WESTERN FIRE CENTER, INC.
2204 Parrott Way, Kelso, Washington 98626
Phone: 360-423-1400 | Fax: 360-423-5003

Fire Performance of ASTM E119 Evaluation of Asymmetric MPP Load-Bearing Wall Assembly

Indicative testing conducted in accordance with the test methodology described in ASTM E119-24, Standard Test Methods for Fire Tests of Building Construction and Materials

Conducted For:

Freres Engineered Wood
PO Box 276
Lyons, OR 97058

WFCi Report #25028

Test Dates: June 10, 2025

Report Issued: June 18, 2025

IAS ACCREDITED Testing Laboratory TL-180

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INTRODUCTION

This report describes the fire resistance testing of a load-bearing wood mass ply panel (MPP) wall assembly for a desired 2-hr fire resistance rating and hose-stream. Testing was performed in accordance with ASTM E119-24, *Standard test methods for fire tests of building and construction materials*, for Freres Engineered Wood as the MPP manufacturer.

The assembly was fabricated and shipped to WFCi for testing. Two sections were shipped for each assembly, joined together at WFCi, and tested on the vertical furnace. The overall unexposed wall assembly area was 10'×10'. Directly following the fire resistance test, the hose-stream was performed on the same assembly.

SUMMARY OF TEST METHOD

Testing was performed using a vertical fire resistance test configuration employing the fire endurance conditions and standard time-temperature curve described in ASTM E119-24, *Standard Test Methods for Fire Tests of Building Construction and Materials*. The exposed surface of the assemblies was subjected to the standard E119 time-temperature curve, with temperature measurements taken inside the natural gas furnace using 9 thermocouples (TC_F) connected to a computerized data acquisition system. TC_F locations were symmetrically disposed and distributed to show the temperature near (within 6") the exposed face of the test assembly.

Here are the following criteria to which these tests were judged, according to ASTM E119:

- Wall assembly will have sustained the applied load for the indicated time (2-hr, in this instance) without passage of flame or gases hot enough to ignite cotton waste
- Wall assembly will have not developed an opening that permits the projection of water from the hose stream beyond the unexposed surface (applicable for hose-stream portion of the test).
- Transmission of heat through the wall will not have risen the temperature on its unexposed side more than 139°C (average) above its initial temperature, or if a temperature higher than 30% (181°C) of the specified limit occurs at any one point (single-point) on the unexposed side of the assembly.

SAMPLE DESCRIPTION

The MPP wall assembly was 10'×10'. The materials and method of construction is described below. Layers of ceramic insulation were inserted and packed along the assembly perimeter, insulating the exposed perimeter of the assembly at the opening of the vertical furnace.

Wood Mass Ply Panel

MPP panels are wood panels designed for tall wood buildings, similar to other cross-laminated timber (CLT) products. The assembly consisted of multiple wood veneers joined together with adhesive. Lumber and adhesive together gave the overall depth of approximately assembly depth 6⅛". A description of the assembly is found below.

- **Test 1**: Freres Engineered Wood Mass Ply Panel (see APA Product Report PR-L325 and ICC-ES ESR-4760)
    - Grade: F16-6 (6⅛" Douglas Fir LVL)
    - Mass: 888.8 lb (north panel), 897.2 lb (south panel).
    - Spline: 1$^{1}/_{16}$"×12", screwed to unexposed side of assembly

Figure 1. Representative MPP panels showing joined assembly (a) exposed side and (b) unexposed side with spline.

Two identical panels (10'×5') were sent for the test (Figure 1), each with a spline cutout section (1$^{1}/_{16}$"×6"). The two panels were joined together in the sample holder and tightened together without any caulk or additional protection. The spline (1$^{1}/_{16}$"×12") was installed on the unexposed side of the wall, consisting of two pieces, an upper 8' piece and a lower 2' piece. The spline was fastened to the main MPP wall with 3⅜" screws ($^{5}/_{16}$" head, TrussTite) at 6" oc spacing, 2" from the long edge and 1" from the joint and top and bottom. With the spline and fasteners on the unexposed side only, this assembly is asymmetric, and was only tested in the configuration.

Sample Thermocouples

Sample thermocouples (TC_S) were used to better describe temperature behavior for the load-bearing assembly. TC_S locations are described below and in Figure 2:

- Unexposed (TC_S1-10): Placed on unexposed surface of the panel. Each was covered with a 6"×6" dry ceramic fiber pad.

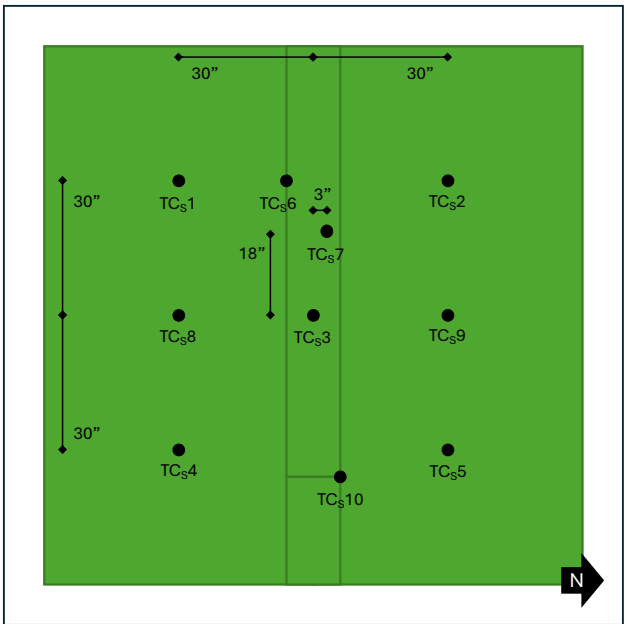

Figure 2. Wall schematic showing TCs layout

Individual groups were averaged together to give a general temperature rise through the assembly. Unexposed criteria outlined in the E119 test were judged from these data.

Loading and Deflection

A superimposed load (80,000 lb_f as indicated by the client as limited by equipment) was applied to the test assembly through a series of hydraulic rams positioned below the wall. The set point for the ram pressure (designed, Table 1) was maintained constant throughout testing. The actual ram pressure was measured during the tests, and the average is shown in Table 1. The load was recalculated and showed a minimal variation (0.9% for Test 1) from the design load. Two linear vertical displacement transducers (LVDT) were placed below each side of the wall assembly, measuring vertical movement of the assembly. Horizontal deflection was also measured at the fire resistance assembly mid-height at each quarter point along the assembly.

Table 1. Load parameters for wall assemblies.

Loading Parameter	Test 1 Assembly		Units
	Design	Actual	
Hydraulic ram pressure	1507.6	1521.1	psi
Length of sill plate	120		in
Width of sill plate	6⅛”		in
Weight of test assembly†	2070		lb
Number of rams	5		-
Area of rams	11.04		in^2
Weight of beam	1150		lb
Upward forces	83,220	83,967	lb_f
Downward forces	3220		lb_f
Load on wall	80,000	80,746	lb_f
Load per linear foot	8000	8075	lb_f/ft
Load per sill plate area	108.8	109.9	lb_f/in^2
†Including wall assembly and side walls			

TEST RESULTS

Testing of the fire resistance wall assembly took place on June 10, 2025. The assembly was fixed in place within the sample holder and insulated on the perimeter edges with ceramic wool insulation. The furnace temperature, sample temperatures, ram pressure, LVDT, and furnace pressure, were continuously monitored at 1 Hz until test termination. Also, horizontal deflection was measured every 5-10 minutes during the test. These data, as well as additional photographs, are presented below.

Fire Resistance

Test Date & Time: 6/10/25, 10:00 PM

Furnace: Large-scale vertical exposure E119 furnace – 2-hr fire exposure with hose-stream

Laboratory Conditions: 22°C, 40% RH

Table 2. Test 1 observations for fire resistance wall test.

Test Time (hr:mm:ss)		**Event**
00:00		Start test – 1507.6 psi
01:00		Darkening face
01:15		Flames on face
02:00		Periodic introduction of water to furnace to help control (approximately 5 min)
08:30		Charred layer of wood
1:15:30		Continued flames on face
1:31:00		Large pop from wall assembly
1:45:00		Another large pop – continued flames
1:58:00		Another large pop – continued flames
2:00:38		Furnace off – area under time-temperature curve met
2:03:23		Start hose-stream (30 psi)
~2:05:53		Stop hose-stream – no water projection Approximately 3” virgin wood remaining

The test was terminated at 120 m 38 s, after the 2-hr limit once the appropriate area under the time-temperature curve was met. This gave an assembly rating of 120 min (corrected), rounded to the nearest integral minute, which would qualify for the desired 2-hr rating.

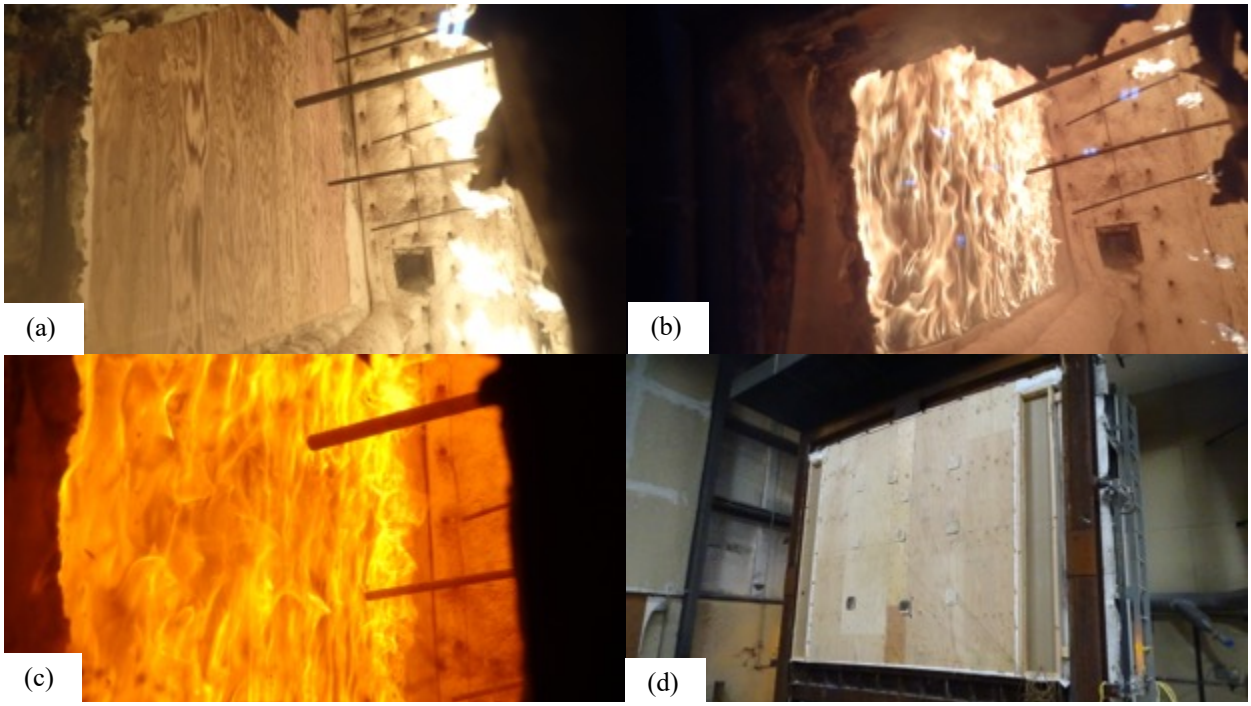

Figure 3. Test 1 wall assembly during fire resistance test showing (a) ignition – 1 min, (b) ignition – 2 min, (c) continued flames – 91 min, and (d) near end of fire endurance – 118 min.

Temperature Data

The furnace temperature followed the standard time-temperature curve as shown in Figure 4a, which had some initial variation due to the intense burning of the wall. Addition of water at the bottom of the furnace helped better control the temperature the required time-temperature curve and only lasted approximately 5 min once started. A comparison of the area under the time-temperature curve with the standard is also shown in Figure 4b. The area (-0.5%) is within the 7.5% recommended for a 2-hr test.

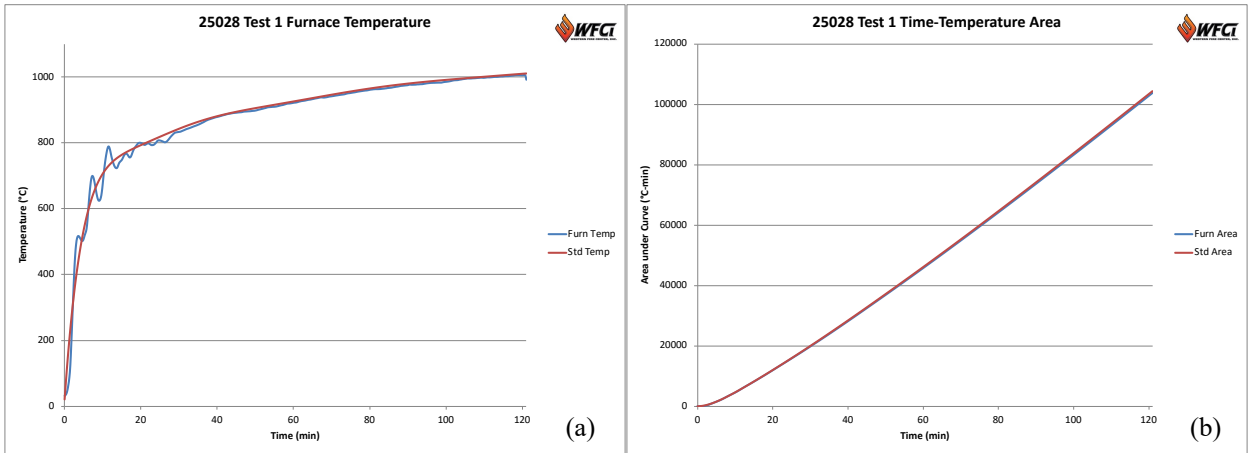

Figure 4. Test 1 furnace comparison with standard showing (a) temperature and (b) area under the curve.

Sample TC_S are shown in Figure 5 on the unexposed side of the assembly. The unexposed thresholds (139°C + ambient for average, 181°C + ambient for single-point) were not surpassed during the test with an average value 26°C, meeting the temperature requirements for a 2-hr test.

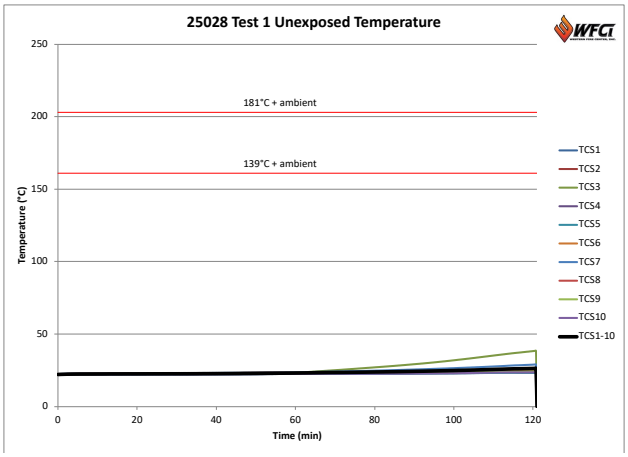

Figure 5. Test 1 sample thermocouples showing unexposed temperature.

Deflection Data

Horizontal deflection measurements (Figure 6) were taken every five to ten minutes at three locations along the horizontal midline on the unexposed sample surface to monitor horizontal movement of the sample. The average horizontal deflection (away from the furnace) showed little difference for the first 60 min, but increased to an average value near ¾" at the end of the test. The vertical deflection showed an average final value of deflection of approximately 0.27".

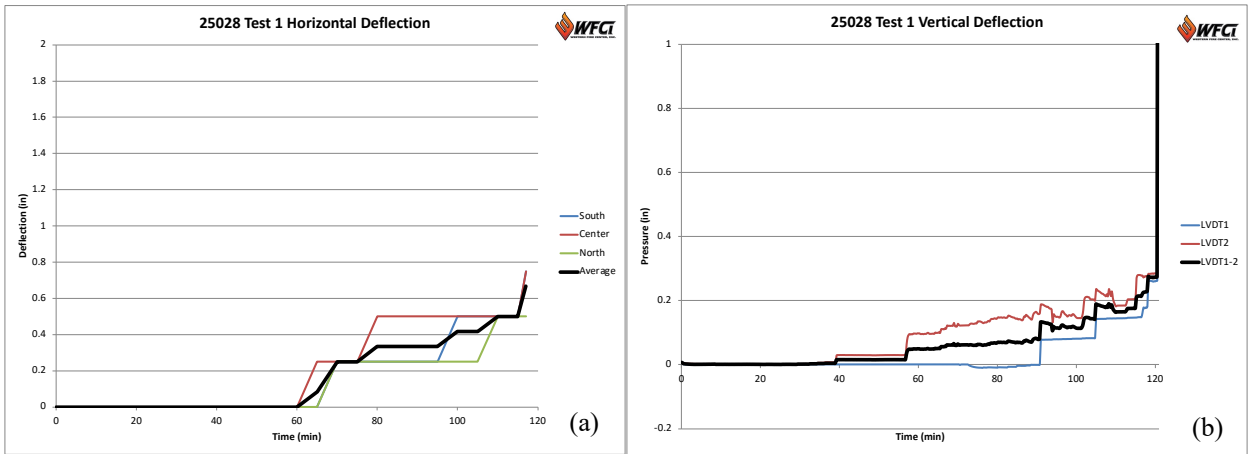

Figure 6. Test 1 showing (a) horizontal deflection and (b) vertical deflection.

Hose-Stream

Directly following the fire resistance portion of the test, the assembly was backed away from the furnace to perform the hose-stream portion (Figure 7). For this portion, a water hose stream was applied at a pressure of 30 psi for 2 m 30 s (2½ min/100 ft^2 for 2-hr resistance, ASTM E2226-25, *Standard Practice for Application of Hose Stream*). Hose stream application began approximately 3 min following the removal of the assembly from the furnace.

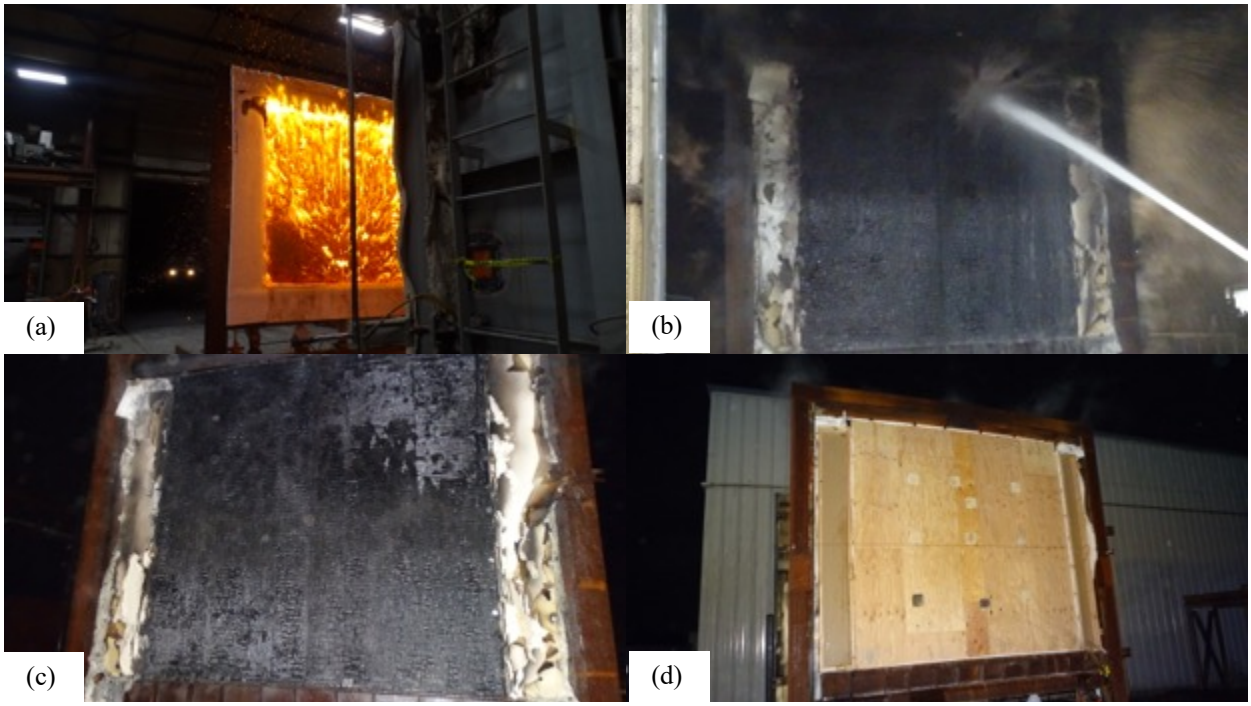

Figure 7. Test 1 showing (a) after fire endurance, (b) during hose-stream, (c) exposed side after hose-stream, and (d) unexposed side after hose-stream.

No holes or penetrations developed in the assembly that permitted the projection of water from the hose-stream beyond the unexposed surface, thus fulfilling this hose-stream requirement of the standard.

Following the fire resistance and hose-stream, approximately 3" of virgin wood (roughly 50%) remained after the testing.

CONCLUSION

An asymmetric MPP wall assembly as described above was tested according to ASTM E119-24, *Standard Test Methods for Fire Tests of Building Construction and Materials*. This wall assembly maintained the applied load, did not allow flames to pass through the wall assembly for the 2-hr test, nor did the unexposed temperature surpass the average (139°C + ambient) or single-point (181°C + ambient) thresholds. Additionally, the hose-stream portion of the standard was performed on the same assembly, which did not permit the project of water beyond the unexposed surface, thus fulfilling the hose-stream requirements. Therefore, this wall assembly met the fire endurance requirements for the desired 2-hr duration. This assembly has not yet been tested in the opposite direction (i.e., spline toward furnace).

SIGNATURES

Reviewed and approved by,

Mike White

Laboratory Manager

Testing performed by,

Brent M. Pickett, Ph.D.

Technical Director

WESTERN FIRE CENTER AUTHORIZES THE CLIENT NAMED HEREIN TO REPRODUCE THIS REPORT ONLY IF REPRODUCED IN ITS ENTIRETY.

This decision was determined by simple acceptance to the requirements in the standard. Fire duration uncertainty is estimated to be 4% of the reported value.

The test specimen identification is as provided by the client, and WFCi accepts no responsibility for any inaccuracies therein. WFCi did not select the specimen and has not verified the composition, manufacturing techniques, or quality assurance procedures.

Version	Date Issued	Document Number	Changes
Original	June 18, 2025	25028	Original report

APPENDIX A: ADDITIONAL FIGURES

Figure A 1. Component identification showing (a) panel and (b) spline fasteners.

Figure A 2. Construction showing (a) exposed joint, (b) exposed side, (c) spline fasteners, and (d) thickness.

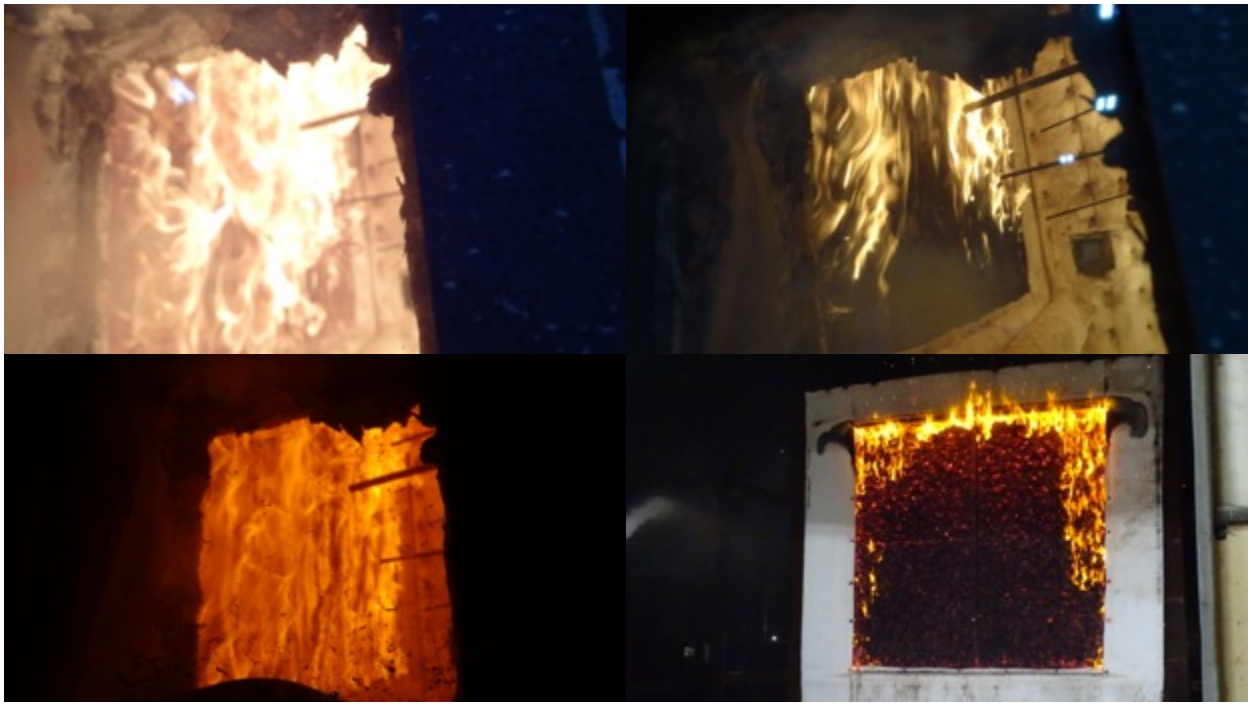

Figure A 3. Additional photos for Test 1 showing (a) 1 min, (b) 5 min, (c) 106 min, (d) before hose.

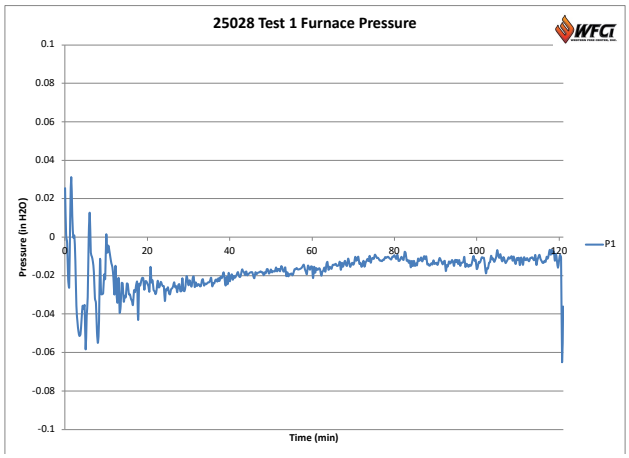

Figure A 4. Furnace pressure for Test 1.

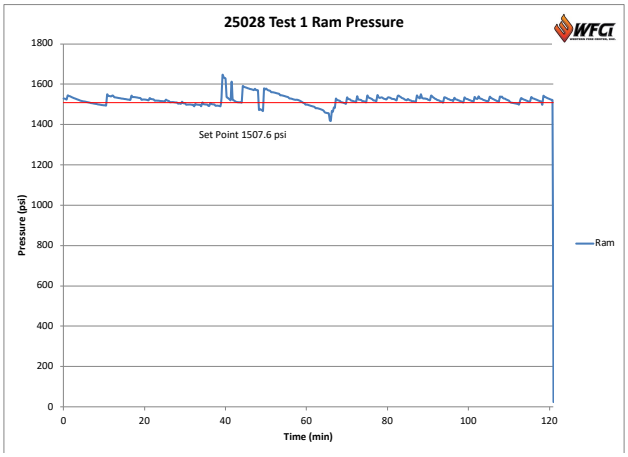

Figure A 5. Ram pressure applied to wall for Test 1.