3M Building & Construction Market Center

Air Barrier Solutions

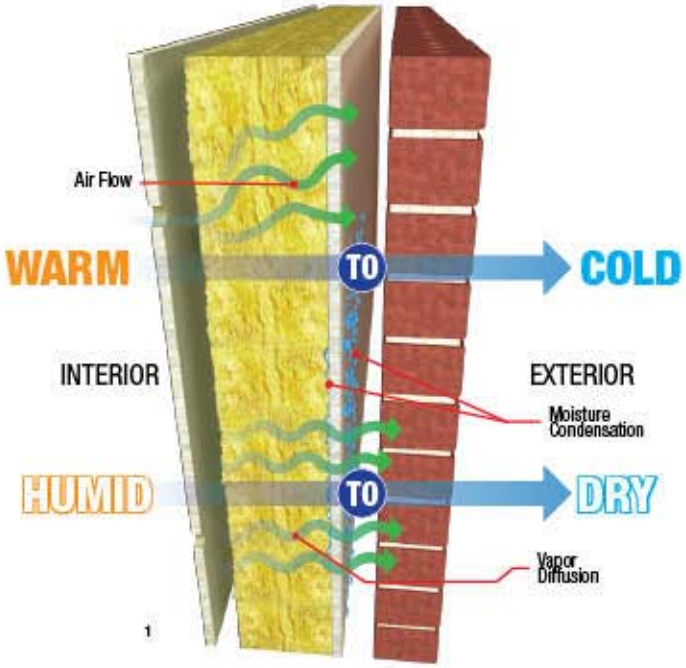
Advanced technologies for enhancing the building envelope

3M

Controlling air flow is crucial for the health & energy efficiency of buildings

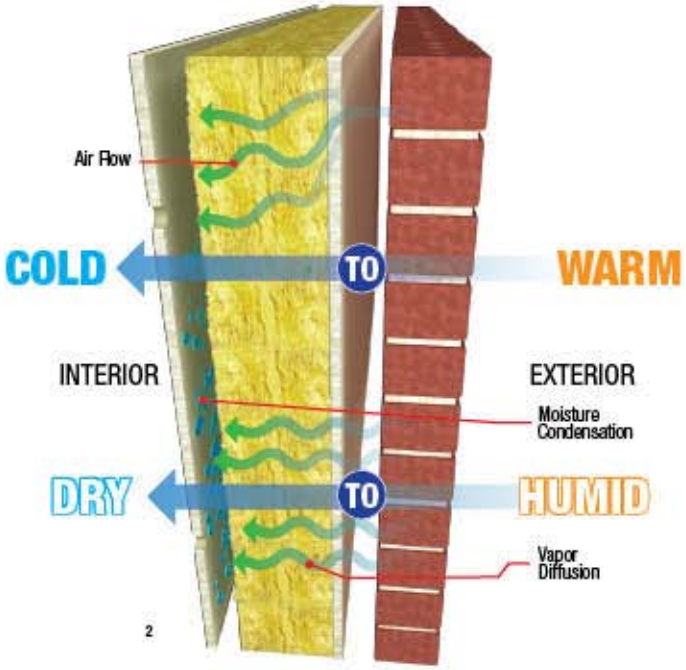
Air barriers are essential elements of new building construction. Air naturally moves from warm to cold areas, and moisture moves from humid to dry areas. In walls without air barriers, uncontrolled movement can result in condensation of moisture on cold surfaces, as shown in the illustrations below. Uncontrolled flow of air and moisture can harm the long-term performance and durability of your building materials, decrease indoor air quality, lower energy efficiency, and literally affect the health of your building and its occupants.

Northern Climates



In northern climates, warm, humid air moves naturally from building interiors to colder, drier exteriors. Without air barriers, moisture will condense on the colder, inside surface of the exterior wall.

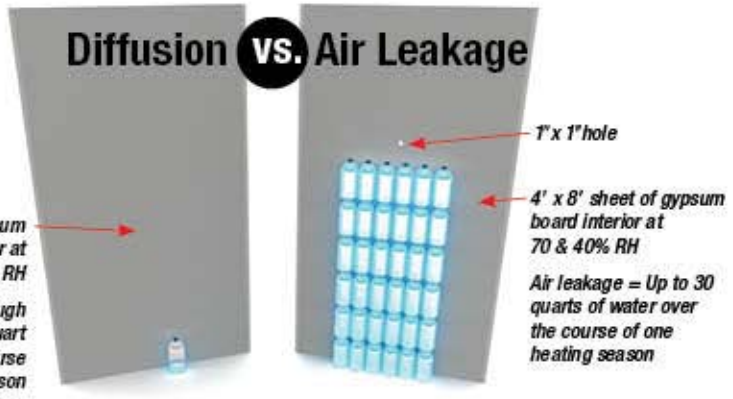
Southern Climates



In southern climates, warm, humid air moves naturally from building exteriors to cooler, drier interior areas. Without air barriers, moisture will condense on the colder, inside surface of the interior wall.

Uncontrolled air flow can be a major problem, especially in cold-weather climates

It's been estimated that over the course of a heating season about 1/3 of a quart of water can pass directly through gypsum board without a vapor retarder, and that 30 quarts of water can pass through the same gypsum wall with just a 1" x 1" hole in that same time period.[1]



[1]Builder's Guide to Cold Climates, Joseph Lstiburek

Air barriers help solve some of the biggest environmental challenges

Modern buildings are affected by a multitude of environmental challenges that can significantly affect their performance.

Wind pressure. The forces of wind on a building can be broken down into two categories: Positive (windward) pressure tries to push air into the building and negative (leeward) pressure tries to draw air out of the building, most commonly through gaps and openings within the structure.

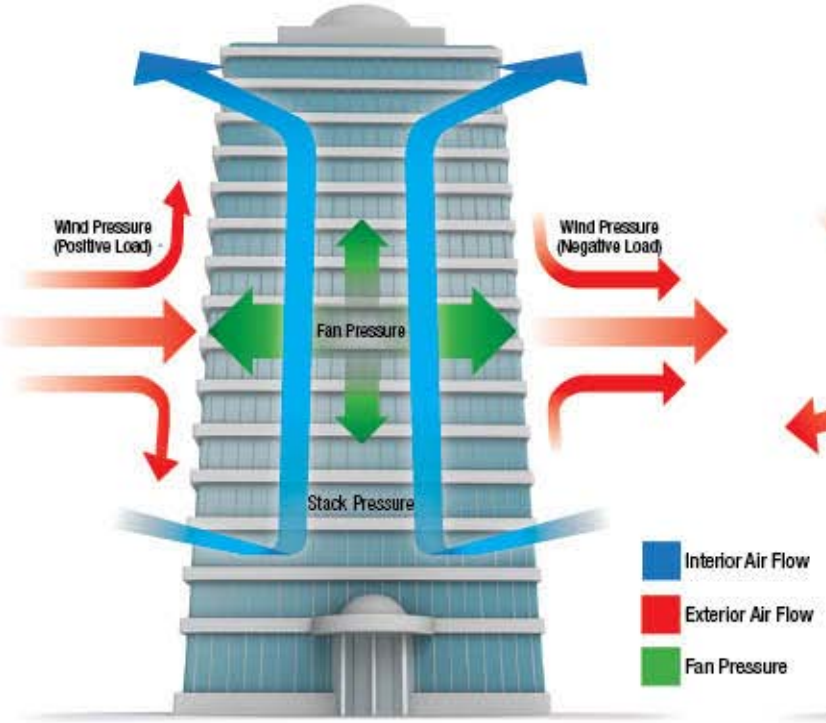
Fan pressurization. Mechanical (HVAC) systems are designed to create air movement within a building. The supply side of the system creates positive pressure that delivers conditioned air to the desired locations, while the return side and exhaust vents recycle and remove air, creating a negative pressure. These systems must be balanced in order to perform properly.

Stack pressure. Air density is related to air temperature. As air temperature warms, it becomes lighter and rises. The opposite is also true: As air temperature cools, it becomes denser and falls. A classic example of this is a hot air balloon.

Barometric cycling. Air pressure changes due to the weather. High pressure is associated with nice weather while low pressure is associated with inclement weather. This is typically not an issue inside buildings except when there are rapid pressure drops, such as those that can result in tornadoes. Then the rapid pressure changes between the interior and exterior can cause windows to blow out, as the building pressure tries to balance itself with the ambient conditions.

Thermal cycling. All construction materials shrink with cold and expand with heat over the 24-hour period from the cool of the night to the heat of the day. Materials are either extracting or emitting heat or cold, which causes the building HVAC system to respond in order to maintain the desired temperature.

Common environmental challenges of buildings



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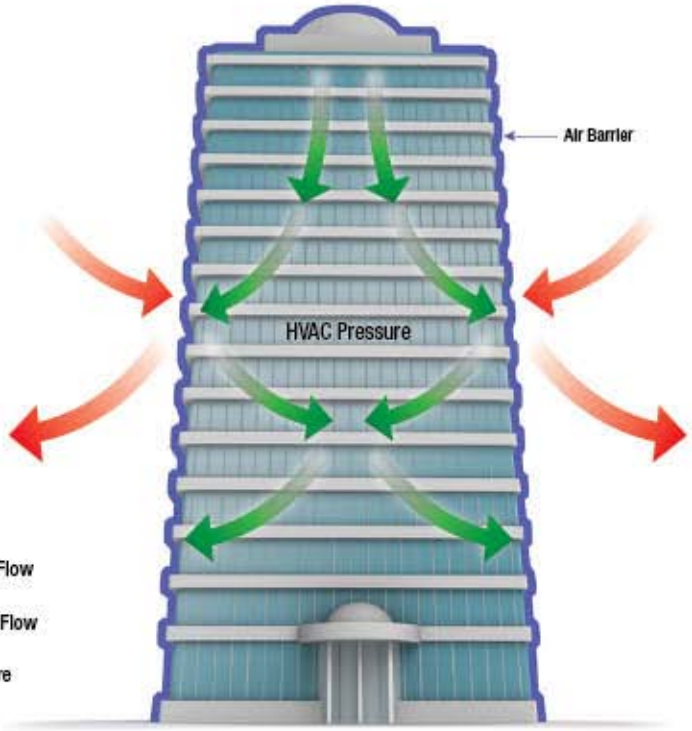
Typical building without an air barrier system.

A continuous air barrier helps maximize building efficiency



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Building with a continuous air barrier system.

How to choose the right air barrier system

Depending on their material characteristics, air barriers can control or block the passage of vapor or water. There are three main types of moisture-control systems:

Rain/liquid barriers. Typically, these are mechanically attached sheet systems that are not designed to limit air, but rather act as a rain or water screen.

Air barriers. Air barriers are permeable systems that allow vapor transmission through a wall assembly. These barriers are available in both sheet- and spray-applied membranes. The perm rating is typically greater than 10.

Air and vapor barriers. These nonpermeable systems stop air and moisture transmission through the wall assembly. They typically have a perm rating of less than 1.0 ("perm rating" is a measure of the diffusion of water vapor through a material).

Choosing the right air barrier system is a function of the kind of wall assembly you're constructing (the primary driver), your climate location (secondary driver), and your goals for sustainable construction.

Once you've selected a wall assembly design, the application temperature and relative humidity of your climate will determine the best barrier type. For example, cold or wet weather may eliminate some coatings and sheet membrane systems.

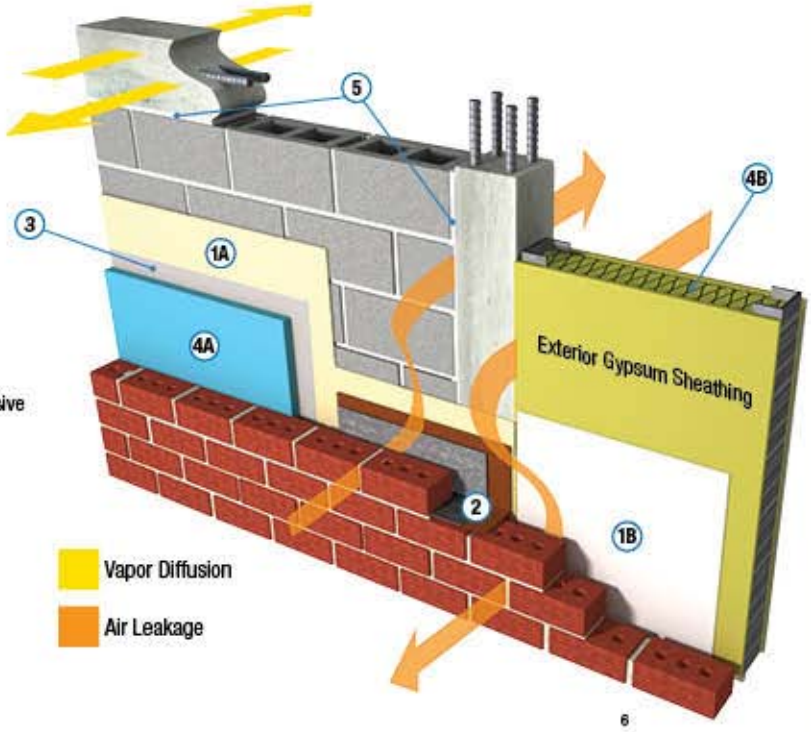
Maximize your building efficiency

Protecting buildings with a continuous 3M™ Air Barrier System provides a wide range of positive benefits, including:

- Better indoor air quality
- Reduced construction and operating costs of your HVAC by enabling smaller, more efficient equipment
- Less risk of mold and mildew
- Happier, healthier residents
- Extended service life and durability of your building
- Energy savings through the reduction of unintended air movement

An air barrier system can be a sheet- or spray-applied membrane. It's designed to control the unintended movement of air flow into and out of the building enclosure.

- 1A 3M™ Air and Vapor Barrier 3015
- 1B 3M™ Liquid Air Barrier 2085VP
- 2 Through-wall flashing
- 3 3M™ Scotch-Weld™ HoldFast 70 Cylinder Spray Adhesive
- 4A Rigid foam insulation
- 4B Fiberglass batt insulation
- 5 Closed-cell foam insulation or approved sealant



3M™ Air & Vapor Barrier 3015

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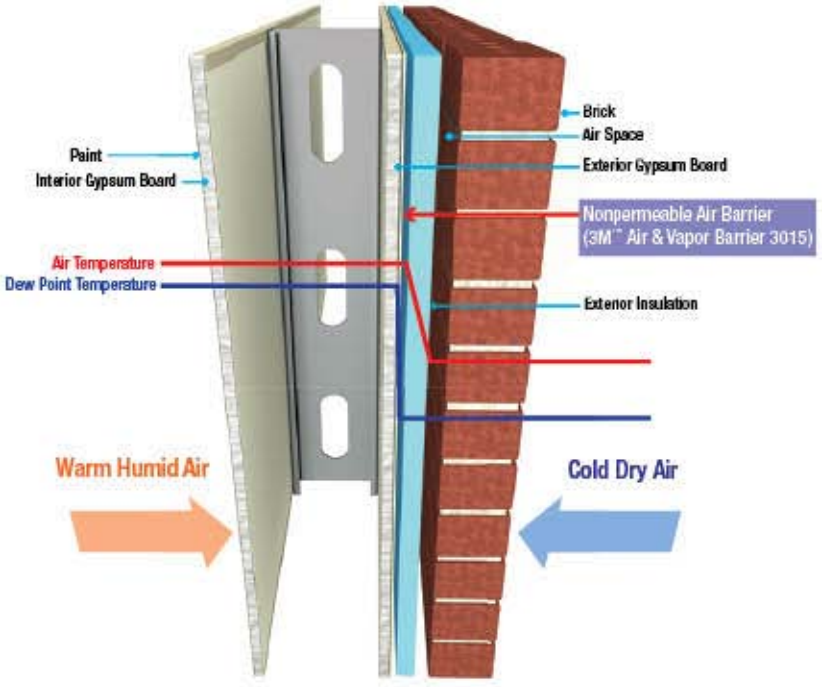
Using the most advanced air barrier technologies, 3M™ Air and Vapor Barrier 3015 is a self-adhered film engineered to help control the indoor climate. It reduces air leakage and uncontrolled airflow from the building envelope, prevents moisture ingress and helps improve indoor air quality.

- **No primer required.** Pressure-sensitive adhesive technology eliminates the time and materials usually required for applying air barriers. Just roll it out and press it down.
- **Compatible with common construction materials and sealants.** The special adhesive sticks well to concrete, concrete block, anodized aluminum, galvanized metal, plywood, extruded polystyrene and most exterior gypsum sheathing. It is also compatible with a wide range of common sealants, including synthetic rubber and butyl-, polyurethane-, silicone- and silane-terminated hybrid sealants.
- **Hot or cold temperature application.** Apply 3M™ Air and Vapor Barrier 3015 in temperatures as high as 150°F (66°C) or as low as 0°F (-18°C).
- **Self-seals if penetrated.** 3M™ Air and Vapor Barrier 3015 will actually seal around nails and staples to further reduce moisture intrusion. It passes ASTM D1970 both before and after thermal cycling.
- **Tough and flexible.** Flexible enough to fit into corners, under siding and around curved surfaces, 3M™ Air and Vapor Barrier 3015 is also tough enough to resist punctures and tears.
- **Lightweight and easy to use.** 3M™ Air and Vapor Barrier 3015 is just 10 mils thick and a roll weighs 21 lbs., yet it outperforms thicker competitive membranes weighing 3 times more!
- **UV resistant up to 6 months.**
- **Nonpermeable.** U.S. perm rating = 0.14 per ASTM E96 (desiccant method), ensuring a better moisture barrier.
- **NFPA 285 compliant** (as part of an approved wall assembly).

One of the basic principles of air barrier design is to ensure that the air temperature curve within the wall assembly is always higher than the dew point temperature curve, as shown in the diagram below. If the dew point temperature curve crosses the air temperature curve, moisture will condense within the wall, which can compromise building health and performance.

Nonpermeable Air Barrier Wall System



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For a properly designed wall, use 3M™ Air & Vapor Barrier 3015 to help prevent moisture condensation by keeping the air temperature curve higher than the dew point throughout the wall.

3M™ Liquid Air Barrier 2085VP

Featuring a proprietary 3M technology, 3M™ Liquid Air Barrier 2085VP is engineered to make air barrier application simple and fast. Yet this vapor-permeable barrier is as effective as traditional membrane-type air barriers at helping control the indoor climate.

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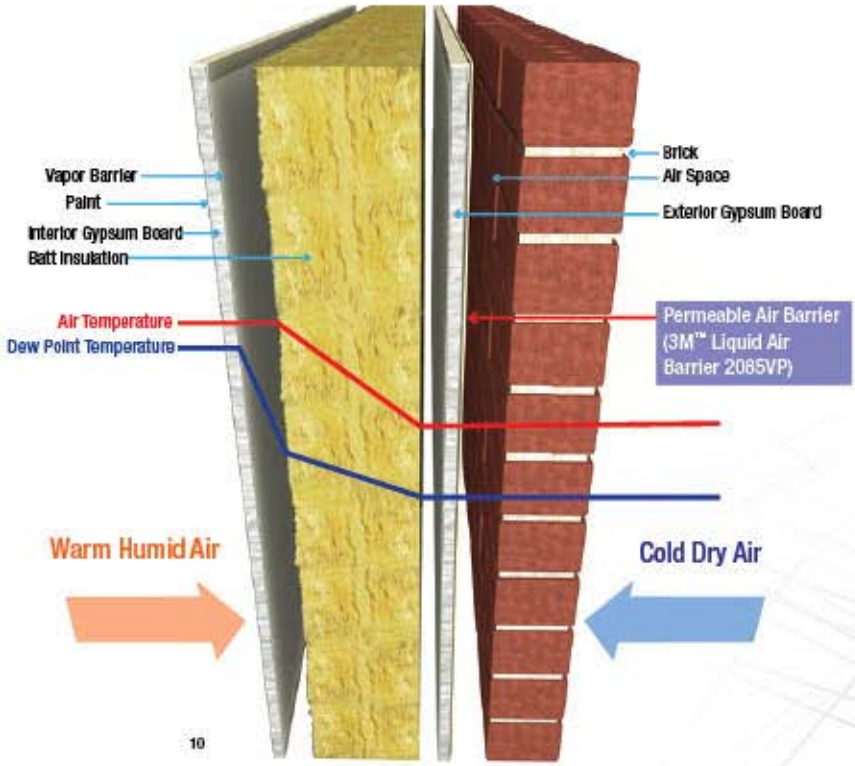
- **Fast drying.** Tack-free time is less than 2 hours under most conditions.
- **Cold-temperature application tolerant.** Apply 3M™ Liquid Air Barrier 2085VP in temperatures as low as 25°F (-4°C), significantly extending your application season.
- **Low VOCs.** Less than 100 g/l of VOCs meets the requirements for architectural coatings in all 50 states.
- **Rain and moisture resistant.** 3M™ Liquid Air Barrier 2085VP can be applied to damp (not wet) surfaces immediately after a rain and up to one hour before rain is expected.
- **Compatible with other 3M Building and Construction Market products.** Using 3M™ Air and Vapor Barrier 3015 for detailing and combining it with 3M™ Polyurethane Construction Sealant 525 can provide a complete air barrier assembly tested to ASTM E2357.
- **High coverage per gallon.** At 60 sq. ft. per gallon coverage on exterior gypsum sheathing, 3M™ Liquid Air Barrier 2085VP provides up to 3 times the coverage of many competitive products.
- **UV resistant.** 6 months UV-exposure resistant.
- **Permeable.** U.S. perm rating = 20 (desiccant method), 30 (wet method), per ASTM E96, ensuring a permeable barrier.

Permeable Air Barrier Wall System



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For a properly designed traditional wall, use 3M™ Liquid Air Barrier 2085VP to help prevent moisture condensation by keeping the air temperature curve higher than the dew point throughout the wall.

Verify
your system design and performance

There are several tools available for verifying the effectiveness of your air barrier system design. All systems must be validated via the ASTM E2357 Test, which looks for air leaks in these eight areas:

1. Duct penetration
2. Electrical box penetration
3. Foundation interface
4. Post-applied masonry or brick ties
5. Water pipe penetration
6. Roof interface
7. Seams
8. Window flashing

Another tool for verifying your system performance is heat and moisture thermodynamic software modeling, known as "WUFI®". This engineering resource requires a trained professional to input data on the individual wall components and interpret the results.

Once construction is finished, you can verify the performance of your system by conducting whole building, air-tightness testing with a third party. These tests measure air leakage from the building using positive pressure.

Trust 3M
for advanced building construction technologies

3M takes a scientific approach to solving the problems presented by the building and construction industries. We offer hundreds of practical and ingenious solutions for almost every stage of construction: From the world's strongest adhesives, waterproofing technologies and fire protection to innovative display films and products that protect, beautify and simplify.

Comprehensive 3M resources help ensure your success every step of the way

3M is much more than a product supplier. We have the expertise and resources to help ensure your success before and after you get to the construction site, including:

- Building Envelope Solutions
- Technical Support, Sales and Field Engineering
- Mobile Download Solutions
- CAD Details
- CSI 3-part Specifications
- Certified Contractor Program
- Industry White Papers
- MSDS
- Technical Bulletins
- Technical Data Sheets

Learn about 3M's advanced technologies for controlling airflow and optimizing the indoor climate at **3M.com/airbarrier** or contact your 3M representative at 1-866-513-4026.

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