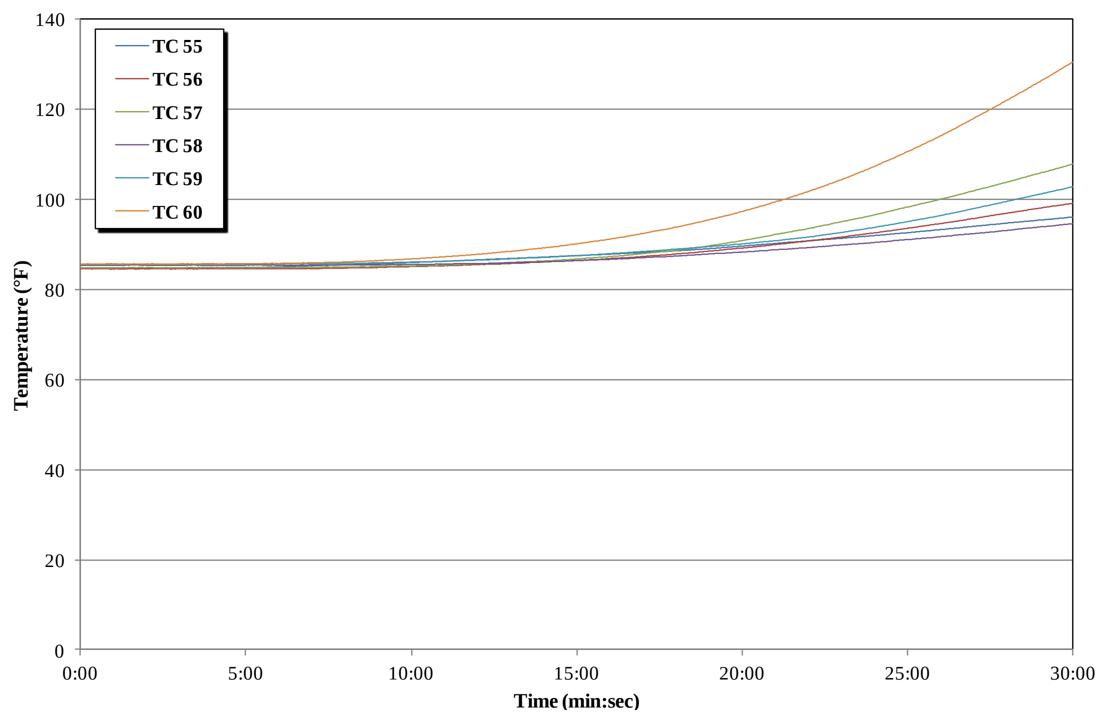

Figure C-12. Insulation Embedded Temperatures (TCs 55–60).

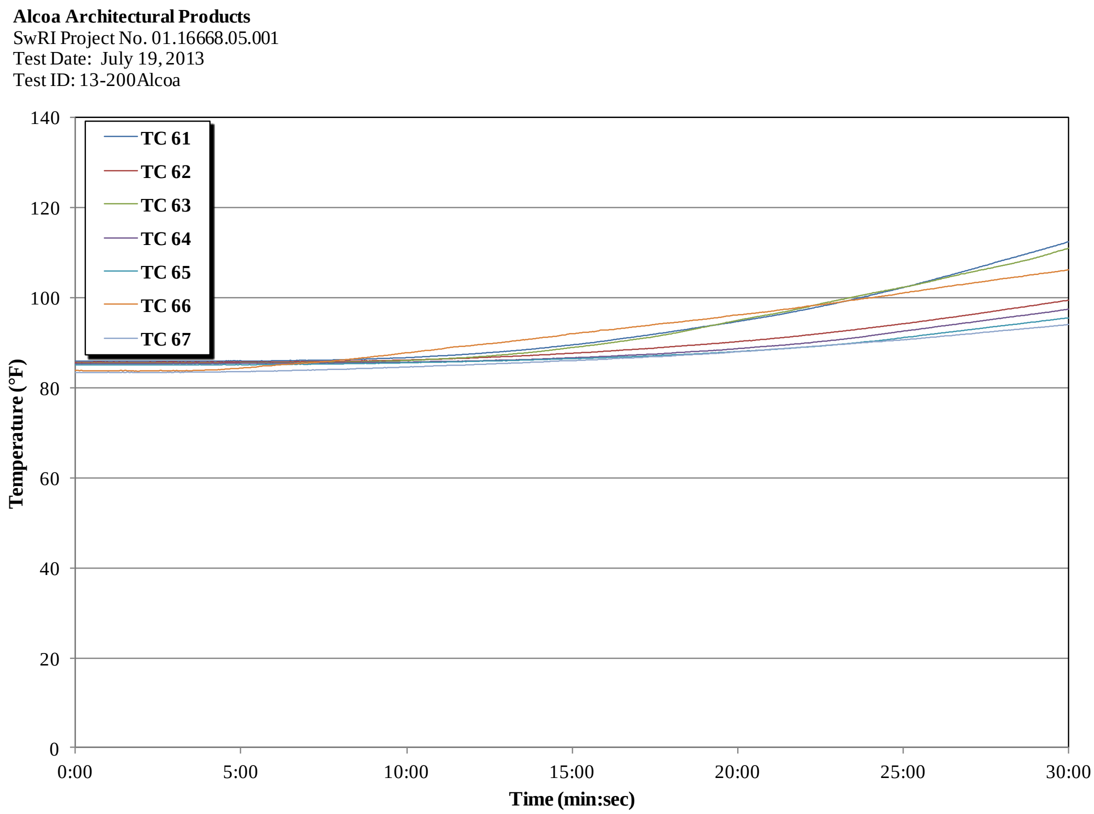

Figure C-13. Insulation Embedded Temperatures (TCs 61–67).