WEATHER-RESISTIVE BARRIERS

How to select and install housewrap and other types of weather-resistive barriers

Buildings for the 21st Century

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- Promotes energy/money saving opportunities to both builders and buyers of homes and commercial buildings
- Works with state and local regulatory groups to improve building codes, appliance standards, and guidelines for efficient energy use
- Provides support and grants to states and communities for deployment of energy-efficient technologies and practices

INTRODUCTION

Weather-resistive barriers are a part of exterior wall systems that protect building materials from exterior water penetration. They perform like a shell for buildings—liquid water that has penetrated the exterior finish does not pass through, yet water vapor can escape. By keeping building materials dry, a weather-resistive barrier improves building durability, decreases maintenance costs, and reduces the risk of moisture-related problems such as bugs, mold, mildew, and rot. Some weather-resistive barriers also reduce air infiltration, cutting utility costs and increasing comfort.

TYPES AND COSTS OF WEATHER-RESISTIVE BARRIERS

Building paper is a traditional paper sheet or felt material that is asphalt coated or impregnated to increase its strength and resistance to water penetration. It is primarily employed to protect against moisture as a drainage layer. Housewrap refers to spun-plastic sheet materials that are wrapped around a house to protect against moisture penetration. If properly sealed, housewrap can also serve as an air retarder to reduce infiltration. In some wall systems, sealed water-resistive sheathing such as rigid foam board can serve as the weather-resistive barrier, eliminating any need for building paper or housewrap.

Building paper typically costs about $300, material and labor, to cover a 2,500-square-foot home. It usually comes in a 3-foot roll that one person can install. Housewrap costs about $450, materials and labor, for the same size house. While it is available in 3-foot rolls, rolls are usually 9-feet wide and require two people for installation.

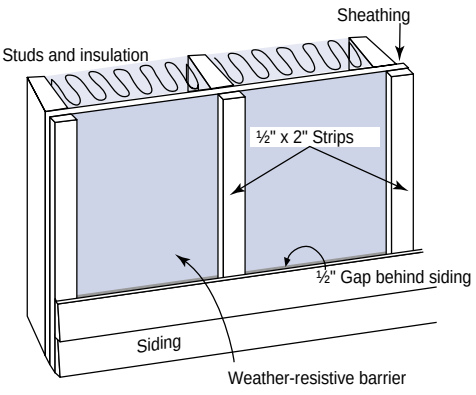
WHEN AND HOW TO USE WEATHER-RESISTIVE BARRIERS

As part of a whole-wall design, weather-resistive barriers need to be integrated with other wall system components, including structure, insulation, vapor retarder, air retarder (if separate), and flashing systems.

A comprehensive approach to water management prevents water from reaching the sheathing or framing. Primary water management strategies include water-shedding characteristics that include overhangs and exterior claddings. Secondary (redundant) water management usually employs a weather-resistive barrier to protect the sheathing and framing from moisture damage.

A weather-resistive barrier is a drainage plane. It allows water that has penetrated past the siding to drain away from the wall system. Building paper or housewrap is usually used to form the barrier. Attaching siding to furring strips provides an air gap between the siding and weather-resistive barrier that improves drainage and addresses related moisture issues.

FURRED-OUT SIDING



INSTALLATION

Weather-resistive barriers require thorough, comprehensive integration with other building envelope elements to retain system integrity. Flashing and other components, including windows, doors, attached decks, and band joists, usually present the most difficulty. Expert supervision by a knowledgeable person can foster proper field installation. While some general installation guidelines are outlined here, it is essential to accommodate regulatory and product manufacturer procedures.

The approach used to install an appropriate weather-resistive barrier is dependent on why it is being used. If intended only to resist water entry, a weather-resistive barrier must be properly lapped and integrated with other flashing—taping of all seams is not critical. If it is used to reduce air infiltration, all seams and edges must be sealed with compatible tape or sealant.

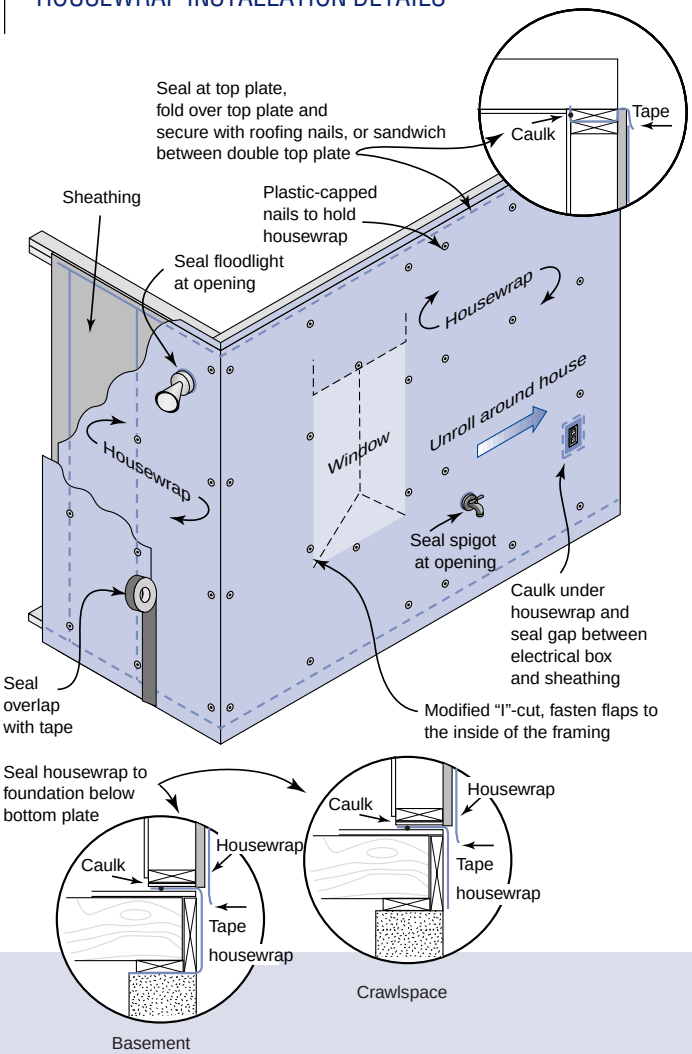
Suitable attachment of the weather-resistive barrier to the sheathing is important. Wide-crown staples, nails with a large head, or nails with a large plastic washer are recommended for wood-frame construction. Distance between fasteners is specified by the manufacturer or by codes, but 12 to 18 inches is typical.

When installing a weather-resistive barrier, especially building paper, remember that materials higher on a wall should overlap materials lower on the wall—consider the path that a drop of water would take if impacting the top of the wall and running downward. Water may also be driven sideways or even upward for a distance by wind pressure. Therefore, laps must be of sufficient length to prevent water entry—4 to 12 inches of overlap is typically recommended. Material should also extend around corners by 6 to 36 inches.

Housewrap installation may be eased by attaching the material to walls before standing the walls up—just leave sufficient additional length at all sides for later overlaps. This approach improves speed and safety, and results in a more wrinkle-free application (wrinkles can impede drainage and hinder cladding application).

To maintain a continuous air retarder around the building envelope, housewrap should cover the seams between framing members (e.g., between bottom plate and foundation). This may be accomplished by incorporating housewrap into the framing or by adhering housewrap continuously across the assembly. Overlap and seal all seams, and seal penetrations in the housewrap. Tape is usually used to cover seams, while sealant is used where tape may not provide sufficient adhesion, such as sealing to wood or concrete. Use manufacturer-approved tapes and sealants, not generic tape such as duct tape.

HOUSEWRAP INSTALLATION DETAILS



DETAILS FOR WINDOWS AND DOORS

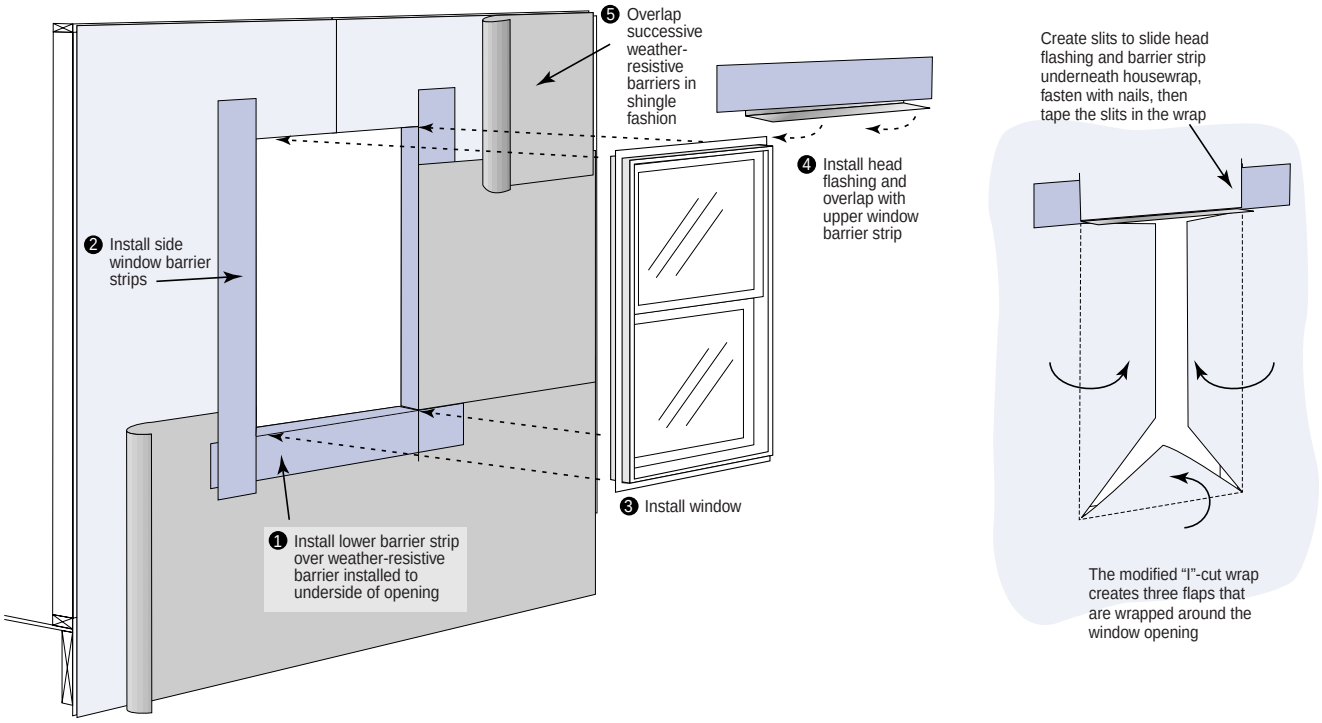
Some windows leak through their frames or at the junction where two or more windows are joined (mulled). Without a weather-resistive barrier, water leaking behind the plane of the nailing flange or on the back of the brick mould can damage the sheathing.

The figures illustrate a procedure for flashing window openings with building paper or housewrap so that any potential leaks do not cause damage. Details may vary with siding and window type and the installation sequence for the window, trim, and weather-resistive barrier. It is advisable to install window head and sill flashing, whether it is metal, plastic, or a self-sticking elastomeric membrane. Avoid relying on tapes or sealants to provide waterproofing, as these products may fail over time. Some building paper may not be suitable for wrapping window openings or corners because of material cracking.

It is common practice and recommended by some manufacturers to cut an "X" in housewrap placed over window and door openings, pull the material inside, and secure it by stapling. Other manufacturers require alternative methods, such as the modified "I"-cut, depending on the overall flashing approach. The "I"-cut allows the vertical leg of head flashing to be placed under the weather-resistive barrier and then taped or sealed.

It is best to divert drainage onto the face of the weather-resistive barrier. Do not tape down or seal behind the bottom nailing flange of windows, as doing so could accidentally trap in water.

FLASHING WINDOW OPENINGS



- Barrier strips are attached with nails and overlapped with successive barrier strips and weather-resistive barriers in shingle fashion. Do not depend on tapes or glues, as they may fail over time.

  Housewrap technique utilizes a modified "I"-cut in the material, which is then wrapped to the inside of the window frame and fastened. The head flashing and barrier strip are fastened and "shingled" under a flap that is cut in the wrap. These seams are then taped.

WEATHER-RESISTIVE BARRIERS

For more information, contact:

Energy Efficiency and Renewable Energy Clearinghouse (EREC)
1-800-DOE-3732
www.eren.doe.gov

Or visit the BTS Web site at www.eren.doe.gov/buildings

Or refer to the Builder's Guide
Energy Efficient Building Association, Inc.
651-268-7585
www.eeba.org

Written and prepared for the U.S. Department of Energy by:

NAHB Research Center
800-898-2842
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www.southface.org

Oak Ridge National Laboratory
Buildings Technology Center
423-574-5178
www.ornl.gov/ORNL/BTC

PROPERTIES OF WEATHER-RESISTIVE BARRIERS

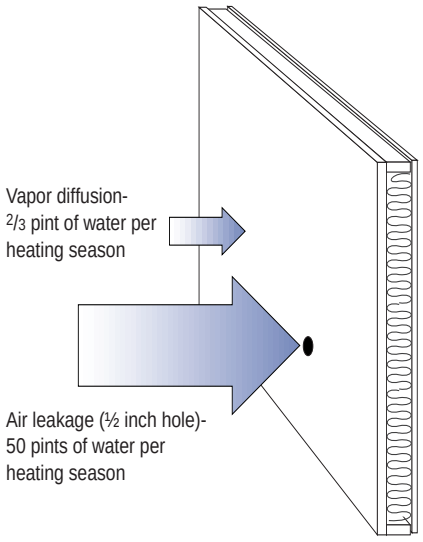
Building paper is made with or without perforations (tiny pinholes) in common weights of 15 and 30 pounds (per 100 square feet). Housewrap comes in a variety of materials and can be perforated or non-perforated. Perforations can hasten moisture vapor outflow while curtailing liquid transfer.

✓ Resistance to Water Penetration

Building paper temporarily resists water penetration, while housewrap is designed to eliminate penetration and absorption. Moisture moving through wood extracts chemicals (surfactants), however, that can in time help water soak through housewrap. Coating all sides of wood siding with clear, water-repellent wood preservative and priming and finish painting with two finish coats helps inhibit this migration.

MOISTURE MIGRATION PRIORITIES

Significantly more water vapor travels through a wall by air leakage than by diffusion



✓ Vapor Permeability

Vapor permeance refers to the amount of water vapor that can pass through a material—the higher the rate, the greater the vapor flow. By code, weather-resistive barriers must be rated at five perms or higher. Higher-perm materials can be desirable to speed the escape of trapped moisture vapor.

✓ Air Resistance

Weather-resistive barriers make an effective air retarder when all seams and penetrations are fully sealed with an appropriate sealant or tape. Common, unsealed building paper is not a true air retarder. Most housewrap air leakage rates (at 0.1 inches mercury pressure differential) fall between 0.03 and 0.08 CFM/ft^2—the higher the rate, the greater the airflow.

✓ Durability

Weather-resistive barriers vary in their resistance to ripping, ultraviolet (UV) radiation, and moisture tolerance.

Tear Resistance—This is important in resisting rips during installation or under wind loading. Housewraps are highly resistant to tearing, unlike building paper.

UV Resistance—UV rays within sunlight will attack many building materials during the construction installation process. Most building paper is non-UV-resistant, whereas recommended housewrap exposure limits vary widely (check with the manufacturer).

Moisture Tolerance—Housewrap tolerates repeated wetting because plastic does not absorb moisture. Building paper absorbs moisture and thus can help dry out water otherwise trapped behind it.

Printed with a renewable-source ink on paper containing at least 50% wastepaper, including 20% postconsumer waste.
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