TECHNICAL REPORT

POLYPROPYLENE FIRE TESTING SYNOPSIS

NOVEMBER 9, 2020

VINYL SIDING INSTITUTE™

BACKGROUND AND PURPOSE

In January 2020, the VSI Technical Committee (TC) formed the Polypropylene Fire Work Group (PPFWG) to study fire behavior in high-density population settings. The work group defined different wall installations scenarios to be tested, then identified and sourced PP siding materials. The test standard used to understand these characteristics was a modified version using a dual-wall system of ASTM E2702 Standard Test Method for Determining Fire Penetration of Exterior Wall Assemblies Using a Direct Flam Impingement Exposure. The polypropylene siding selected has one of the highest material densities on the market, which provided a cladding with one of the highest fuel loads in the category.

In October 2020, two VSI staff members traveled to Western Fire Center (WFC) in Kelso, Washington, to witness the polypropylene fire testing. The in-person attendees discussed each test setup with the WFC technicians and determined the sequence of the testing. Photographs were taken to capture the testing, and the testing was streamed live to the work group audience.

The purpose of the testing was to see how the polypropylene siding performed when tested in accordance with the fire separation requirement identified in the International Building Code (IBC) and the International Residential Code. Section 1403.12 of the IBC (similar in the IRC), the fire separation distance between a building with polypropylene siding and the adjacent building shall be not less than 10 feet. Additionally, testing with the fire separation being less than 10 feet was conducted to witness first-hand how the material performed during a 10-minute burn test on the burner and receiver walls replicating building to building fire spread. Polypropylene siding was installed on both the ignition source, and the walls exposed to the ignition source, to simulate fire in high density settings.

EXECUTIVE SUMMARY

The product was tested in a setting that represents tight lot line settings (i.e. close fire separation distance) by having a burner wall and an exposed receiver wall; the tests were spaced at 4', 6', and 10+' respectively. The product was tested with just the gypsum sheathing and as part of a fully combustible wood wall setup. Based on the results of the testing, the following has been noted:

- Polypropylene typically melts, spits, and falls off the wall, and in some cases, will continue to collect and burn on the floor within 18 inches of the burner wall
- At no point did any portion of the polypropylene siding receiver wall combust, even at the closest 4' wall separation
- The heat release rate of the polypropylene siding & gypsum sheathing base wall was about 65% less than the heat release rate of the polypropylene & fully combustible wood wall
- The rate of burn (speed) was significantly quicker for the fully combustible wood wall versus the wall with polypropylene siding & gypsum sheathing base wall
- Observation of the reaction of all the wall assemblies to the fire exposures during the tests clearly show and confirm that the respective fire resistive and fire separation distance sections within the building code provide the intended protection of exterior walls with polypropylene siding.

TESTING DETAILS

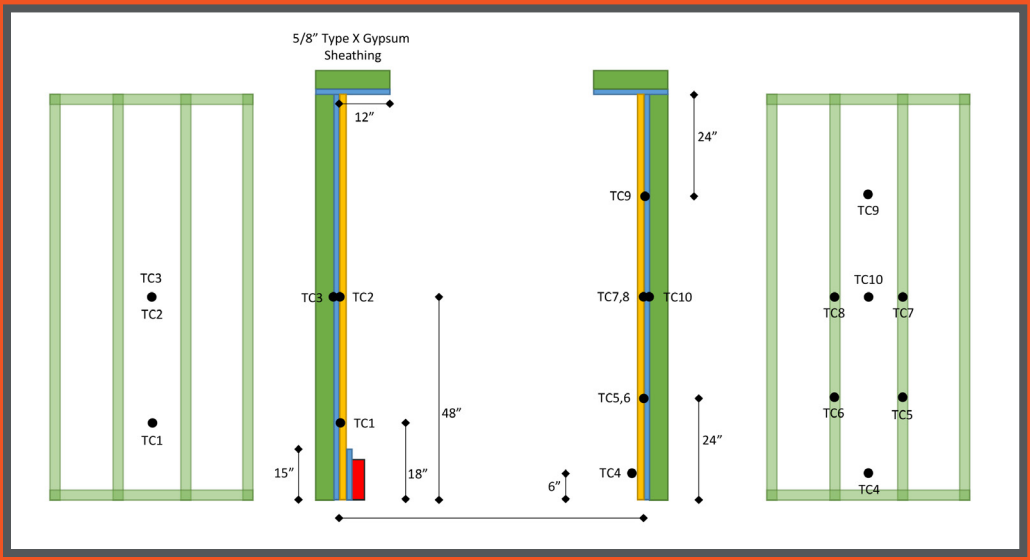
All walls were clad in polypropylene siding.

6′ Wall Separation – Burner Wall Gypsum Board Sheathing, Receiver Wall Gypsum Board Sheathing

4′ Wall Separation – Burner Wall Wood Sheathing and Gypsum Board Sheathing, Receiver Wall Wood Sheathing

10′ 1″ Wall Separation – Burner Wall Wood Sheathing Over Gypsum Board Sheathing, Receiver Wall Wood Sheathing

Single Wall Baseline Tests (2) – Wood Sheathing, Gypsum Board Sheathing



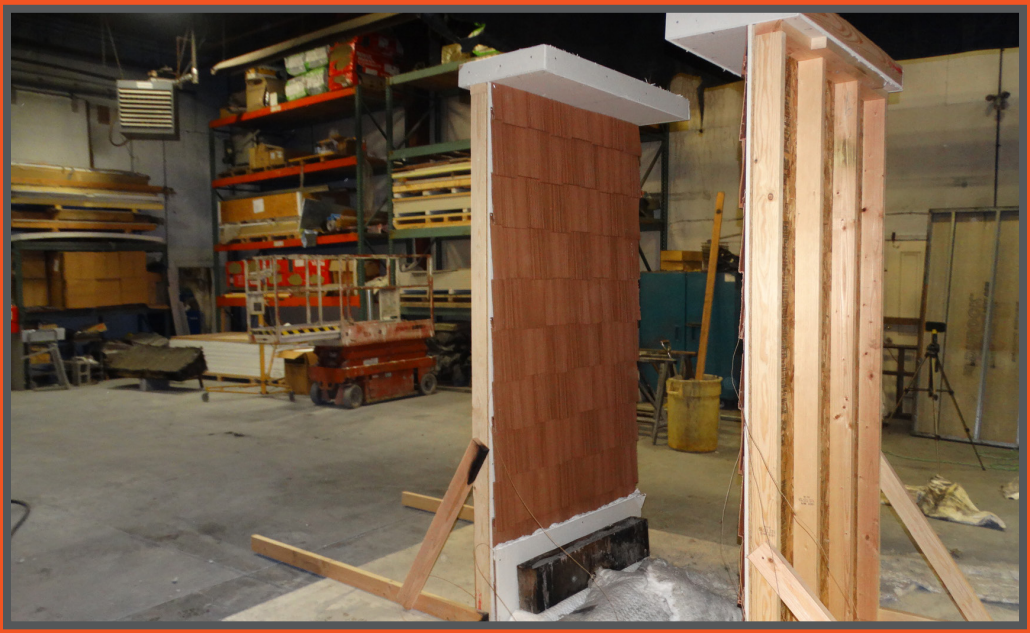


Photo of 4′ burner wall

6' WALL TEST RESULTS AND CONCLUSION

ASTM E2707 Standard Test Method for Determining Fire Penetration of Exterior Wall Assemblies Using a Direct Flame Impingement Exposure prescribes a 4"×39" gas sand burner that exposes a 150 kW flame to a 4'×8' exterior wall assembly for a period of 10 min. The standard measures the ability of the sample to resist fire penetration of the material following direct flame exposure. However, this modified test provided for a 2nd receiver wall to be placed 6' directly opposing the burner wall. The heat release rate was measured in the hood by means of oxygen consumption calorimetry, and thermocouples were placed on each specimen wall to monitor how the temperature changed over time. Both the burner wall and the receiver wall were comprised of wood framing, covered by gypsum sheathing and polypropylene siding.

TEST TIME (MM:SS)	EVENT
00:00	Start test – 150 kW burner on
00:30	Warping of siding on burner wall
00:55	Melted siding – exposed gypsum
01:20	Flames attached 4'
02:40	Spitting (about 12" – 18" from Burner Wall) material from siding
03:40	Most of burner wall engulfed in flames
04:40	Slight warping of receiver wall siding
05:30	Collection of fire at base of burner wall - approximately 6" from side (also into burner)
06:30	Increased melting of receiver wall siding
08:15	Reduced flames on burner wall
08:40	Deformation of siding on receiver wall
09:45	Melting/deformation of siding on receiver wall, exposing gypsum sheathing
10:00	Burner off
12:30	Most flames near base of burner wall
20:00	Terminate test – no ignition of receiver wall – some deformed/melted sections of polypropylene siding

The burner wall of a dual-wall system was exposed to a 150 kW burner for 10 minutes with an opposing receiver wall placed 6' from the burner wall. Most of the polypropylene siding from the burner wall ignited and/or melted off the wall and continued to burn at the base of the wall.

The receiver wall did not ignite but had some deformation of the polypropylene siding.

4’ WALL TEST RESULTS AND CONCLUSION

This test was conducted in the same setup manner as the 6’ test, with the walls being spaced 4’ apart. Both the burner wall and the receiver wall were comprised of wood framing, covered by OSB sheathing, covered by gypsum sheathing, and polypropylene siding.

TEST TIME (MM:SS)	EVENT
00:00	Start test – 150 kW burner on
00:30	Warping of siding on burner wall
01:00	Melted siding – exposed gypsum
01:30	Flames attached 5’
02:00	Spitting (about 12” – 18” from Burner Wall) material from siding
02:30	More intense fire
02:45	Buckling of siding on receiver wall
03:00	Most siding fallen/melted on burner wall
03:50	Drooping receiver wall siding
04:30	25% of receiver wall gypsum sheathing exposed
06:00	Small collection of fire at base of burner wall
07:15	Receiver wall siding mostly fallen – collected at base but not ignited
10:00	Burner off - collection of fire at burner wall only
20:00	Terminate test – no ignition of receiver wall – significant deformed/melted sections of polypropylene siding

The burner wall of a dual-wall system was exposed to a 150 kW burner for 10 minutes with an opposing receiver wall placed 4’ directly opposed from the burner wall. Most of the polypropylene siding from the burner wall ignited and/or melted off the wall and continued to burn at the base of the wall. The receiver wall had significant deformation and melting of the polypropylene siding, exposing most of the gypsum sheathing behind it, but no ignition of the polypropylene siding.

10’ 1” WALL TEST RESULTS AND CONCLUSION

This test was conducted in the same setup manner as both the 6’ and 4’ tests, with the walls being set at 10’ 1” apart. The burner wall was comprised of a wood framing, covered by OSB sheathing, covered by gypsum sheathing and polypropylene siding. The receiver wall was comprised of wood framing, covered by OSB sheathing and polypropylene siding.

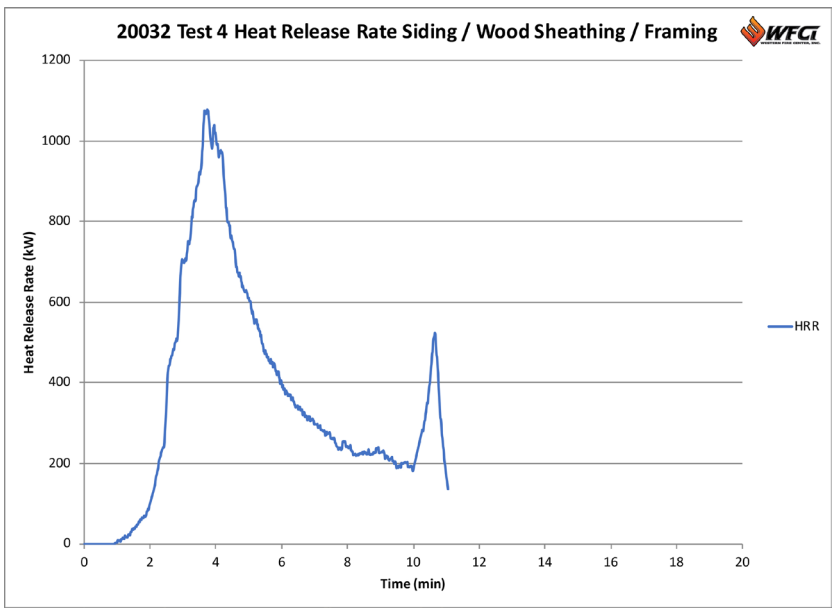
TEST TIME (MM:SS)	EVENT
00:00	Start test – 150 kW burner on
00:35	Warping of siding
01:00	Attached flames – dripping siding
01:20	Exposed OSB
01:50	Melted material up to 4’
02:30	Intense fire
03:00	Most siding burning on burner wall
04:30	Slight bowing in receiver wall siding
05:50	Reduced flames on burner wall
10:00	Burner off - collection of fire remaining on burner wall
17:30	Reduced flames
18:20	Sections of OSB falling from burner wall
20:00	Terminate test – no ignition of receiver wall – only slight bowing of siding

The burner wall of a dual-wall system was exposed to a 150 kW burner for 10 minutes with an opposing receiver wall placed 10’ 1” directly opposed from the burner wall. Most of the polypropylene siding from the burner wall ignited and/or melted off the wall and continued to burn at the base of the wall. There was also significant fire and heat release contribution from the exposed OSB sheathing. The receiver wall did not ignite and had little deformation of the polypropylene siding. Only slight bowing was observed.

BASELINE TEST RESULTS AND CONCLUSIONS

The first baseline test consisted of a single wall that was built of OSB sheathing and polypropylene siding. ASTM E2707 prescribes a 4"×39" gas sand burner that exposes a 150 kW flame to a 4'×8' exterior wall assembly for a period of 10 min. The standard measures the ability of the sample to resist fire penetration of the material following direct flame exposure. However, this modified test is intended to monitor the siding performance and not necessarily burn-through. Additionally, to better determine the burning characteristics of the burner wall, the heat release rate was measured in the hood by means of oxygen consumption calorimetry. Thermocouples were also placed on each specimen to monitor how the temperature changed over time.

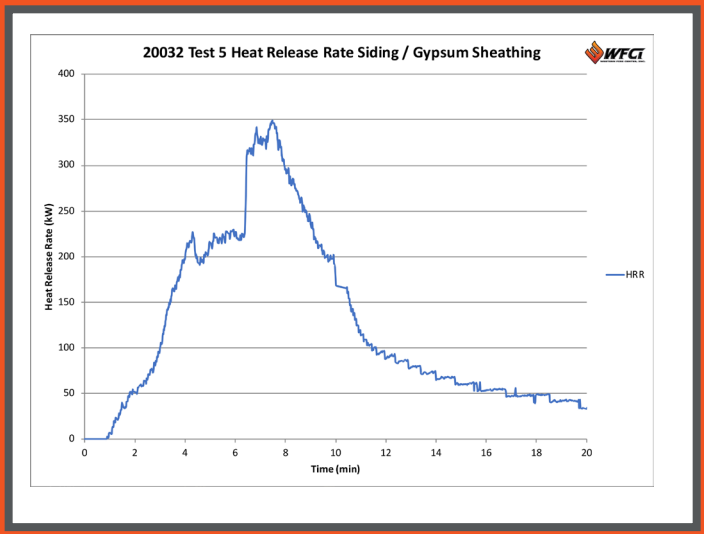
TEST TIME (MM:SS)	EVENT
00:00	Start test – 150 kW burner on
00:40	Warping of siding
01:10	Dripping material
01:25	Exposed OSB
02:00	Approximately 1/2 wall melted – increasing flames
03:00	Wall engulfed in flames – intense fire
05:10	Smoking on unexposed side
07:00	Reduced flames
07:50	Darkening on unexposed side
08:40	Glowing on unexposed side
09:55	Glowing on unexposed side
10:00	Burner off
10:45	Terminate test – need to extinguish assembly on



To the left is the heat release rate chart for Test 4.

The second baseline test consisted of a single wall that was built of an OSB base, gypsum sheathing, and polypropylene siding. All other aspects of the testing were similar to the first baseline test.

TEST TIME (MM:SS)	EVENT
00:00	Start test – 150 kW burner on
00:40	Warping of siding
00:55	Dripping material
01:10	Exposed gypsum
02:00	Flames approximately 6' up right side
03:00	Flames approximately 4' up left side
04:00	Increasing flames
04:45	Flames to soffit
07:20	Most wall engulfed
09:30	Reduced flames
10:00	Burner off - continued flames on wall and collect fire at base
20:00	Terminate test – slight flames on wall



To the left is the heat release rate chart for Test 5.

The walls of two single-wall systems were exposed to a 150 kW burner for10 min. Most of the polypropylene siding from the burner wall ignited and/or melted off the wall and continued to burn at the base of the wall. The OSB sheathing (Test 4) allowed for significantly faster and more intense flames (-4 min, peak —1100 kW) when compared to the gypsum sheathed (Test 5) assembly (-7min, peak 350 kW). The wall constructed with only OSB sheathing wall had burn-through of the sheathing prior to the burner shutting off. The gypsum sheathed wall did not have burn-through, and it also had a significantly lower heat release rate.

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