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CHEMISTRY AND CHEMICAL ENGINEERING

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FIRE PERFORMANCE EVALUATION OF A *TIGERLOC* FIRE TEST PANEL, TESTED IN ACCORDANCE WITH NFPA 285, 2023 EDITION, *STANDARD FIRE TEST METHOD FOR EVALUATION OF FIRE PROPAGATION CHARACTERISTICS OF EXTERIOR WALL ASSEMBLIES CONTAINING COMBUSTIBLE COMPONENTS*

FINAL REPORT
Consisting of 37 Pages

SwRI® Project No. 01.28401.01.414
Test Date: November 21, 2024
Report Date: January 20, 2025

Prepared for:

Nox-Crete, Inc.
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KF

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for Karen C. Carpenter, M.S., P.E.
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ABSTRACT

Southwest Research Institute's® (SwRI®) Fire Technology Department, located in San Antonio, Texas, conducted an Intermediate-Scale Multistory Test Apparatus fire performance evaluation test for Nox-Crete, Inc., located in Omaha, Nebraska. Testing was conducted on November 21, 2024 on a *TigerLoc* fire test panel system.

Testing was performed in accordance with the National Fire Protection Association 285, *Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Wall Assemblies Containing Combustible Components,* 2023 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, Texas, conducted an Intermediate-Scale Multistory Test Apparatus (ISMA) fire performance evaluation test for Nox-Crete, Inc., located in Omaha, Nebraska, on November 21, 2024. 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 Wall Assemblies Containing Combustible Components,* 2023 Edition.

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 panels from 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 three concrete panel systems from Nox-Crete, Inc. on November 15, 2024. Figure 1 shows the panels as received. The panels consisted of Plaskolite C286 Fire Retardant high-density polyethylene (HDPE) foam middle with two concrete panels on the ends. Fiberglass rods reinforced between the two concrete panels and through the Plaskolite C286 Fire Retardant HDPE foam center. The fire side concrete was 5 in. thick with the Plaskolite C286 Fire Retardant HDPE foam center being 3 in. thick and the exterior concrete being 3 in. thick. The panels were placed directly onto the frame and attached with screws. Once the panel was screwed in, angle was welded to ensure the sample stayed in place and did not fall from the frame. The angle was placed on the far ends of the test assembly to not affect the test. One additional section of angle was welded across the top to help hold the assembly into the frame. Nox-Crete, Inc. provided the window header being preinstalled into their concrete panels. The window head was made of HDPE. Detailed drawings of the assembly are provided in Appendix A with Client-provided drawings.

Figure 1. Panels as Received.

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 31, 2024, 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	36.9	648 (36,881)	–	–
05:00 - 10:00	36.9	648 (36,881)	10.0	176 (10,002)
10:00 - 15:00	40.7	715 (40,699)	13.2	232 (13,203)
15:00 - 20:00	44.9	790 (44,941)	14.5	254 (14,481)
20:00 - 25:00	44.9	790 (44,941)	17.9	314 (17,888)
25:00 - 30:00	47.1	827 (47,057)	18.9	333 (18,946)

Table 2 compares the average heat flux data obtained during the calibration test with the allowable heat flux ranges specified in Table 7.1.11 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/cm^2)	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	1.9	2.4	3.5	**4.3**	4.5
Calorimeter 2 (3 ft Above Window, W/cm^2)	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	1.2	2.4	3.1	3.7	4.2	4.4
Calorimeter 3 (4 ft Above Window, W/cm^2)	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	2.1	2.4	2.8	3.2

Notes: Window Burner's centerline placed 2.5 in. away from face of wall assembly. Numbers bolded are outside the allowable range.

Table 3 compares the average temperature data obtained during the calibration test with the allowable temperature range specified in Table 7.1.11 of NFPA 285 for the indicated time period. The allowable temperature range is -10%, +20% of the temperature values specified in Table 7.1.11.

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)	Range	1036-1381	1211-1615	1334-1778	1440-1920	1437-1916	1483-1978
	Actual	1098	1274	1405	1520	1558	1621
Interior Wall Surface (Average of 3 TCs)	Range	959-1278	1168-1558	1290-1720	1420-1894	1418-1891	1490-1986
	Actual	1050	1261	1400	1524	1569	1637
1 ft above Window	Range	542-722	783-1044	857-1142	893-1190	941-1255	970-1294
	Actual	613	902	1016	1103	1147	1174
2 ft above Window	Range	611-815	914-1218	1009-1345	1065-1420	1121-1494	1166-1555
	Actual	623	952	1062	1147	1197	1231
3 ft above Window	Range	581-775	874-1165	986-1315	1057-1409	1121-1494	1183-1577
	Actual	591	962	1074	1176	1243	1278
4 ft above Window	Range	519-692	772-1030	884-1178	957-1276	1022-1362	1102-1469
	Actual	556	922	1032	1142	1229	1267
5 ft above Window	Range	469-625	689-918	788-1050	854-1139	906-1208	995-1327
	Actual	504	820	919	1032	1124	1168
6 ft above Window	Range	425-566	621-828	708-944	770-1027	822-1096	909-1212
	Actual	438	709	791	897	978	1021

Notes: Window Burner centerline placed 2.5 in. away from face of wall assembly.

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

The instrumentation for this test consisted of thermocouples (TCs) at the following locations:

- Exterior surface and center of the wall assembly as shown in Figure A-2 and Figure A-5.
- Interior face of observation room as shown in Figure A-3.
- Burn room ceiling area as shown in Figure A-4.

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 controlled using mass flow controllers.

Equipment used to complete the testing included the items summarized in Table 4.

Table 4. Equipment Calibration Documentation.

Item	Make	Model	Serial No.	Cal Due
Input Module	National Instrument	NI 9213	16CFE0D	Dec 18, 2025
Input Module	National Instrument	NI 9205	16B19BA	Dec 18, 2025
Input Module	National Instrument	NI 9213	145B30F	Dec 18, 2025
Input Module	National Instrument	NI 9213	145B3E4	Dec 20, 2024
Input Module	National Instrument	NI 9213	145B3A0	Dec 18, 2025
Input Module	National Instrument	NI 9213	145B428	Dec 15, 2024
Input Module	National Instrument	NI 9213	145B2C9	Dec 18, 2025
Output Module	National Instrument	NI 9263	188EDE1	Dec 20, 2024
Flow Meter	Alicat	MCR-3000SLPM-D-PAR/5M	152528	Feb 7, 2025
Flow Meter	Alicat	MCR2000SLPM-D-40X55-PAR	478673	Mar 27, 2025
Temperature/Humidity Meter	Control Company	20250	200563195	Nov 8, 2025
Anemometer	Omega	HHF142	1019060	Mar 5, 2025

6.0 TEST PROCEDURE

Testing was conducted on November 21, 2024, 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 offset 2½ in. from the exterior face of the gypsum. The test conditions were recorded as an ambient temperature of 67 °F and a relative humidity of 24% on November 21, 2024. The airflow was 0 ft/s measured immediately prior to testing.

Documentation for the test consisted of digital photographs taken of the test wall assembly during the test, and during posttest to include dissection of the test assembly. Video of the exterior face of the test wall assembly was taken prior to, during, and posttest. 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.

The graphical temperature and gas flow data can be found in Appendix C.

7.0 TEST RESULTS

The NFPA 285 test for Nox-Crete, Inc. was performed on November 21, 2024. Visual observations made during the test appear in Table 5 and Table 6. 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.

Table 5. Test Observations of Front Wall.

Time (min:s)	Visual Observations
-2:00	Data start. Camera's recording.
0:00	Room burner lit.
4:20	Window burner lit.
5:00	Window burner in place.
10:12	Spalling on the interior wall, near window.
14:00	HDPE window header charring/deforming.
21:32	Top of window spalls causing the HDPE window header to fall in one section.
23:30	HDPE window header that has fallen ignites. Spalling continues.
30:00	Test ended, burners off. Flaming around window. Water used to extinguish assembly.
Posttest	Spalling concentrated around window opening. No damage to exterior anywhere else.

Table 6. Test Observations of Second-Floor Room.

Time (min:s)	Visual Observations
0:00	Visibility approximately 100%.
5:00	Visibility approximately 100%.
10:00	Visibility approximately 100%.
15:00	Visibility approximately 100%.
20:00	Visibility approximately 100%.
25:00	Visibility approximately 100%.
30:00	Visibility approximately 100%.

* Note: Visibility is approximated by reviewing the video footage of the second-floor room.

The following sections outline the performance of the wall assembly with respect to the conditions of acceptance detailed in NFPA 285.

7.1.1 Flame Propagation, Exterior Face of Wall Assembly:

1. The temperatures on the exterior face, measured by 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 at any time during the test.

7.1.2 Flame Propagation, Core Components:

1. The temperatures in the wall cavity insulation of the *TigerLoc* fire test panel, as measured by TCs 28 and 31–40, did not exceed 750 °F above the ambient temperature at the start of the test any time during the test.

7.1.3 Flame Propagation, Beyond First-Story 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. Temperatures in the wall cavity insulation of the *TigerLoc* fire test panel, as measured by TCs 18 and 19, did not exceed 750 °F above the ambient temperature at the start of the test at any time during the test.

7.1.5 Temperatures in Second-Story 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 of the test facility at any time during the test.

7.1.6 Flames in Second-Story Test Room:

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

Appendix A contains diagrams detailing the instrumentation and construction of the wall assembly. See Appendix B for photographic documentation of the test and posttest inspection. Graphical temperature data is located in Appendix C.

8.0 CONCLUSION

SwRI's Fire Technology Department, located in San Antonio, Texas, conducted an NFPA 285 fire performance evaluation test for Nox-Crete, Inc., located in Omaha, Nebraska. The test performed on November 21, 2024, was conducted on a *TigerLoc* fire test panel system.

Using the methods described in this report on the wall constructed, as described in this report, was shown that the wall assembly met the acceptance criteria stated in the NFPA 285 standard.

APPENDIX A

TEST ASSEMBLY DRAWINGS, INSTRUMENTATION LAYOUT,

AND CLIENT-PROVIDED DRAWINGS

(CONSISTING OF 15 PAGES)

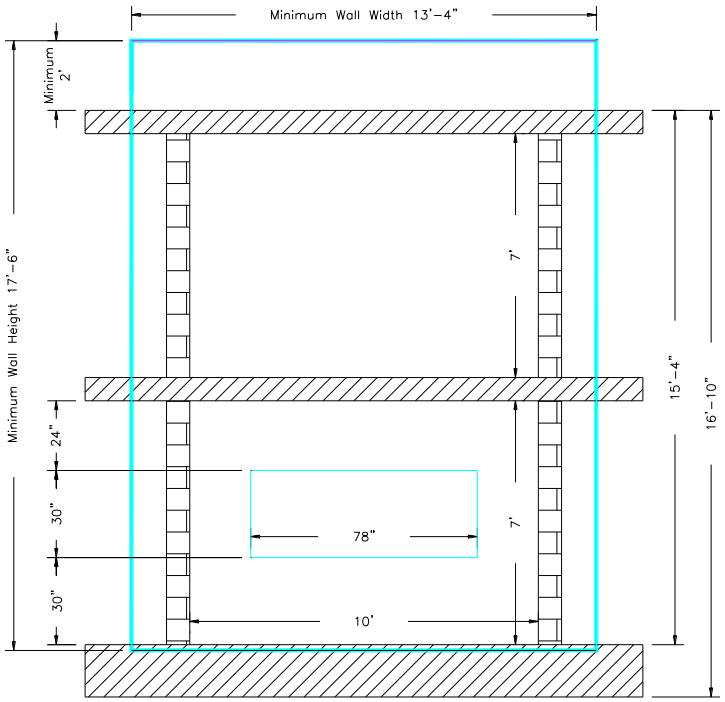

Figure A-1. Front View of Wall System in Place on Test Structure.

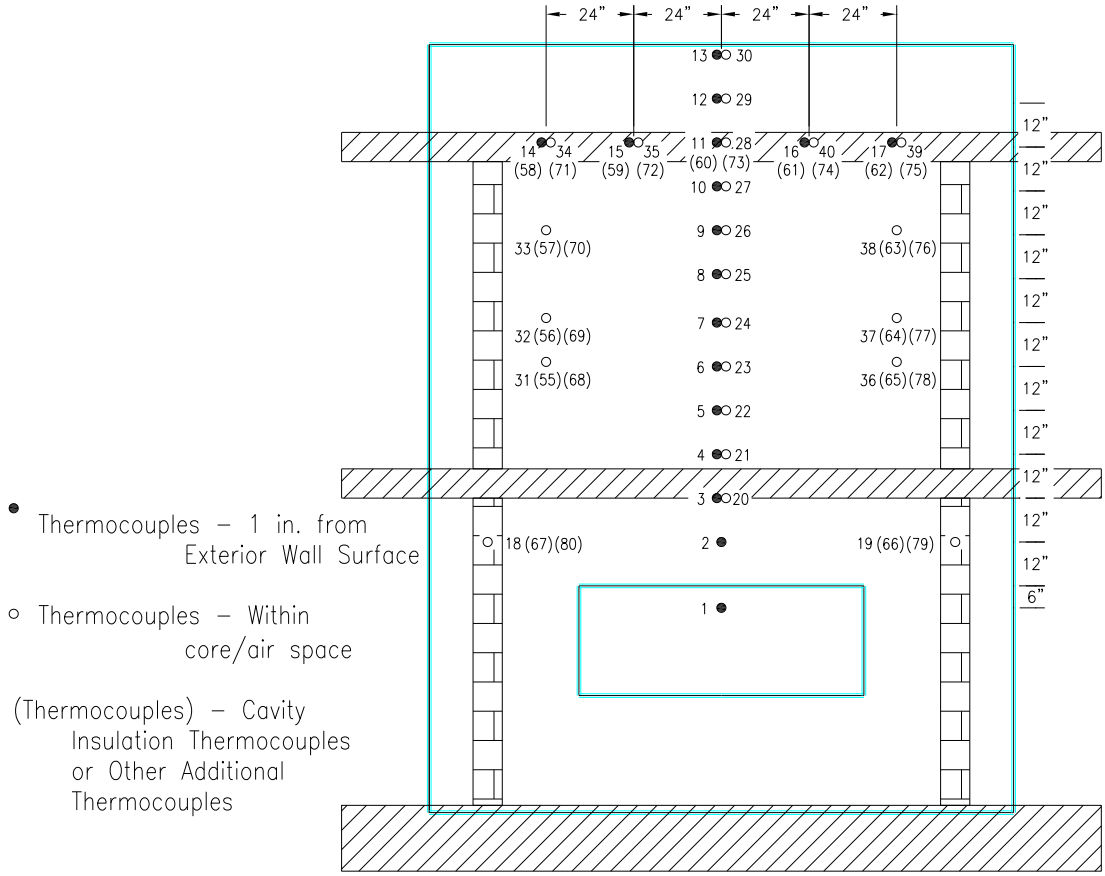

Figure A-2. Instrumentation Arrangement (Exterior Face, Air Cavity, and Foam Core).

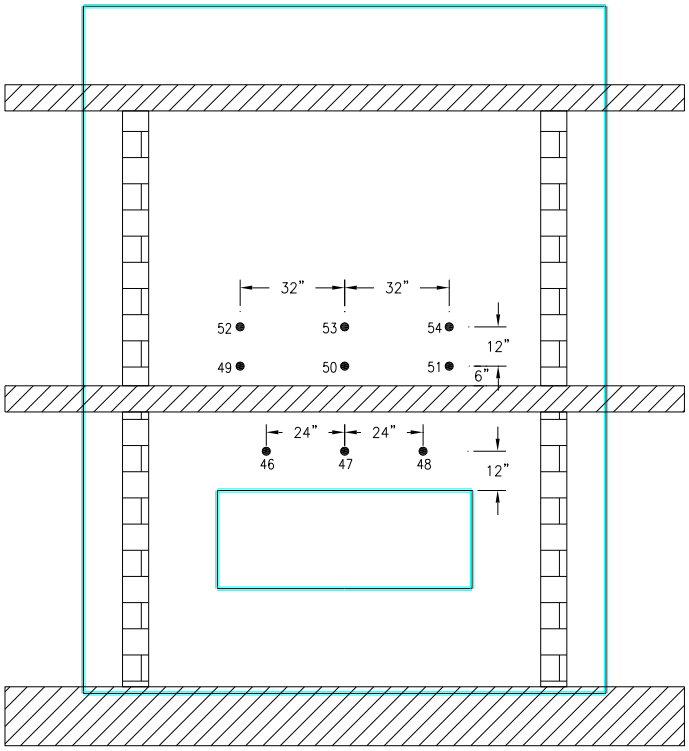

Figure A-3. Instrumentation Arrangement (Interior Face of Wall Assembly on Second-Floor Room and Burn Room).

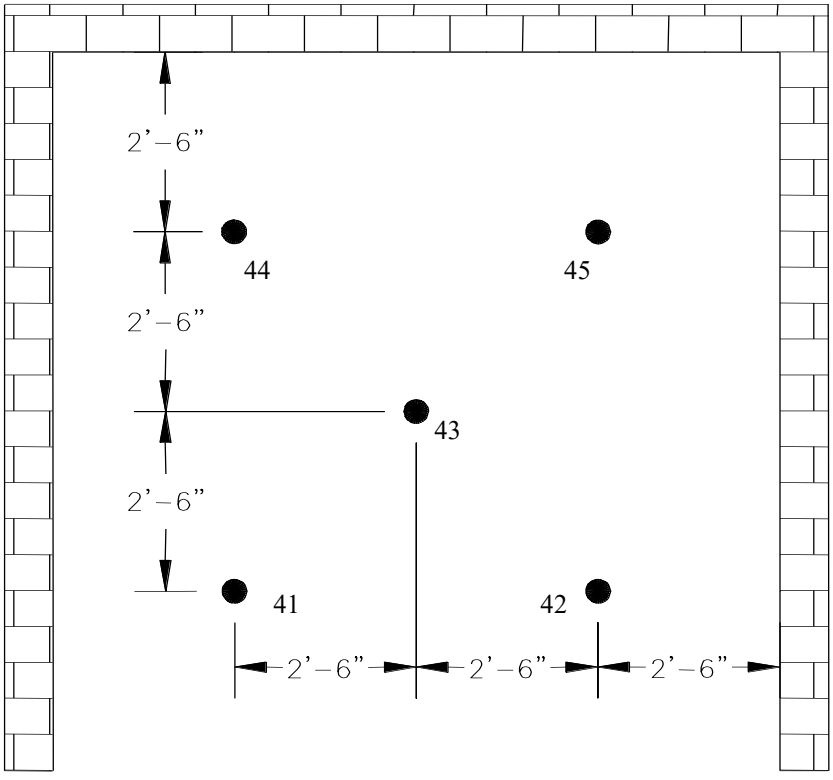

Figure A-4. Instrumentation Arrangement (Burn Room Ceiling).

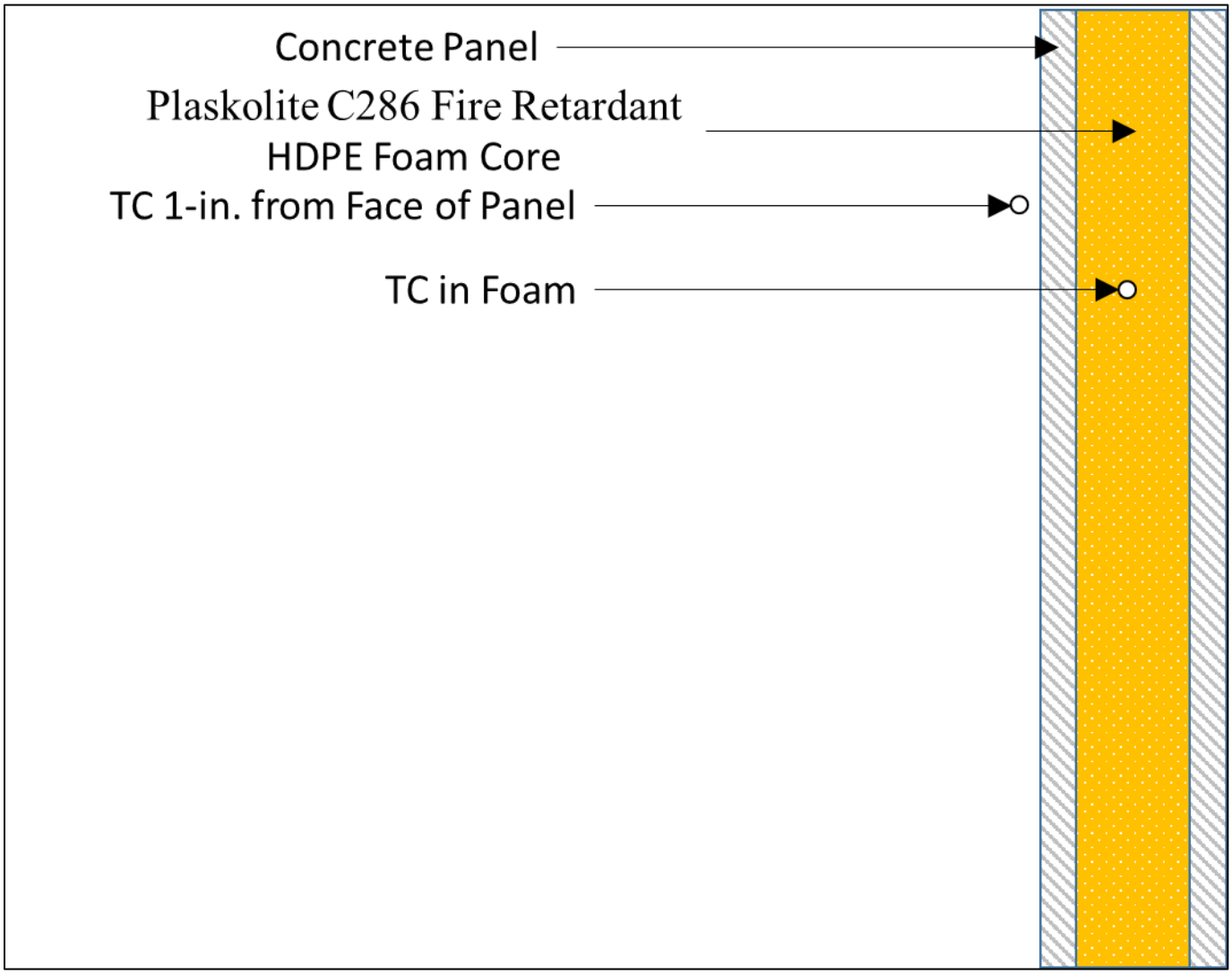

Figure A-5. Instrumentation Arrangement – Profile View System (TCs on Exterior Face and within Wall Components).

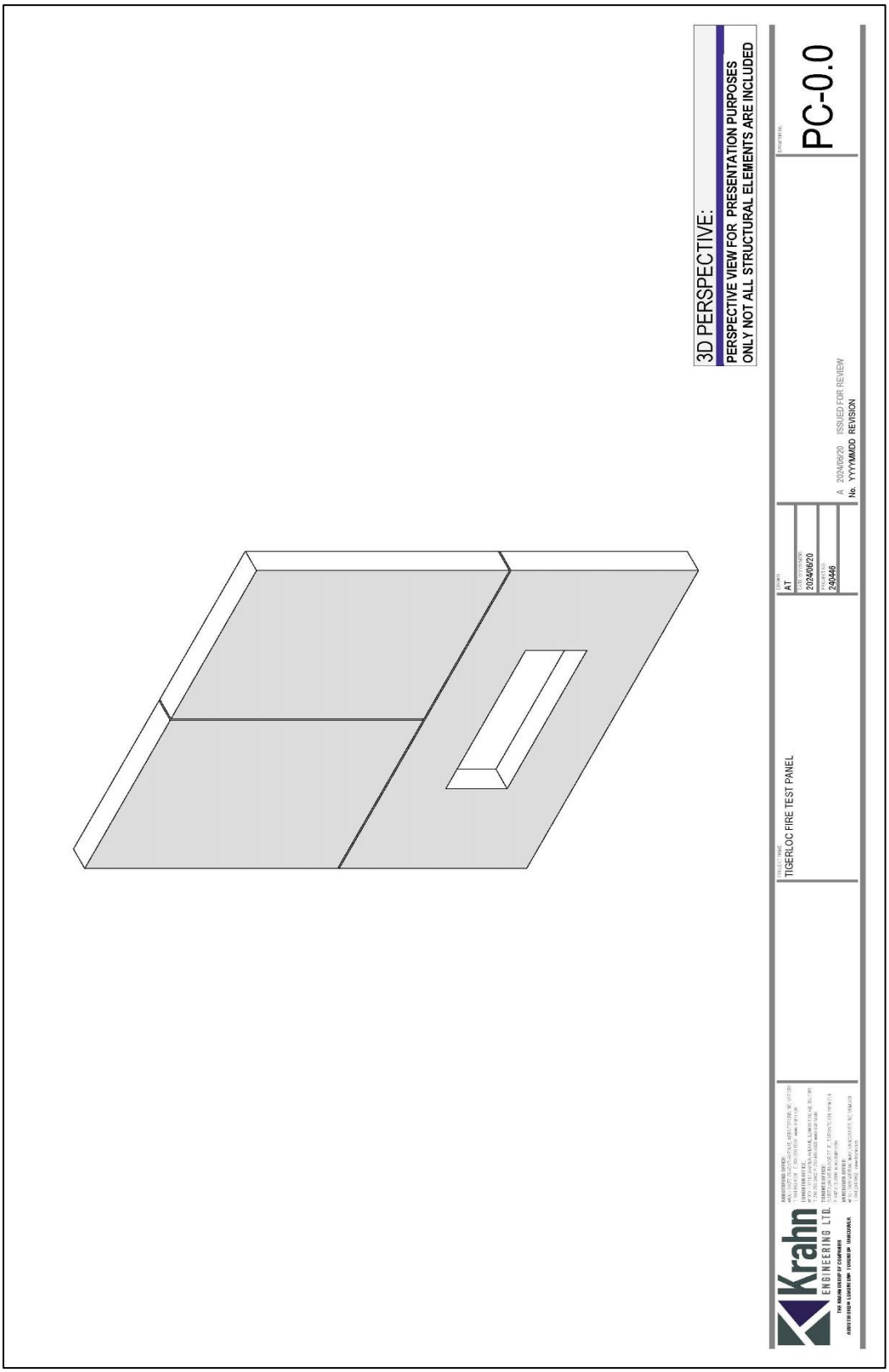

Figure A-6. Client-Provided Drawing.

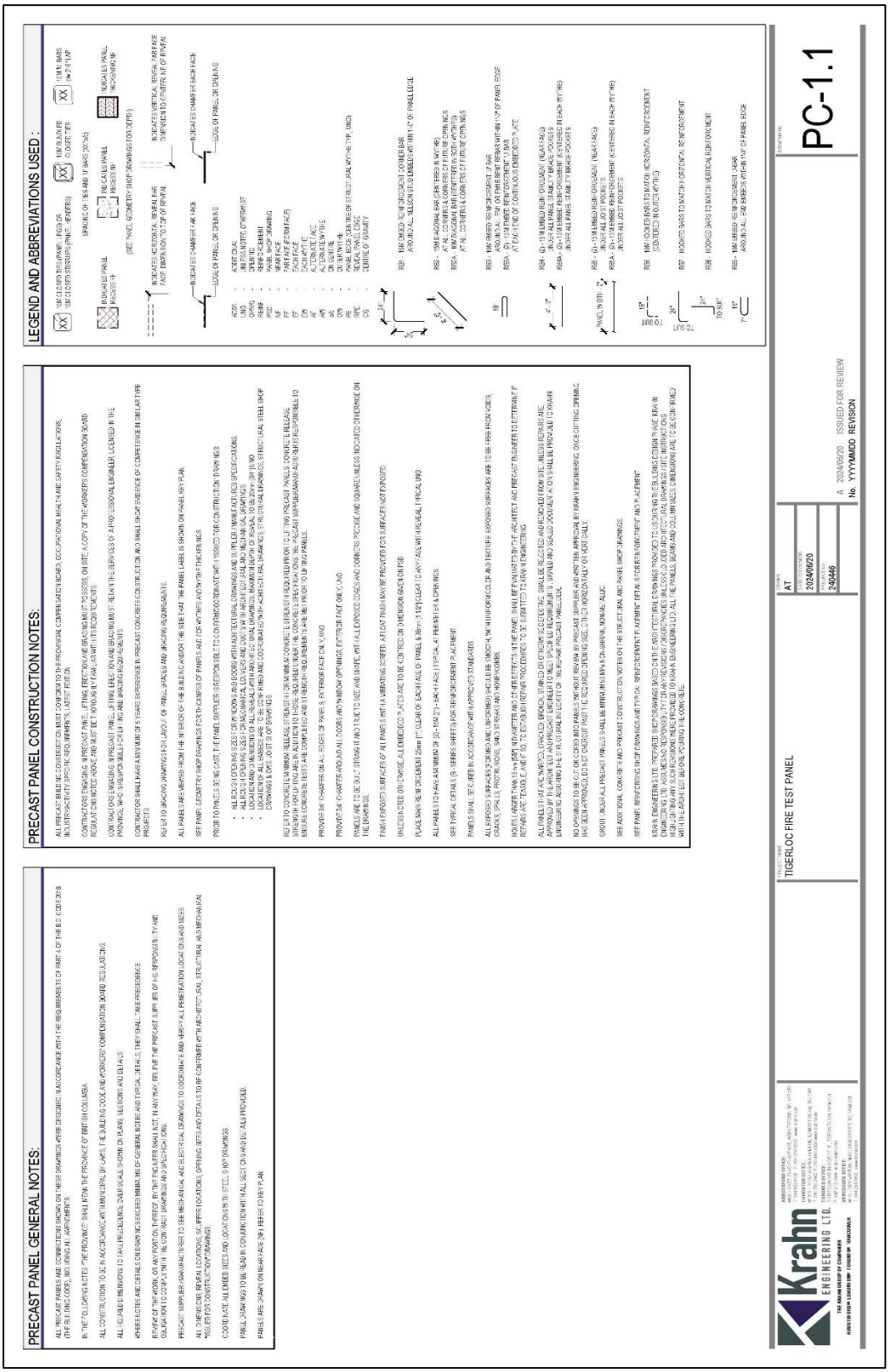

Figure A-7. Client-Provided Drawing.

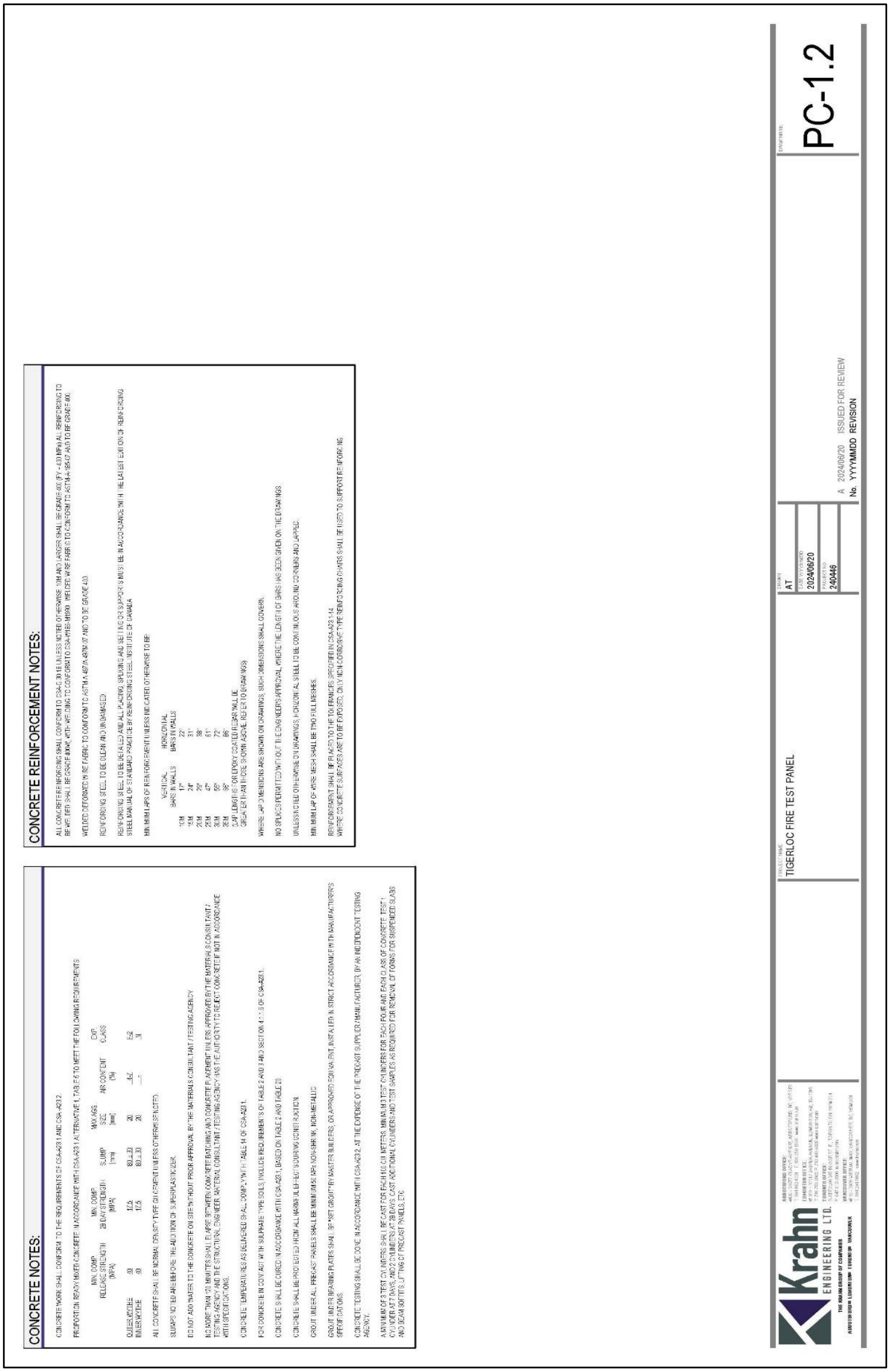

Figure A-8. Client-Provided Drawing.

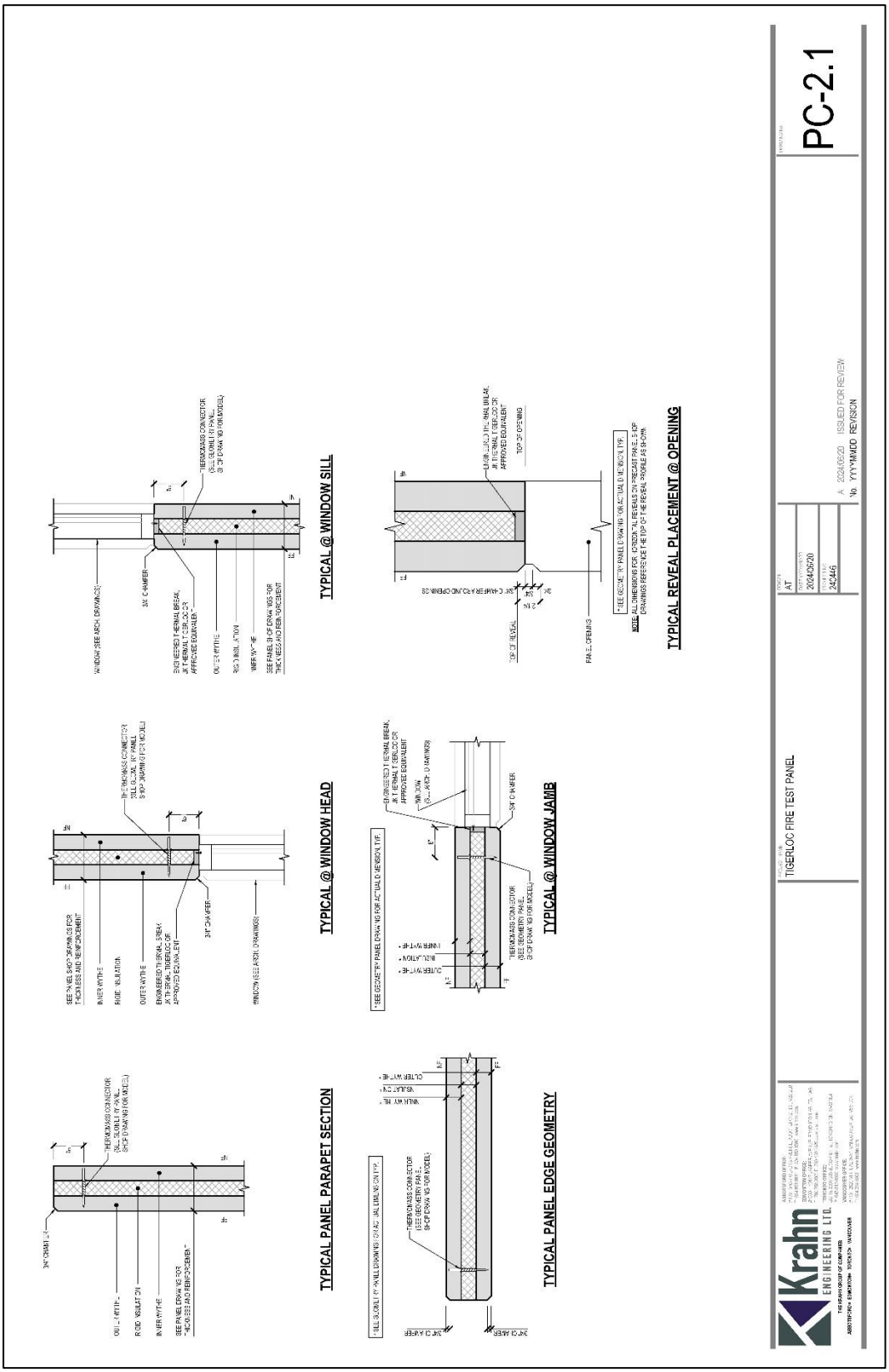

Figure A-9. Client-Provided Drawing.

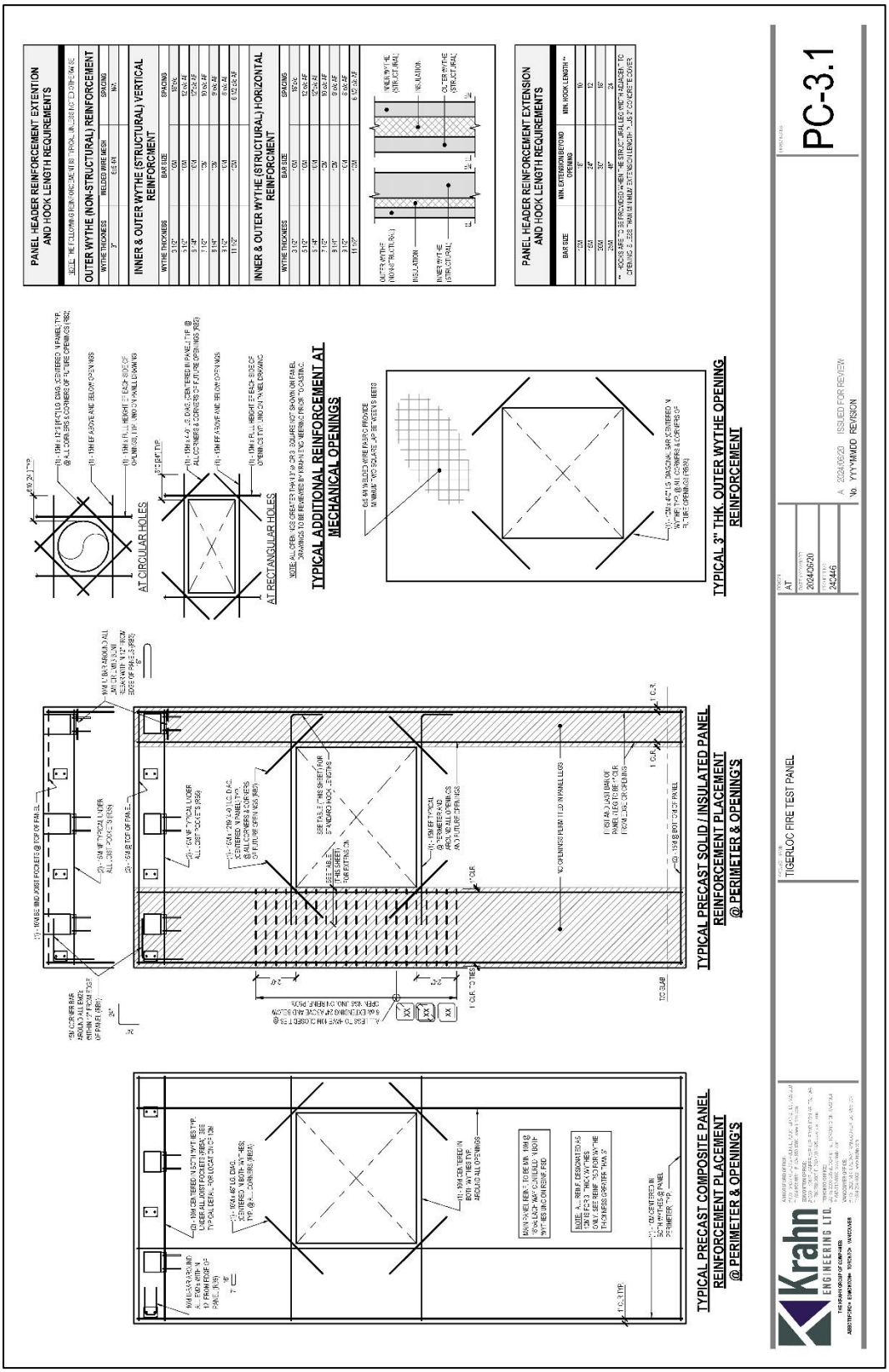

Figure A-10. Client-Provided Drawing.

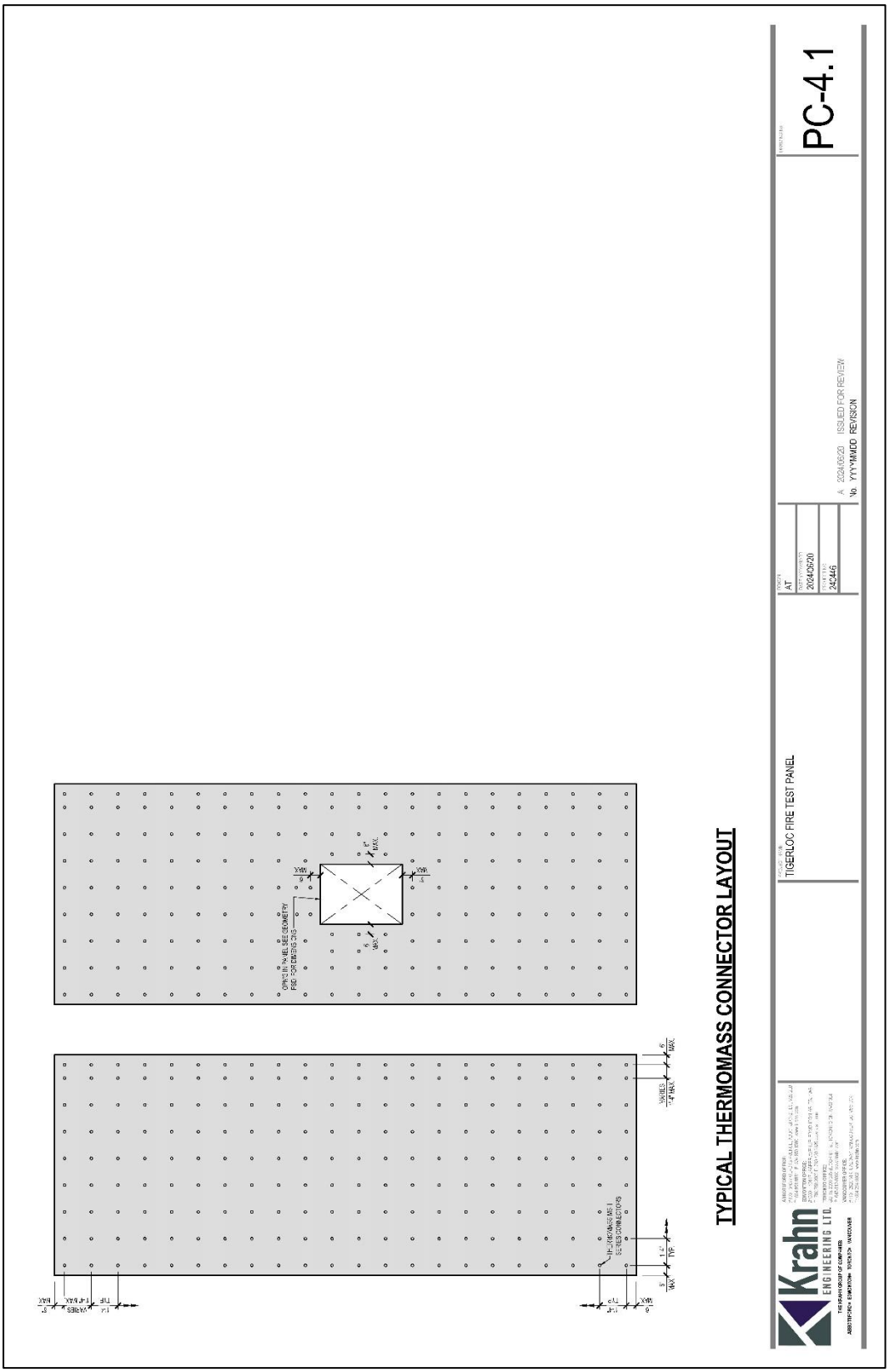

Figure A-11. Client-Provided Drawing.

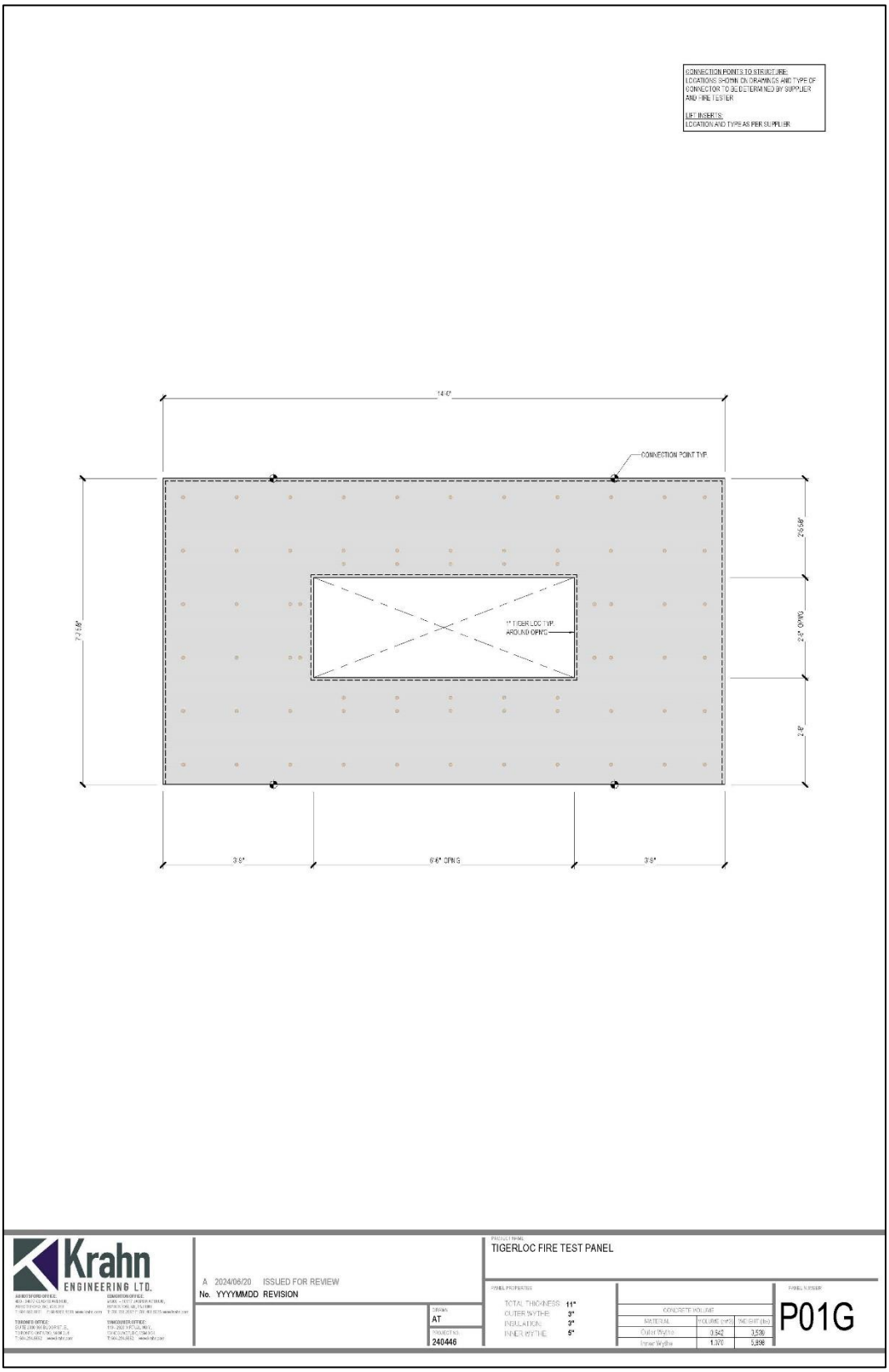

Figure A-12. Client-Provided Drawing.

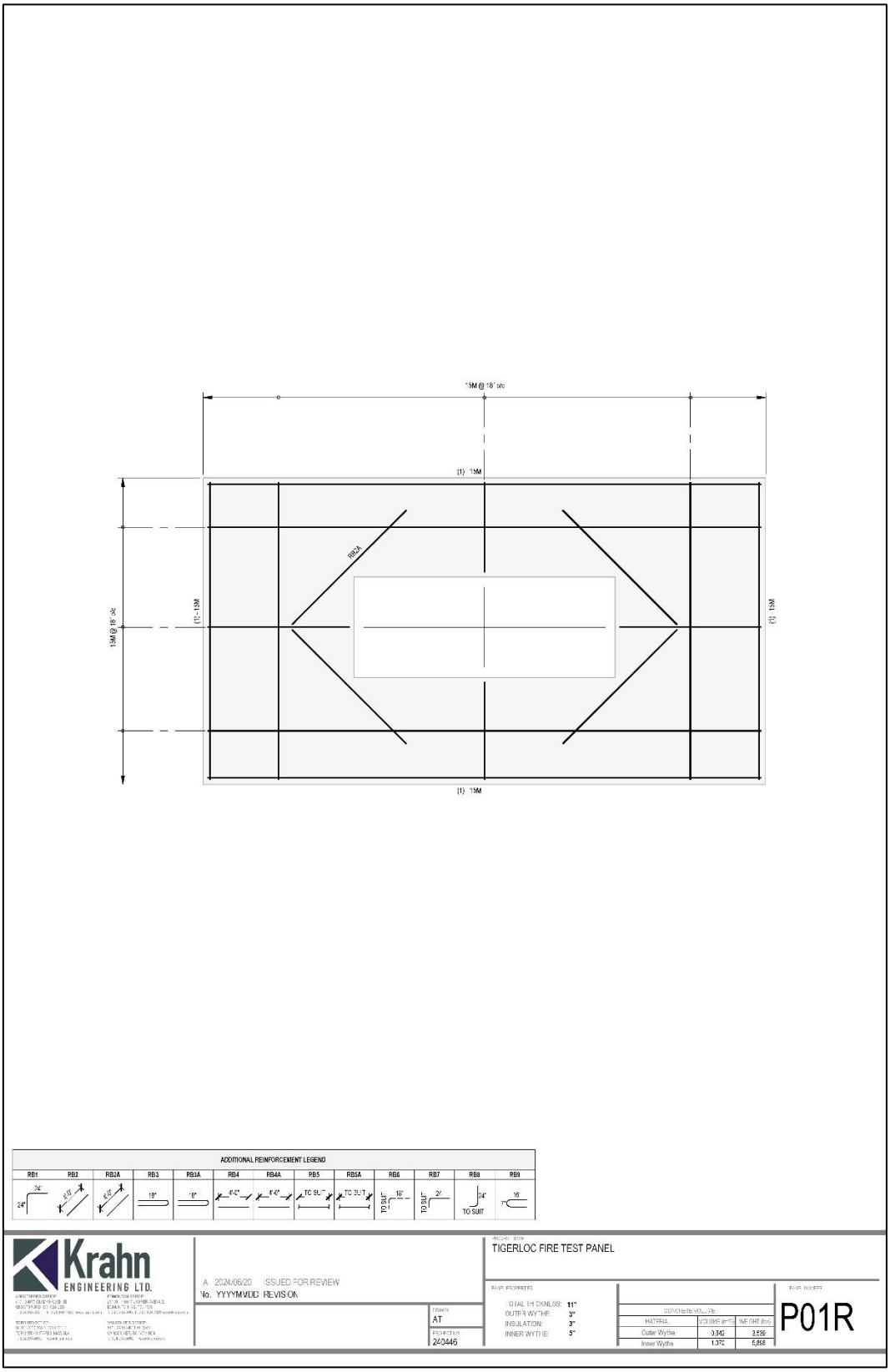

Figure A-13. Client-Provided Drawing.

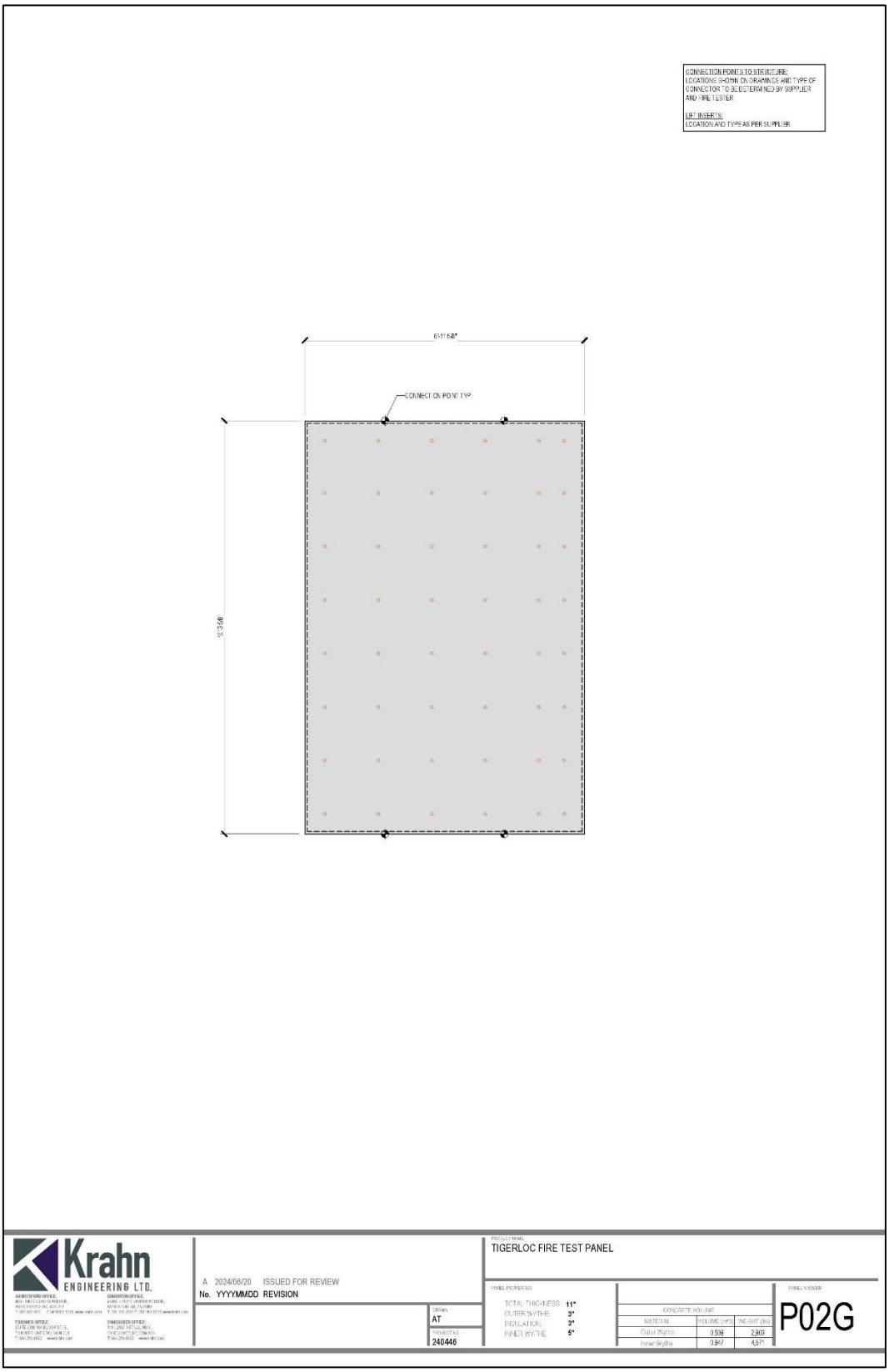

Figure A-14. Client-Provided Drawing.

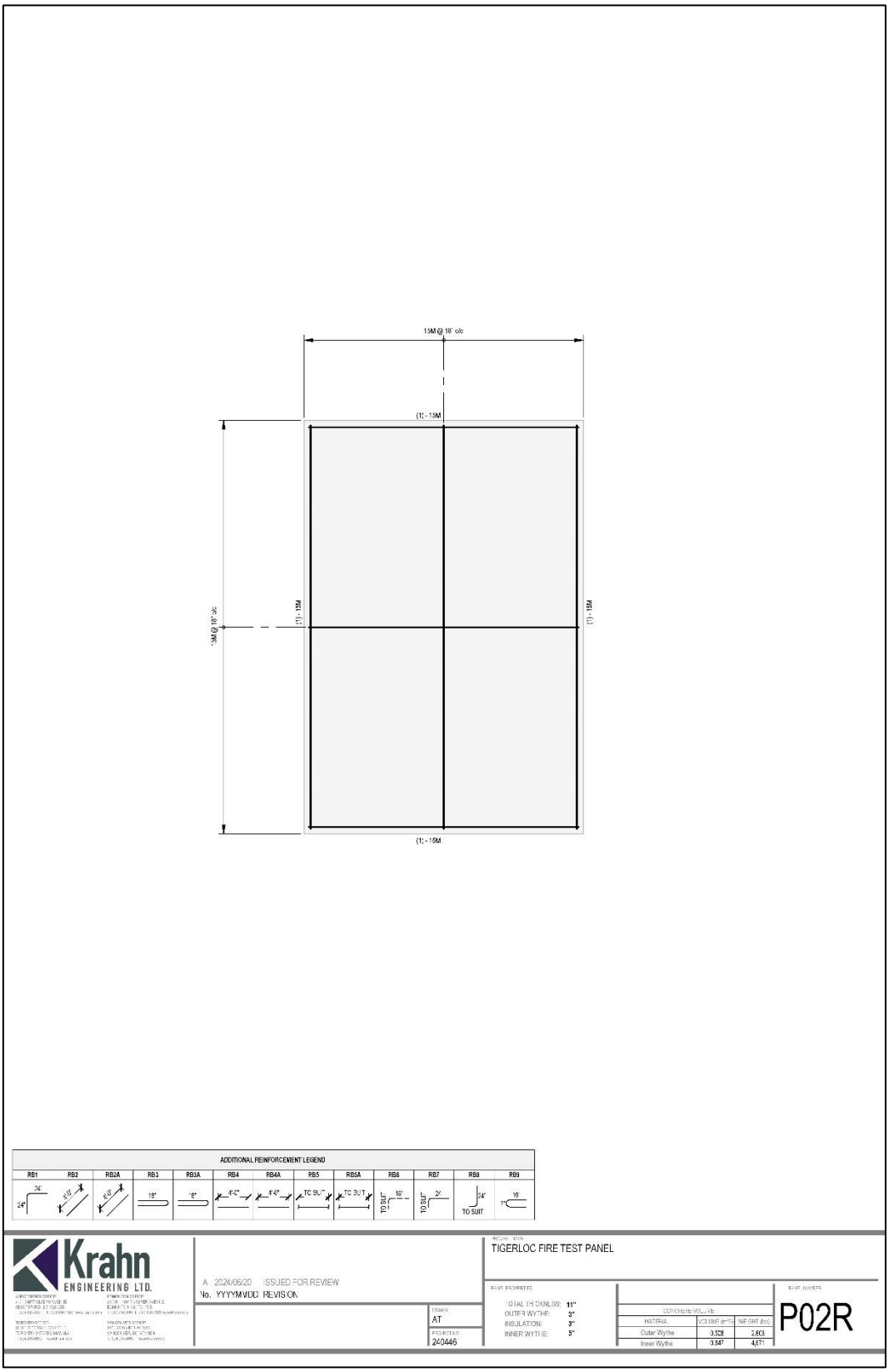

Figure A-15. Client-Provided Drawing.

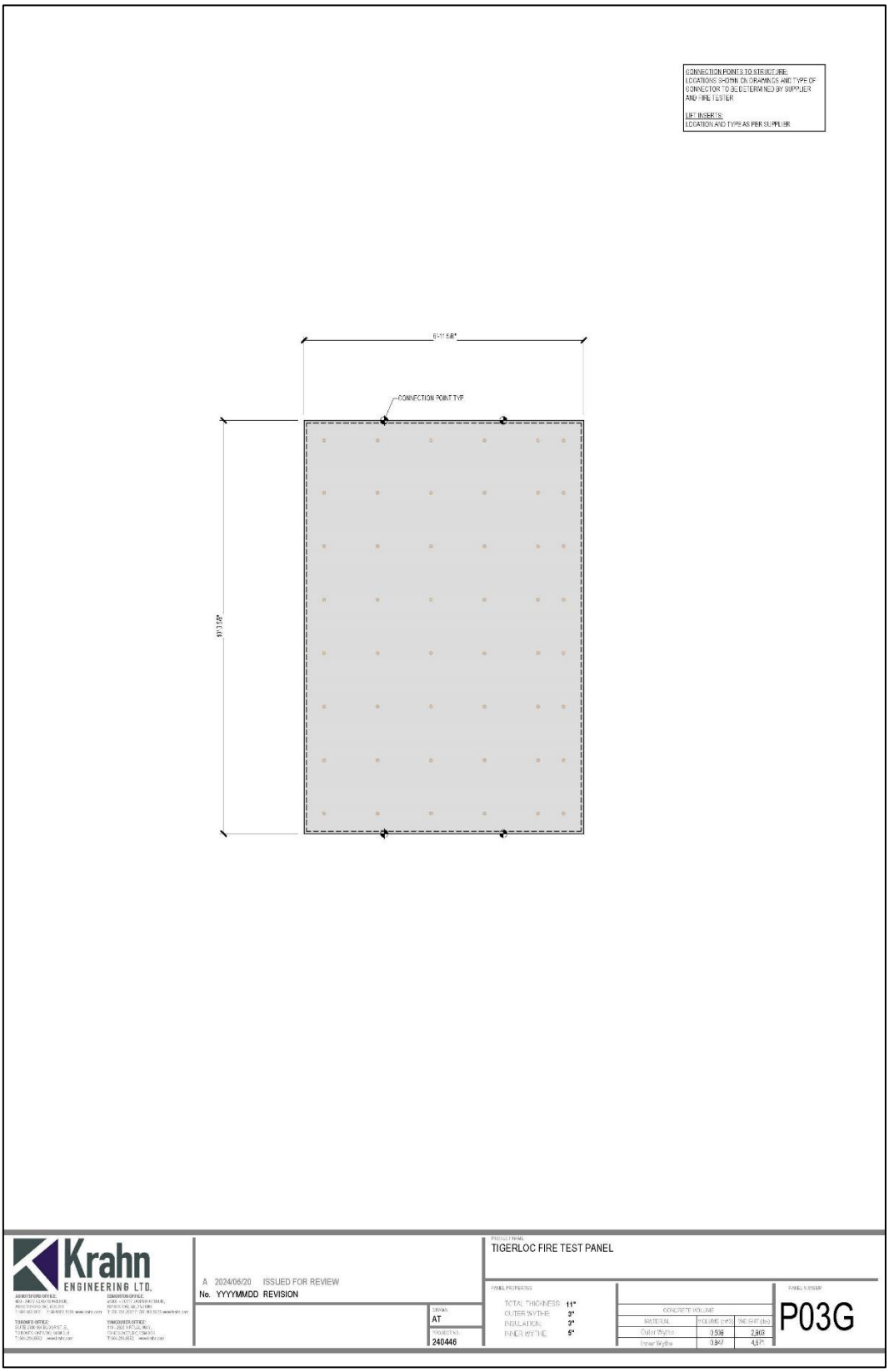

Figure A-16. Client-Provided Drawing.

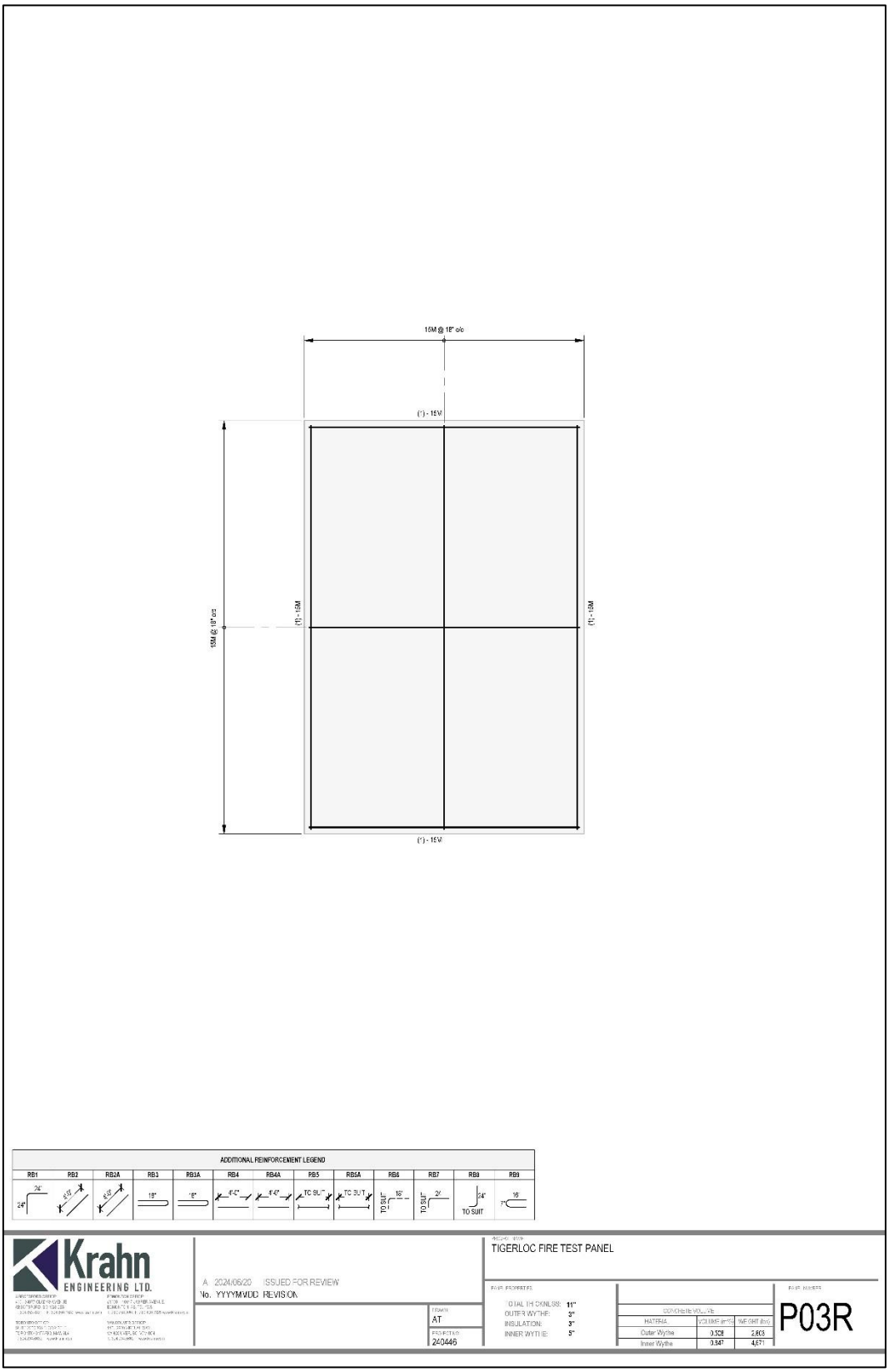

Figure A-17. Client-Provided Drawing.

APPENDIX B

PHOTOGRAPHIC DOCUMENTATION

(CONSISTING OF 5 PAGES)

Figure B-1. Panels as Received.

Figure B-2. Exterior View prior to Testing.

Figure B-3. View of Second Story prior to Testing.

Figure B-4. Exterior View at 5 min 2 s into Test.

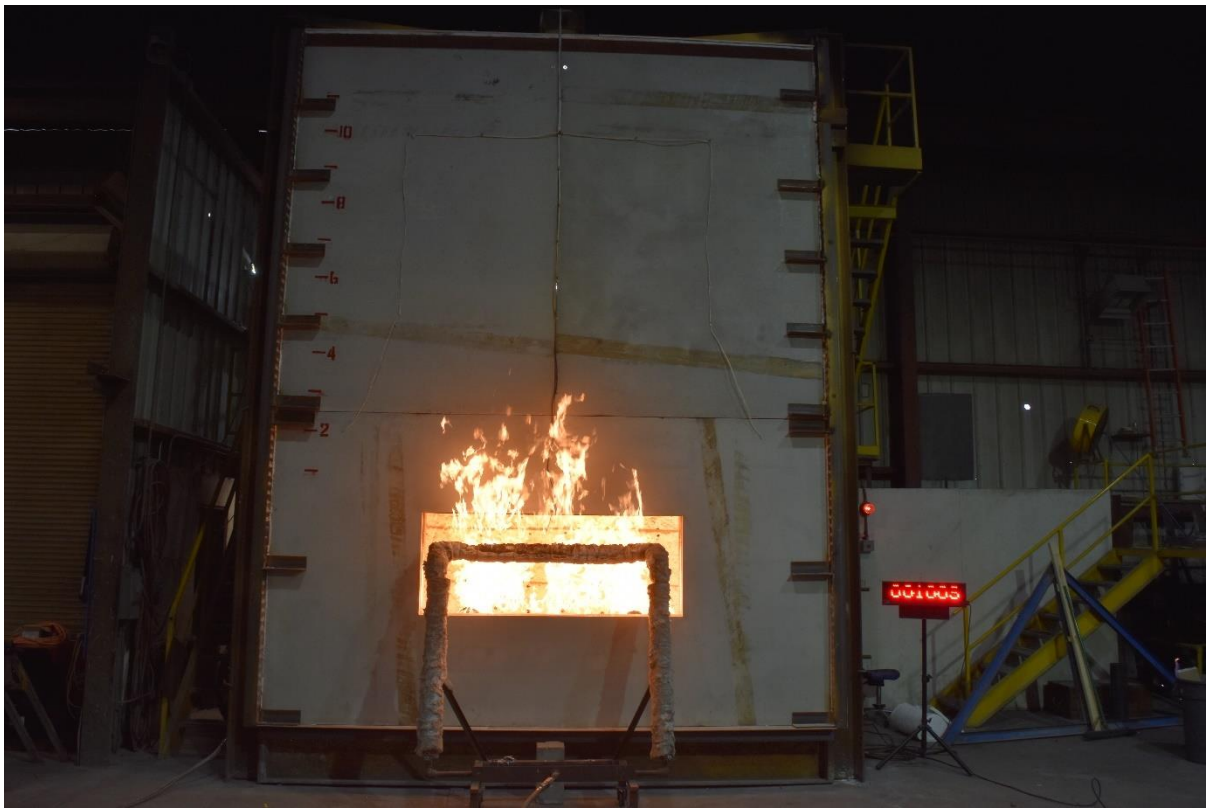

Figure B-5. Exterior View at 10 min 5 s into Test.

Figure B-6. Exterior View at 15 min 33 s into Test.

Figure B-7. Exterior View at 25 min 5 s into Test.

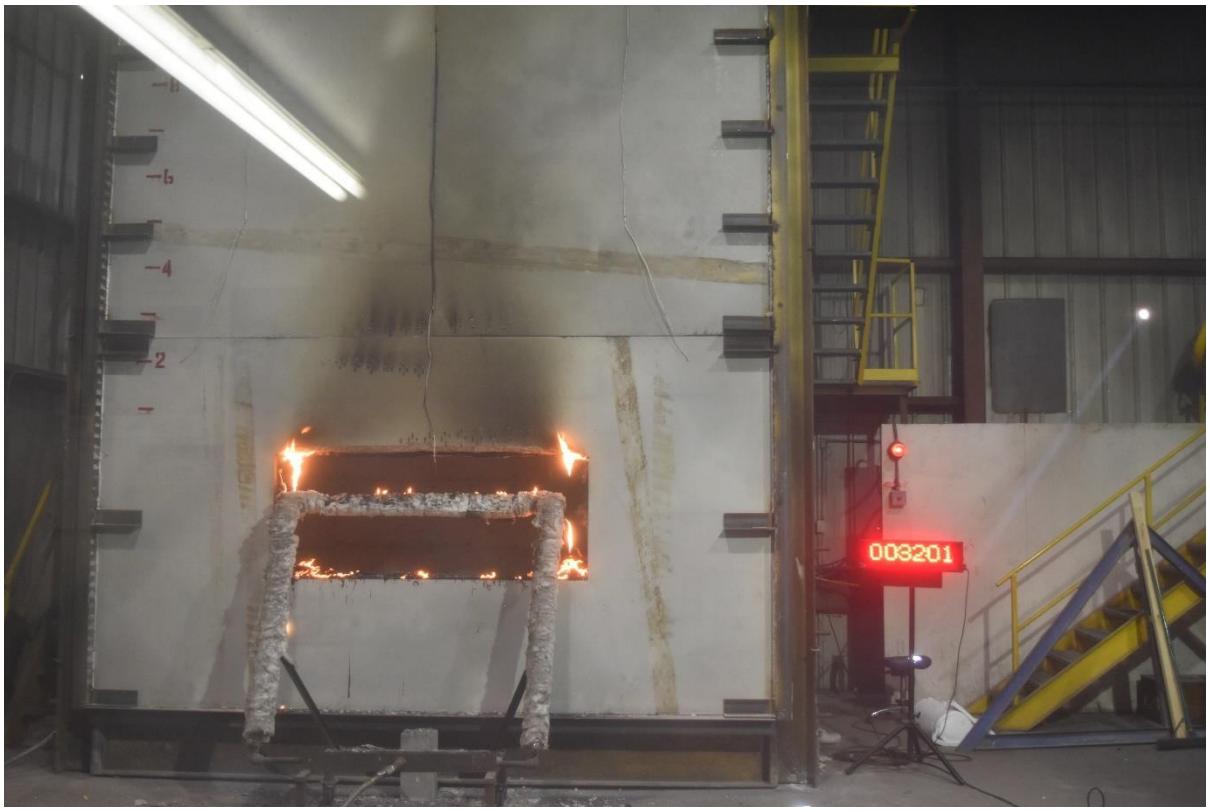

Figure B-8. Exterior View at 32 min into Test, during Observations Period.

Figure B-9. Exterior View at 40 min 7 s into Test, End of Observation Period.

APPENDIX C

GRAPHICAL TEMPERATURE DATA

(CONSISTING OF 6 PAGES)

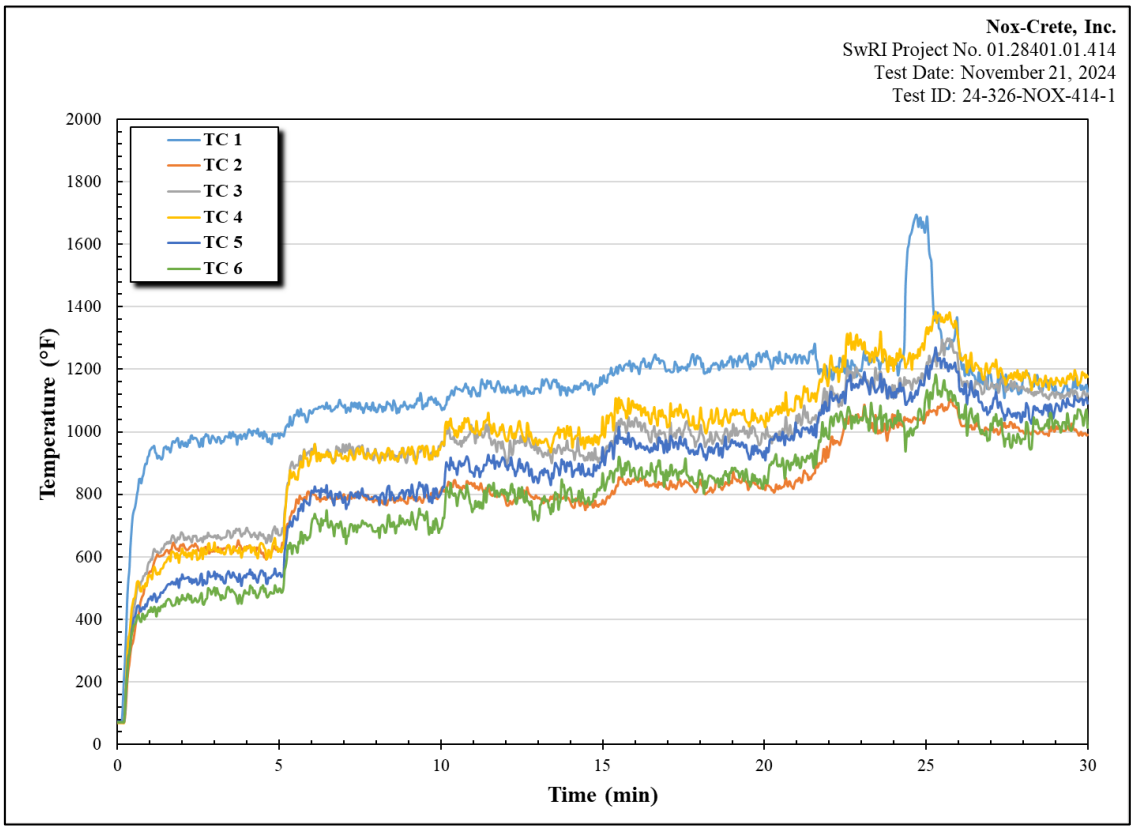

Figure C-1. Exterior Wall Temperatures (TCs 1–6).

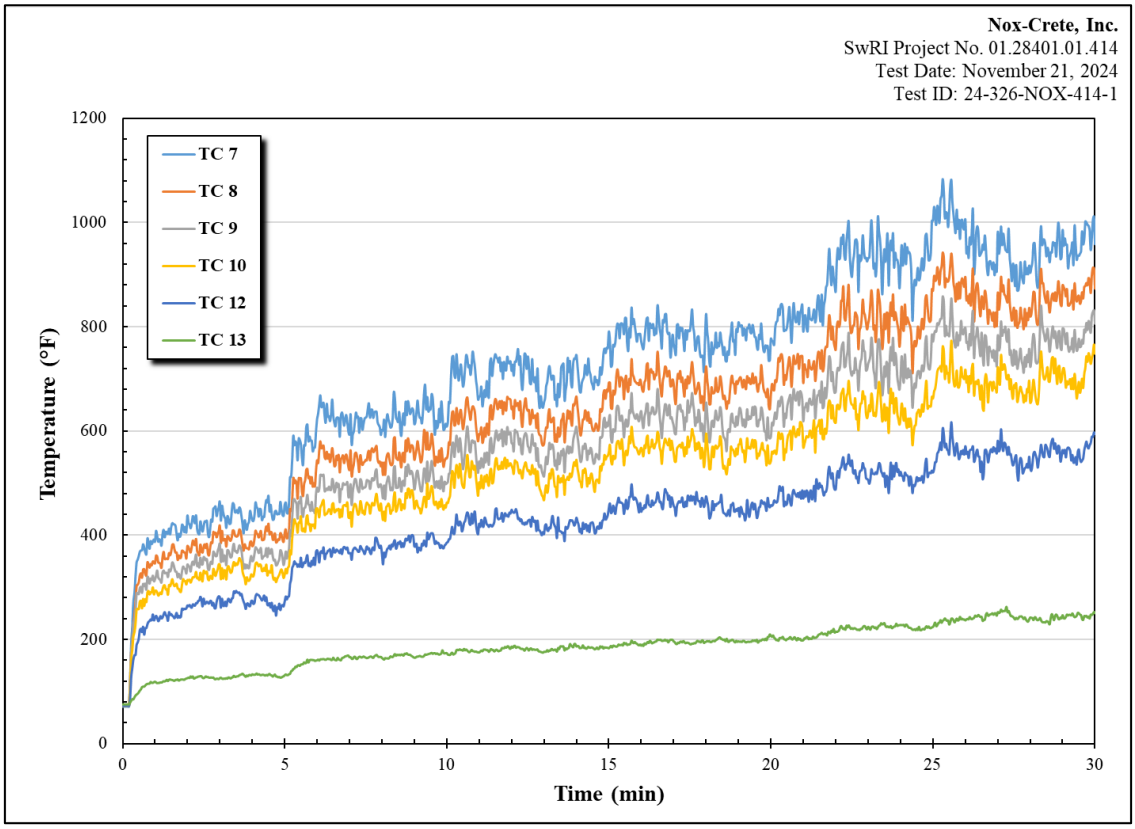

Figure C-2. Exterior Wall Temperatures (TCs 7–13).

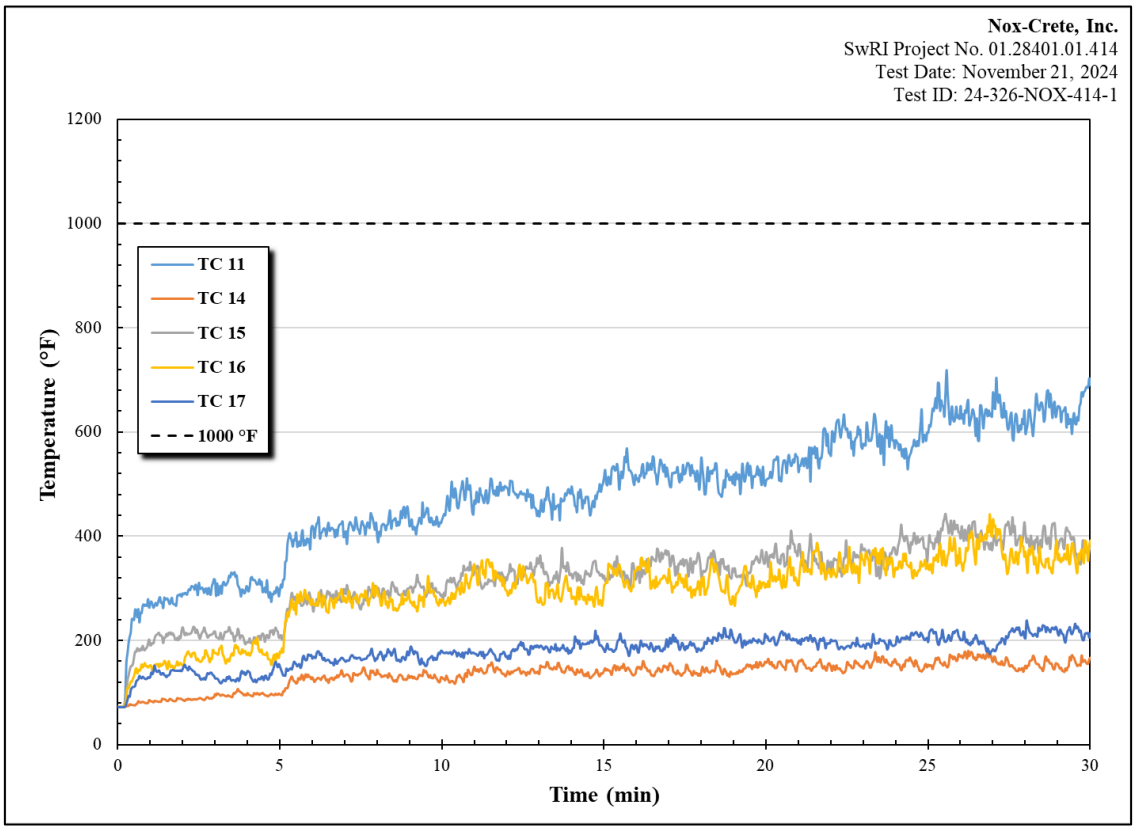

Figure C-3. Exterior Wall Temperatures (TCs 11 and 14–17).

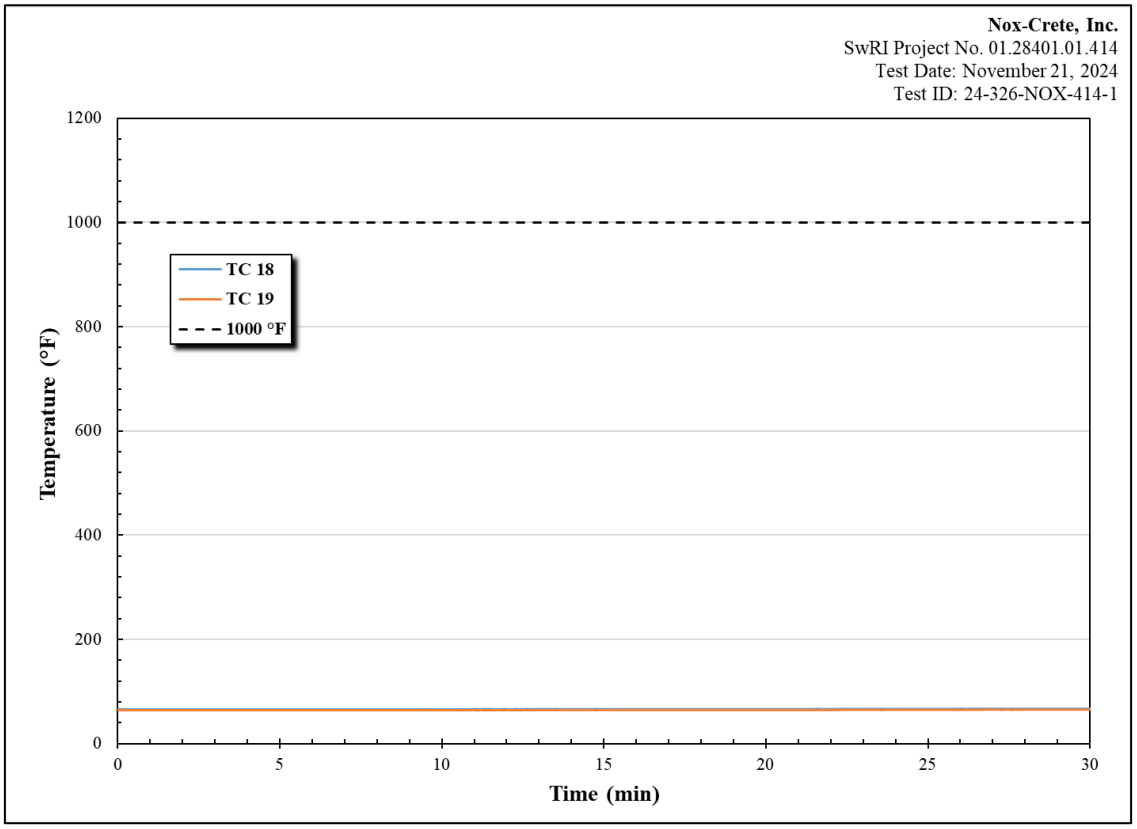

Figure C-4. Lateral Foam Insulation Temperatures (TCs 18 and 19).

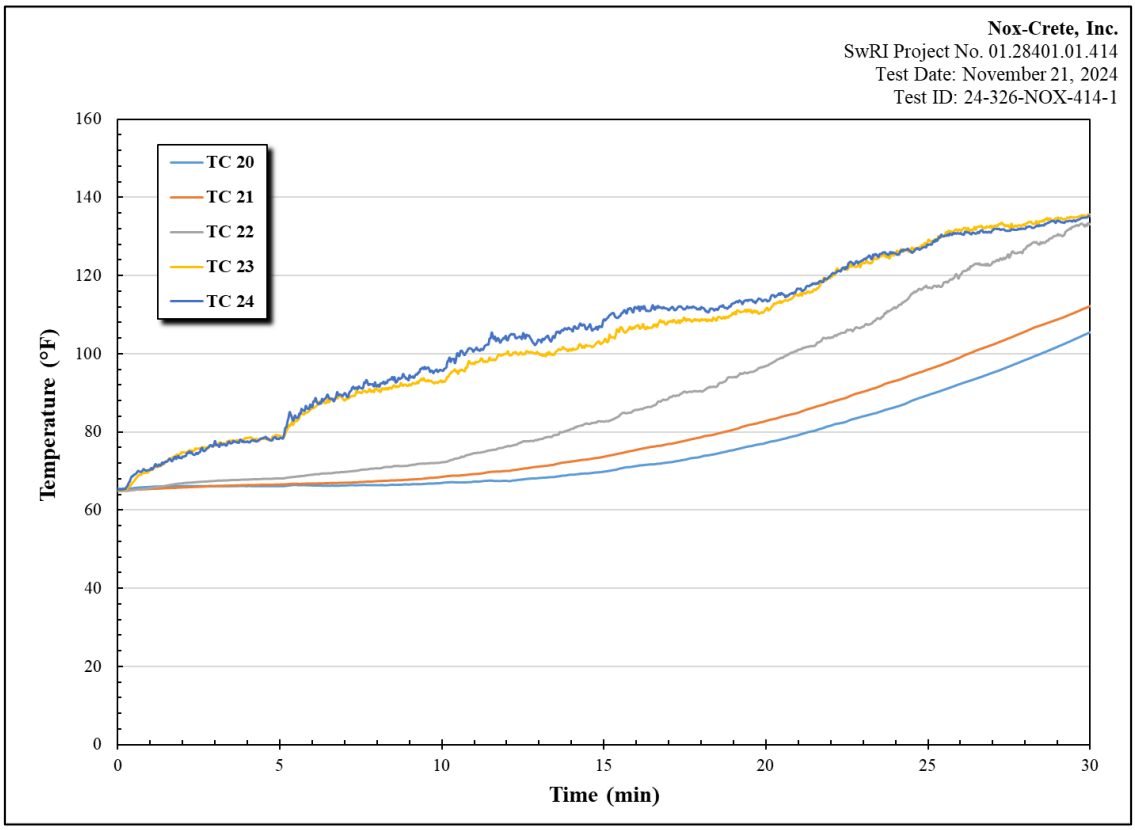

Figure C-5. Foam Insulation Temperatures (TCs 20–24).

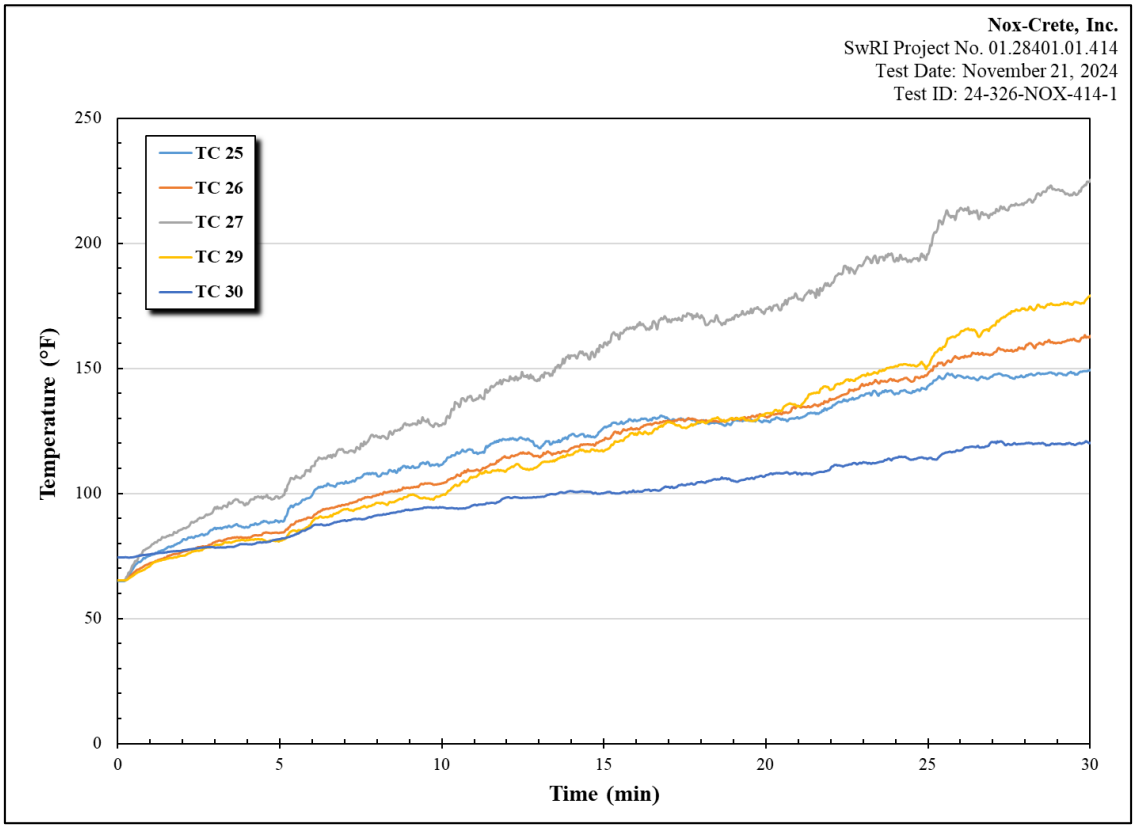

Figure C-6. Foam Insulation Temperatures (TCs 25-30).

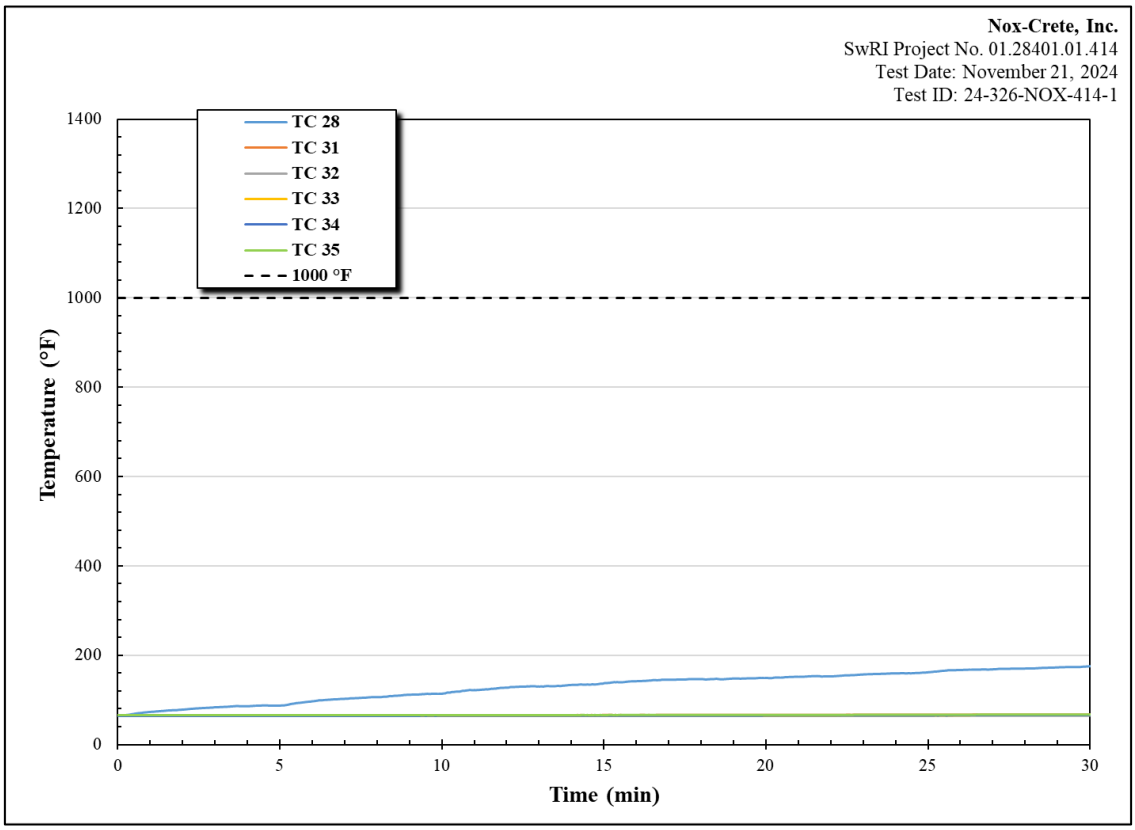

Figure C-7. Foam Insulation Temperatures (TCs 28 and 31–35).

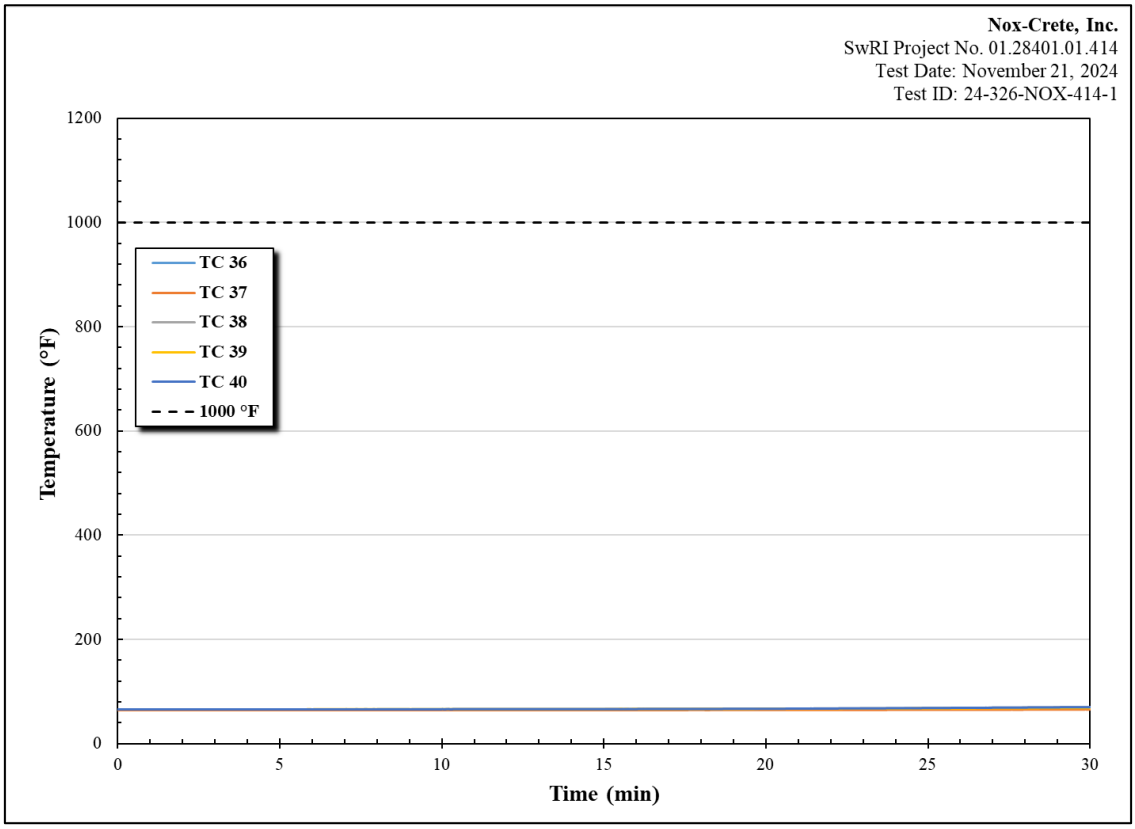

Figure C-8. Foam Insulation Temperatures (TCs 36–40).

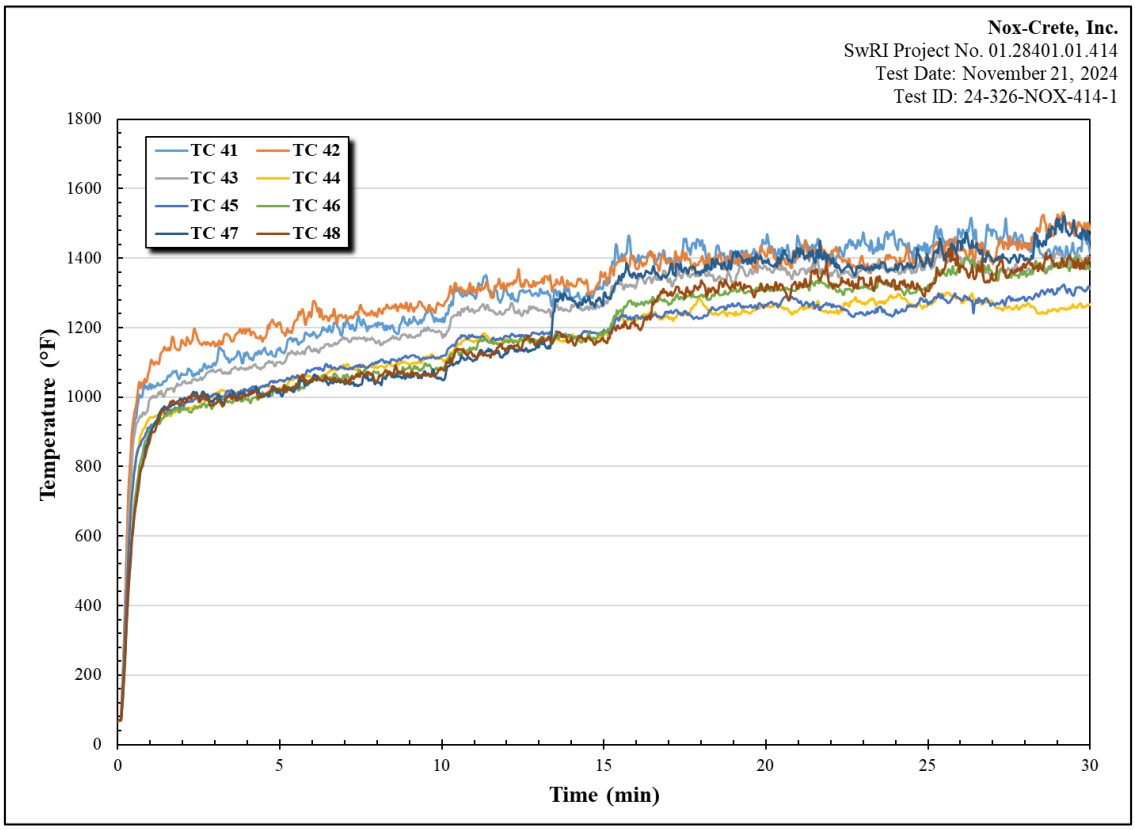

Figure C-9. Room Temperatures (TCs 41–48).

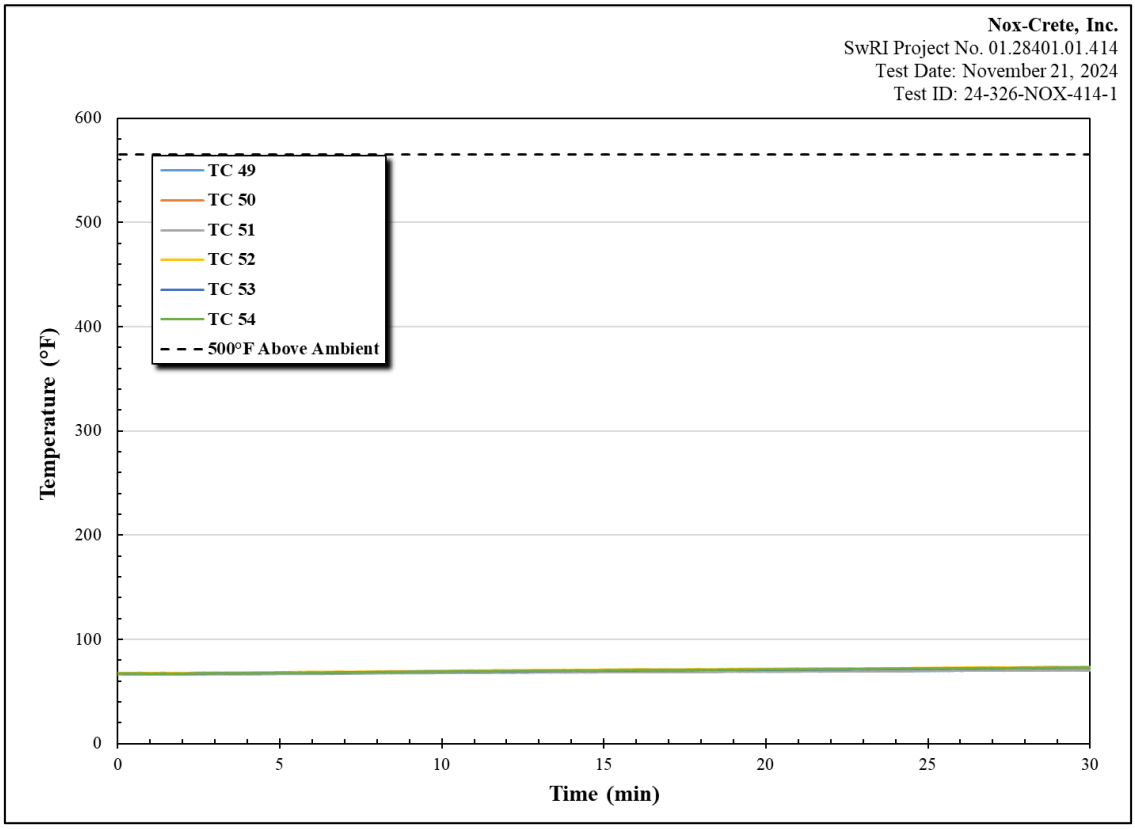

Figure C-10. Second-Story Temperatures (TCs 49–54).

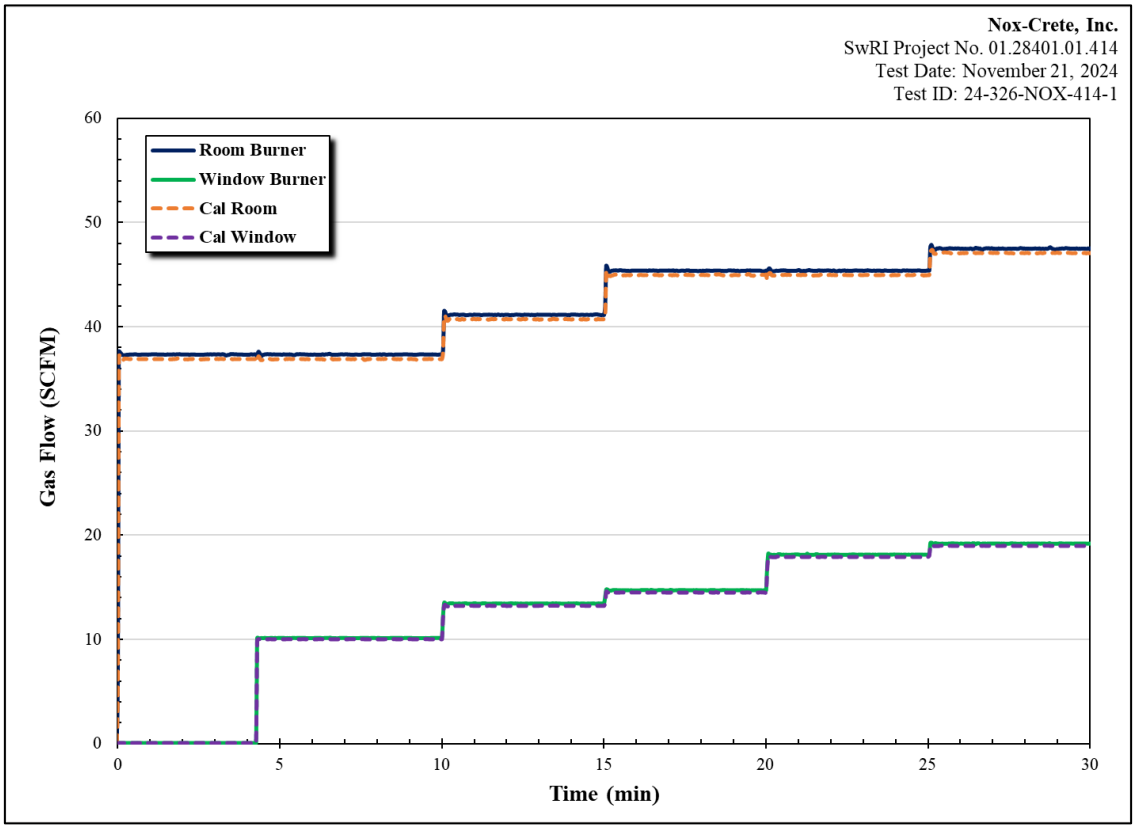

Figure C-11. Gas Flow Data.