Proof positive. The Science Behind the System.

The DensElement™ Barrier System
An Integrated Water-Resistive and
Air Barrier Sheathing Solution

Dens Element™ BARRIER SYSTEM
GP
Georgia-Pacific

Rigorous Testing.
Optimal Performance.

All-in-One Water-Resistive and Air Barrier Solution Met All The Challenges

Understanding design considerations, limitations and realistic performance is critical for the successful deployment of any new product. The research and development teams at Georgia-Pacific Gypsum recognize this as a risk potential and require scientific proof of success before introducing innovative, new systems, like the patent-pending DensElement™ Barrier System. Rigorous testing of the various assemblies and the individual components of the system is a crucial step prior to a real-world launch.

The following tables demonstrate only a sampling of the specific experiments performed on the system to replicate potential real world exposure. This exhaustive testing resulted in the evidence needed for the International Code Council to confirm the performance of the DensElement™ Barrier System as a combination exterior wall sheathing, water-resistive and air barrier (WRB-AB) system (ESR-3786).

A New Chemistry

AquaKOR™ Technology

Conventional fluid-applied water-resistive barriers (WRB) coat the entire face of a commercial building's exterior sheathing. Instead of simply duplicating this traditional approach, Georgia-Pacific Gypsum engineers and chemists went to the drawing board to develop the most robust system.

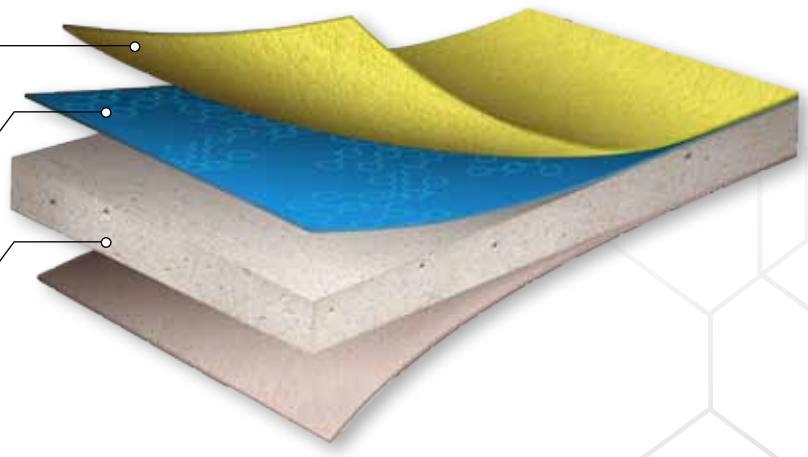
The DensElement™ Barrier System is the result. Retaining fiberglass gypsum mats on its exterior and fusing a WRB layer within the core – through a proprietary method known as AquaKOR™ Technology – tests reveal that this enhanced gypsum sheathing retains the physical properties of typical gypsum sheathing while simultaneously providing the full benefits of a WRB plus a continuous air barrier when the joint/seams, fasteners, penetrations and other openings are sealed properly.

Engineering the WRB within the sheathing's core also guarantees continuity of application. As such, the mil thickness of fluid-applied membranes is no longer a consideration factor for installation error.

Fiberglass Mats
Provide superior moisture and mold resistance – identical to the long-trusted and preferred GOLD DensGlass® Sheathing mat

AquaKOR™ Technology
Chemically bonded between the gypsum core and fiberglass mat to create a consistent, permeable WRB-AB

Gypsum Core
Identical fire-resistance properties and dimensional stability as DensGlass® Sheathing



System Assembly

DENSELEMENT™ BARRIER SYSTEM ASSEMBLY TESTING			
TEST	**DESCRIPTION**	**MEETS or EXCEEDS**	**RESULTS**
ASTM C297 Standard Test Method for Flatwise Tensile Strength of Sandwich Constructions	Provides information on the strength and quality of core-to-facings bonds; Pull strength must meet 15 psi	✓ Exceeded requirement by > 25%	> 19 psi
ASTM D2247 Standard Practice for Testing Water Resistance of Coatings in 100% Relative Humidity	Water resistance tested over a treated joint for 24-hours per day for 14 days at 100% relative humidity and 100°F	✓	No signs of panel cracking, crazing, blistering, erosion or other deleterious effects were observed
Freeze-ThawTesting **per** **ICC-ES AC212** Water-Resistive Coatings Used as Water-Resistive Barriers Over Exterior Sheathing	Samples subjected to 10 freeze-thaw cycles with temperatures ranging from -20°F to 120°F; this is a pass/fail test	✓	No cracking or delamination of the WRB surface
ASTM E96 Standard Test Method for Water Vapor Transmission of Materials	Obtain reliable values of water vapor transfer through permeable and semipermeable materials, expressed in suitable units	**> 30 perms** System has high vapor permeability	Tested using the Wet Cup Method to measure weight loss due to water vapor from the cup transmitting through the material to the test atmosphere, as well as the humidity of the test chamber
ASTM E331 Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference **per** **ICC-ES AC310** **Section 4.5** Acceptance Criteria for Water-Resistive Membranes Factory-Bonded to Wood-Based Structural Sheathing, Used as Water-Resistive Barriers	Water penetration testing of the assembly; test includes windows, brick ties, penetrations; no visible water penetration allowed at sheathing joints or nail penetrations	✓	**No leaks!** Three separate wall assemblies tested for robustness; windows, transitions, penetrations and brick ties passed all inspections

System Assembly

DENSELEMENT™ BARRIER SYSTEM ASSEMBLY TESTING

ASTM E331 (4-Stage)

In this 4-stage event, water penetration was tested after the DensElement™ Barrier System was subjected to three other test methods – loading, racking and environmental conditioning – as described below

	TEST	DESCRIPTION	MEETS or EXCEEDS	RESULTS
STAGE 1	**ASTM E1233** Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Cyclic Air Pressure Differential	The first stage of conditioning for the ASTM E331 test – transverse load testing (panel deflection test); no failure of WRB allowed; this is a pass/fail test	✓ ✓	**No WRB failure!** Per IBC code requirements, DensElement™ Barrier System endured 10 specified deflection cycles with no WRB failure (deflection specified per IBC table 1603.4)
STAGE 2	**ASTM E72** Standard Test Methods of Conducting Strength Tests of Panels for Building Construction	The second stage of conditioning for the ASTM E331 test – racking test (panel strength test); no failure of WRB allowed during or after racking; this is a pass/fail test	✓	**No WRB failure!** System was racked at ⅛" net deflection
STAGE 3	**Restrained Environmental Conditioning of Panel with WRB-AB**	The third stage of conditioning for the ASTM E331 test – system subjected to water and heat after being deflected and racked; no failure of WRB allowed; this is a pass/fail test	✓	**No WRB failure!** System subjected to 5 cycles of 24-hour water spray and 24-hour radiant heat on panels that were tested structurally
STAGE 3	**ASTM E331** Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference	The final stage of testing using the components that have already undergone stage 1-3 testing; the system was then tested to determine its resistance to water penetration under uniform static air pressure differences	✓	**No leaks!** Assembly tested in chamber using a 5 gal/hr water spray with 137 Pa (2.84 psf) static air pressure

System Assembly

DENSELEMENT™ BARRIER SYSTEM ASSEMBLY TESTING

Hydrostatic Pressure Test (3-Stage)

per
ICC-ES AC212
Water-Resistive Coatings Used as Water-Resistive Barriers Over Exterior Sheathing

In this 3-stage event, hydrostatic pressure was tested after the DensElement™ Barrier System was subjected to two other test methods – UV light exposure and accelerated aging – as described below

	TEST	DESCRIPTION	MEETS or EXCEEDS	RESULTS
STAGE 1	**Ultraviolet (UV) Light Exposure**	The first stage of conditioning for the hydrostatic head test – a sample with a joint was exposed to high heat for an extended period; this is a pass/fail test	✓	**No WRB failure!** System subjected to 21 cycles of UV light at 135°F to 140°F for 10 hours per day, followed by conditioning for 14 hours per day for a total of 210 hours; no delamination
STAGE 2	**Accelerated Aging**	The second stage of conditioning for the hydrostatic head test – the previous sample with a joint was taken from the UV exposure test and subjected to 25 accelerated aging cycles	✓	**No WRB failure!** System subjected to high heat oven drying and soaked in water for 18 hours at room temperature; no delamination
STAGE 3	**Hydrostatic Pressure Test** **per** **AATCC Test Method 127-1985** for Water Resistance	The final stage of testing using the components that have already undergone stages 1-2; the system was then tested for leakage and to verify performance and durability	✓	**No leaks!** Assembly tested under 550 mL of water in a 22-in. column for 5 hours; column had 6-in. diameter and spanned a full joint plus 1-in. of sheathing on either side
	ASTM E2357 Standard Test Method for Determining Air Leakage of Air Barrier Assemblies	Simulate the performance of various air barrier materials/ accessories when combined into an assembly; results will assign an air leakage rating for the assembly	✓ Exceeded IECC requirements by 75%	Assembly far exceeded code requirements of 0.04 cfm/ft² at 75 Pa with below code air infiltration rates of 0.01 cfm/ft² at 75 Pa
	NFPA 285 Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components	Provides a standardized fire test procedure for evaluating the suitability of exterior, non-load bearing wall assemblies and panels used as components of curtain wall assemblies that are constructed using combustible materials or that incorporate combustible components for installation on buildings where the exterior walls are required to be non-combustible	✓	Wall assembly testing and engineering evaluations completed for the DensElement™ Barrier System compliance with NFPA 285

Component Testing

LIQUID FLASHING COMPONENT TESTING			
TEST	**DESCRIPTION**	**MEETS or EXCEEDS**	**RESULTS**
AAMA 714 Voluntary Specification for Liquid-Applied Flashing Used to Create a Water-Resistive Seal Around Exterior Wall Openings in Buildings	Establishes minimum performance requirements for liquid-applied flashing used to provide a water-resistive seal around exterior wall openings in buildings that includes fenestrations, such as windows and doors, as well as other through-wall penetrations	✓	PROSOCO FastFlash® liquid flashing approved for use and listed in ICC-ES ESR-3786

AAMA – *The American Architectural Manufacturers Association* A material-neutral organization, the AAMA proactively and effectively influences codes, construction and specification issues.

Component Testing

SHEATHING COMPONENT TESTING			
TEST	**DESCRIPTION**	**MEETS or EXCEEDS**	**RESULTS**
ASTM E2178 Standard Test Method for Air Permeance of Building Materials	Measurement of the air permeance of flexible sheet or rigid panel-type materials; results may be useful in determining suitability of that material as a component of an air retarder system	✓ Exceeded IECC requirements by 50%	Sheathing far exceeded code requirements of 0.004 cfm/ft^2 at 75 Pa with below code air infiltration rates of 0.002 cfm/ft^2 at 75 Pa
ASTM D3273 Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber	Determines the resistance of interior coatings to mold growth; useful in estimating the performance of coatings designed for use in interior environments that promote mold growth	✓	Highest Score of 10
ASTM C473 Standard Test Method for Physical Testing of Gypsum Panel Products	Test methods cover (1) flexural strength; (2) core, end, and edge hardness; (3) nail pull resistance; (4) humidified deflection; (5) end squareness; (6) nominal thickness; (7) recessed- or tapered-edge depth; (8) width; (9) length; (10) water resistance of core-treated water repellant gypsum panel products; and (11) surface water resistance of gypsum panel products with water-repellant surfaces	✓	Gypsum physical properties testing as covered in ASTM C1177
ASTM E84 Standard Test Method for Surface Burning Characteristics of Building Materials	Provides comparative measurements of surface flame spread and smoke density measurements with that of select fiber-cement board surfaces under specific fire exposure conditions	✓	Best score of 0 - Flame Spread 0 - Smoke Developed
ASTM E136 Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750°C	Assists in indicating those materials which do not act to aid combustion or add appreciable heat to an ambient fire; materials passing the test are permitted to limited flaming and other indications of combustion	✓	Non-combustible

ASTM – *ASTM International* A globally recognized leader in the development and delivery of voluntary consensus standards used around the world to improve product quality, enhance health and safety, strengthen market access and trade, and build consumer confidence.

ICC – *International Code Council* An association dedicated to developing model codes and standards used in the design, build and compliance process to construct safe, sustainable, affordable and resilient structures.

NFPA – *National Fire Protection Agency* A global, nonprofit organization, established in 1896, that delivers information and knowledge through more than 300 consensus codes and standards, research, training, education, outreach and advocacy.

DensElement.com

GP Technical Hotline: (800) 225-6119

PROSOCO Technical Hotline: (800) 358-7809

Georgia-Pacific Gypsum LLC
133 Peachtree Street, N.E.
Atlanta, GA 30303