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ICC-ES Evaluation Report

ESR-3786

Reissued January 2023

This report is subject to renewal November 2024.

DIVISION: 07 00 00—THERMAL AND MOISTURE PROTECTION
Section: 07 25 00—Water-resistive Barriers/Weather Barriers
Section 07 27 00—Air Barriers

DIVISION: 09 00 00—FINISHES
Section: 09 29 00—Gypsum Board

REPORT HOLDER:

GEORGIA-PACIFIC GYPSUM LLC

EVALUATION SUBJECT:

DENSELEMENT™ BARRIER SYSTEM

1.0 EVALUATION SCOPE

Compliance with the following codes:

- 2018, 2015, 2012 and 2009 *International Building Code®* (IBC)
- 2018, 2015, 2012 and 2009 *International Residential Code®* (IRC)
- 2018, 2015, 2012 and 2009 *International Energy Conservation Code®* (IECC)
- 2018, 2015 and 2012 *International Green Construction Code™* (IGCC)

For evaluation for compliance with codes adopted by the Los Angeles Department of Building and Safety (LADBS), see ESR-3786 LABC and LARC Supplement.

Properties evaluated:

- Water resistance
- Air leakage
- Structural
- Noncombustibility
- Surface-burning characteristics
- Fire-resistance-rated construction
- Physical properties

2.0 USES

DensElement™ Barrier System is a combination exterior wall sheathing, air barrier and water-resistive barrier system. This report recognizes the use of the DensElement™ Barrier System when installed with the DensElement™ sheathing and liquid-applied flashing as described in this report on walls of all types of construction and dwellings under the IRC. The DensElement™ Barrier System is intended for use as an alternate to the water-resistive barrier prescribed in Chapter 14 of the IBC and Chapter 7 of the IRC, as an air barrier material prescribed in accordance with 2018 and 2015 IECC Sections C402.5 and R402.4; 2012 IECC Sections R402.4 and C402.4; 2009 IECC Sections 402.4 and 502.4; IRC Section N1102.4 and 2018 IgCC Section 701.3 and 2015 IgCC Section 605.1.2, and as a component of an air barrier assembly in accordance with 2018 and 2015 IECC Section C402.5 and 2012 IECC Section C402.4.1.2.2. The sheathing may be used to resist transverse wind loads when installed in accordance with Section 4.2.1, and racking loads due to wind and seismic forces when installed in accordance with Section 4.2.2. The $^{5}/_{8}$-inch (15.9 mm) thick sheathing, Type X, may be used as a component of a fire-resistance-rated wall assembly when installed in accordance with Section 4.3. The system is classified as a noncombustible material in accordance with 2018, 2015 and 2012 IBC Section 703.5 (2009 IBC Section 703.4).

3.0 DESCRIPTION

3.1 DensElement™ Sheathing:

DensElement™ Sheathing complies as a glass mat gypsum substrate in accordance with ASTM C1177 as specified in Table 2506.2 of the IBC and Section R702.3.1 of the IRC. The glass mat facer and core of the sheathing is treated to provide water resistance. The sheathing is classified as a noncombustible building material in accordance with ASTM E136. The sheathing is ½-inch (12.7 mm) or $^{5}/_{8}$-inch (15.9 mm) thick and 48 inches wide (1219 mm), has square edges and is available in lengths up to 12 feet (3.7 m).

When tested in accordance with ASTM E96 (water method), the $^{5}/_{8}$-inch-thick (15.9 mm) sheathing, has a vapor permeance of 24 perms when tested with a sealed joint and 32 perms when tested without a joint.

When tested in accordance with ASTM E96 (water method), the ½-inch-thick (12.7 mm) sheathing has a vapor permeance of 33 perms when tested with a sealed joint.

When tested in accordance with ASTM E2178, the sheathing has an air permeability less than 0.004 cfm/ft^2 (0.02 L/s•m^2) under a pressure differential of 0.3 inches of water gauge (75 Pa).

3.2 Liquid Applied Flashing:

The liquid-applied flashings used to seal the sheathing joints, fastener heads and to flash penetrations must be Georgia-Pacific DensDefy™ Liquid Flashing or Prosoco R-Guard® FastFlash® liquid flashing. The liquid-applied flashings are a polymer based material. The liquid-applied flashings are applied in a minimum 2-inch-wide (51mm) band with a minimum 16 wet mils over joints, interfaces and transitions. Fastener heads must be completely covered with the liquid flashing materials so no portion of the fastener head is exposed. The flashing materials are packaged in tubes and pails of varying quantities. Materials have an approximate shelf life of 12-months from date of manufacture when stored in a cool dry place.

4.0 DESIGN AND INSTALLATION

4.1 Installation: DensElement™ sheathing must be attached to wall framing in accordance with ASTM C1280 (Standard Specification for Application of Gypsum Sheathing) and GA-253 (Application of Gypsum Sheathing) for IBC applications, or IRC Table R602.3 (1) and IRC Section R702.3.5 for IRC applications; the manufacturer's published installation instructions; and this report.

DensElement™ sheathing must be attached with the yellow-colored side facing the exterior. Sheathing fasteners must be flush with the panel surface without countersinking through the glass mat facer. The sheathing must not be used as a nailing base and any attachments of exterior coverings must be made directly to the framing.

Sheathing exposed fastener heads must be sealed with the liquid applied flashing described in Section 3.2 of this report to ensure the fastener heads are not exposed. The sheathing joints, openings, penetrations and transitions must be sealed with the liquid applied flashing described in Section 3.2 and as detailed in Section 4.1.1 of this report. The sheathing surface must be free of ice and frost during application of liquid flashing.

4.1.1 The DensElement™ sheathing surface must be free of contaminants prior to the application of the liquid-applied flashing. Apply liquid flashing over the sheathing joint in a zig-zag or ribbon pattern dispensed from either a tube-type container or pail and then spread evenly with a straight edge knife or trowel. Cover a minimum of 1 inch (25 mm) on both sides of the joints to achieve a 2-inch (51 mm) width of coverage. Apply at a rate to achieve a wet mil thickness of 16 mils over the entire area.

4.1.2 For the perimeter or openings, penetrations, terminations and transitions, a minimum 2-inch-wide (51 mm) liquid-applied flashing must be installed in accordance with Georgia Pacific published installation instructions. See Figure A for a typical joint, fastener, opening, penetration and transition sealing details.

The manufacturer's published installation instructions and this report must be strictly adhered to, and a copy of the instructions must be available at all times on the jobsite during installation.

4.2 Design:

4.2.1 Transverse Wind Resistance: DensElement™ Sheathing may be used to resist transverse wind loads as permitted by the applicable code for gypsum sheathing.

4.2.2 Shear Resistance: DensElement™ Sheathing may be used as components of conventional light framed walls for resisting shear loads when installed as described in this section.

4.2.2.1 Prescriptive Wall Bracing: The DensElement™ sheathing boards are equivalent to gypsum sheathing for use as bracing to resist lateral loads due to wind and seismic forces. When installed as prescribed by code for gypsum sheathing, the DensElement™ sheathing board may be used as wall bracing in accordance with 2018 and 2015 IBC Section 2308.6.3, Method GB; 2012 and 2009 IBC Section 2308.9.3, Method 5; subject to the limitations in IBC Section 2308.2, or in accordance with 2018, 2015 and 2012 IRC Section R602.10.4, Method GB; 2009 IRC Section IRC R602.10.2, Method GB, as applicable.

4.2.2.2 Engineered Shear Walls: The DensElement™ sheathing boards may be used as a component of engineered shear walls when designed in accordance with IBC Section 2305 for wood framed walls or 2018 IBC Sections 2211.1 and 2211.1.1, 2015 and 2012 IBC Section 2211.6; 2009 IBC Section 2210.6 for light steel framed walls. The design wind and seismic loads must not exceed the allowable racking shear capacity for gypsum sheathing shown in the AWC 2015 SDPWS for recognition under the 2018 and 2015 IBC and 2018 and 2015 IBC Table 2306.3(3); AF&PA 2008 SDPWS for recognition under the 2012 IBC and 2012 IBC Table 2306.3(3); and the 2009 IBC Table 2603.7. Design wind loads must be determined in accordance with Section 1609 of the IBC. Design seismic loads must be determined in accordance with Section 1613 of the IBC.

For seismic design, the substrate may be used as a component of wood-framed engineered shear walls for resisting seismic loads in Seismic Design Categories A, B, C, and D. The response modification factor, R, must be equal to 2; the system overstrength factor, Ω_o, must be equal to 2½; and the deflection amplification factor, C_d, must be equal to 2. The maximum building height is 35 feet (10.6 m) for buildings located in Seismic Design Category D areas.

Structural members, systems and components, including boundary studs and plates, must be anchored to resist design forces and to provide continuous load paths for these forces to the foundation.

4.3 Fire-resistance-rated Wall Assemblies:

4.3.1 One-hour Fire-resistance-rated Load-bearing Wall: The 5/8-inch-thick (15.9 mm) DensElement™ Sheathing, Type X, is installed vertically to both faces of a wood stud partition wall with nominal 2-by-4 studs at 16 inches (406 mm) on center. The wall must be bridged every 5 feet (1524 mm), maximum, and the board on one face installed with joints staggered 16 inches (406 mm) from those on the opposite face. The boards are attached using 1¾ inch-long (45 mm) galvanized nails with a 7/16-inch-diameter (11.1 mm) head and 0.128-inch-diameter (3.25 mm) shank, spaced 8 inches (203 mm) on center at edges and intermediate studs. Allowable bearing loads must not exceed 2030 pounds (9030 N) per stud, 78 percent of the allowable F'_c, or 78 percent of the calculated stress with studs having a slenderness ratio, l_e/d, of 33, whichever is less.

4.3.2 One-hour Fire-resistance-rated Non-load-bearing wall: The $^5/_8$-inch-thick (15.9 mm) DensElement™ Sheathing, Type X, is installed horizontally to both faces of a steel stud wall, of minimum No. 25 gage [0.018 inch (0.457 mm) base-metal-thickness steel, minimum $3^5/_8$-inch-deep (92 mm) web, minimum 1.25-inch flanges and minimum $^3/_{16}$-inch returns, spaced 24 inches (609.6 mm) on center. The board on one face is installed with joints staggered 24 inches (609.6 mm) from those on the opposite face. The boards are attached with $1^1/_4$-inch-long (31.7 mm), Type S, screws spaced 8 inches (203 mm) on center on the stud with 1 inch (25.4 mm) spacing from the joints, 12 inches (304.8) on center for end fastening, and 6 inches on center for edge fastening. The joints are taped with $3^1/_4$-inch-wide (82.6 mm) flashing tape and the fastener heads are coated with liquid-applied flashing.

4.3.3 Other Fire-resistance-rated Construction: One layer of $^5/_8$-inch-thick (15.9 mm) DensElement™ Sheathing, Type X, may be substituted for the gypsum sheathing specified for exterior faces of assemblies Nos. 13-1.1, 13-1.3, 14-1.3, 14-1.5, 15-1.1, 15-1.5, 15-1.6 of 2018, 2015 and 2012 IBC Table 721.1(2) (2009 IBC Table 720.1(2)).

4.4 Air Barrier Assembly: DensElement™ Sheathing fastened to 16-inch-center (406 mm), steel-framed wall, using No. 6 self-drilling screws spaced at 8 inches (203 mm) on center in the field and perimeter, forms an air barrier assembly when the joints between the panels and the perimeter of penetrations are sealed with the liquid flashing, as described in Section 4.1. The assembly has demonstrated an air leakage less than 0.04 cfm/ft^2 (0.2 L/s•m^2) under a pressure differential of 0.3 inches of water gauge (75 Pa) when tested in accordance with ASTM E2357.

4.5 Water-resistive Barrier Assembly: The DensElement™ Barrier System when installed in accordance with Section 4.1 of this report may be used as an alternate to the water-resistive barrier prescribed in IBC Chapter 14 or IRC Chapter 7.

5.0 CONDITIONS OF USE

The DensElement™ Barrier System described in this report complies with, or is a suitable alternative to what is specified in, those codes listed in Section 1.0 of this report, subject to the following conditions:

5.1 The products must be manufactured, identified and installed in accordance with this report, the manufacturer's published installation instructions and the applicable code. If there is a conflict between the manufacturer's published installation instructions and this report, this report governs.

5.2 When the sheathing is not installed as bracing, as described in Section 4.2.2.1, or as an engineered shear wall, as described in Section 4.2.2.2, the stud walls must be braced by other materials in accordance with the applicable code.

5.3 Shear walls using the sheathing must not be used to resist forces imposed by masonry and/or concrete walls.

5.4 The DensElement™ Barrier System must be covered with a code complying exterior wall covering.

6.0 EVIDENCE SUBMITTED

6.1 Reports of physical property testing in accordance with ASTM C473, for compliance with ASTM C1177.

6.2 Reports of surface-burning tests in accordance with ASTM E84 (UL 723).

6.3 Reports of noncombustibility tests in accordance with ASTM E 136

6.4 Reports of tests on a fire-resistance-rated wall assembly in accordance with ASTM E119 (UL 263) and fire analysis.

6.5 Data in accordance with Sections 4.1, 4.2, 4.3, 4.4 4.7 and 4.8 of the ICC-ES Acceptance Criteria for Water-resistive Coatings Used as Water-resistive Barriers Over Exterior Sheathing (AC212), dated February 2015 (Editorially revised April 2018).

6.6 Report of wind-driven rain tests in accordance with ASTM E331.

6.7 Report of flashing tests with applicable AAMA 714 standard for liquid-applied flashings described in Section 3.2 of this report.

6.8 Report of air leakage tests in accordance with ASTM E2178 and ASTM E2357.

6.9 Quality documentation.

7.0 IDENTIFICATION

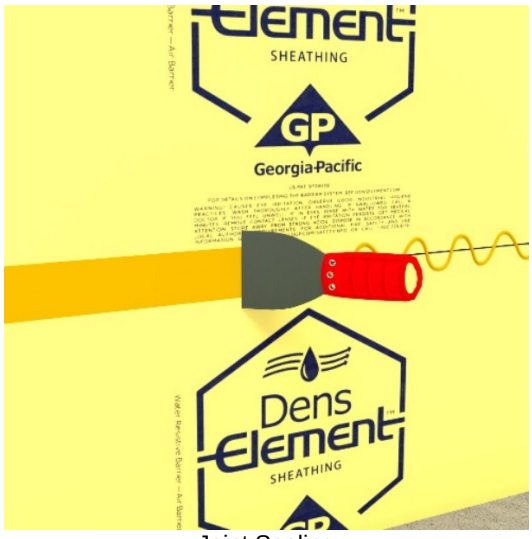
7.1 Each DensElement™ Sheathing board is identified with the manufacturer's name (Georgia-Pacific Gypsum LLC), a plant identifier and date code, the product name, the board thickness, and the evaluation report number (ESR-3786).

The liquid flashings must be identified with the product name and company name described in Section 3.2 of this report.

7.2 The report holder's contact information is the following:

GEORGIA-PACIFIC GYPSUM LLC
2861 MILLER ROAD
DECATUR, GEORGIA 30035
(800) 225-6119
www.buildgp.com

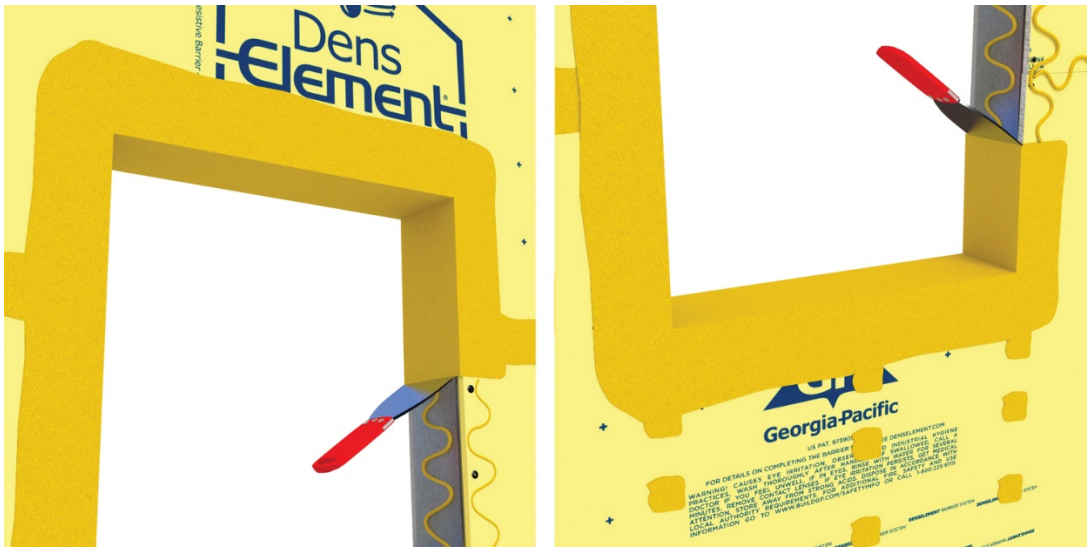
FIGURE 1—DENSELEMENT™ BARRIER SYSTEM



Joint Sealing

Penetration Sealing

Corner Sealing



Opening Sealing

FIGURE 1—DENSELEMENT™ BARRIER SYSTEM (CONTINUED)

DIVISION: 07 00 00—THERMAL AND MOISTURE PROTECTION
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DIVISION: 09 00 00—FINISHES
Section: 09 29 00—Gypsum Board

REPORT HOLDER:

GEORGIA-PACIFIC GYPSUM LLC

EVALUATION SUBJECT:

DENSELEMENT™ BARRIER SYSTEM

1.0 REPORT PURPOSE AND SCOPE

Purpose:

The purpose of this evaluation report supplement is to indicate that DensElement™ Barrier System, described in ICC-ES evaluation report ESR-3786, has also been evaluated for compliance with the codes noted below as adopted by the Los Angeles Department of Building and Safety (LADBS).

Applicable code editions:

- 2020 *City of Los Angeles Building Code* (LABC)
- 2020 *City of Los Angeles Residential Code* (LARC)

2.0 CONCLUSIONS

The DensElement™ Barrier System, described in Sections 2.0 through 7.0 of the evaluation report ESR-3786, complies with the LABC Chapters 7, 14, 22, 23 and 25, and the LARC Sections R602.10.4 and R703.2, and is subjected to the conditions of use described in this supplement.

3.0 CONDITIONS OF USE

The DensElement™ Barrier System described in this evaluation report supplement must comply with all of the following conditions:

- All applicable sections in the evaluation report ESR-3786.
- The design, installation, conditions of use and identification of the DensElement™ Barrier System are in accordance with the 2018 *International Building Code®* (IBC) provisions noted in the evaluation report ESR-3786.
- The design, installation and inspection are in accordance with additional requirements of the LABC Chapters 16 and 17, Sections 2211, 2305, 2306, 2308, and 2503, as applicable.
- The DensElement™ Barrier System has not been evaluated under the LABC Chapter 7A or the LARC Section R337 for use in the exterior design and construction of new buildings located in any Fire Hazard Severity Zone within State Responsibility Areas or any Wildland—Urban Interface Area.
- The seismic design provisions for hillside buildings referenced in LABC Section 2301.1 have not been considered and are outside of the scope of this supplement.

This supplement expires concurrently with the evaluation report, reissued January 2023.

DIVISION: 07 00 00—THERMAL AND MOISTURE PROTECTION
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GEORGIA-PACIFIC GYPSUM LLC

EVALUATION SUBJECT:

DENSELEMENT™ BARRIER SYSTEM

1.0 REPORT PURPOSE AND SCOPE

Purpose:

The purpose of this evaluation report supplement is to indicate that the DensElement™ Barrier System, described in ICC-ES evaluation report ESR-3786, has also been evaluated for compliance with the codes noted below.

Applicable code editions:

- 2019 *California Building Code* (CBC)

For evaluation of applicable chapters adopted by the California Office of Statewide Health Planning and Development (OSHPD) AKA: California Department of Health Care Access and Information (HCAI) and the Division of State Architect (DSA), see sections 2.1.1 and 2.1.2, below.

- 2019 *California Residential Code* (CRC)

2.0 CONCLUSIONS

2.1 CBC:

The DensElement™ Barrier System, described in Sections 2.0 through 7.0 of the evaluation report ESR-3786, complies with CBC Sections 703.2, 703.5, and 1403.2; and CBC Chapters 22, 23 and 25, provided the design and installation are in accordance with the 2018 *International Building Code*® (IBC) provisions noted in the evaluation report and the additional requirements of CBC Chapters 7, 14, 16, 22, 23 and 25, as applicable.

2.1.1 OSHPD: The applicable OSHPD Sections of the CBC are beyond the scope of this supplement.

2.1.2 DSA: The applicable DSA Sections of the CBC are beyond the scope of this supplement.

2.2 CRC:

The DensElement™ Barrier System, described in Sections 2.0 through 7.0 of the evaluation report ESR-3786, complies with CRC Sections R602.10.4 and R703.2, provided the design and installation are in accordance with the 2018 *International Residential Code*® (IRC) provisions noted in the evaluation report.

This supplement expires concurrently with the evaluation report, reissued January 2023.