

TECHNICAL BULLETIN SERIES

Selecting Air-Barrier Vapor Permeance in Climate Zone 7

Very cold walls need a vapor-open exterior, rigorous interior control, and high exterior R- value.

APPLICATION

Above-grade exterior wall assemblies

AUDIENCE

Architects, consultants, contractors, and owners

CLIMATE

IECC Zone 7: 7

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KEY CONCLUSION For conventional Climate Zone 7 framed walls, the exterior air/water barrier should generally be vapor-permeable. The primary moisture defenses are a continuous interior-side air/vapor- control strategy, controlled indoor humidity, and enough exterior insulation to keep sheathing warmer. Exterior permeability provides essential recovery capacity.

Climate conditions and drying direction

Zone 7 has a long, severe heating season and strong outward vapor drive. Moisture carried by exfiltrating air can condense or freeze within the wall and may remain stored until warmer weather. The assembly must minimize entry, tolerate limited storage, and dry safely during seasonal recovery. ^[1]

Subzone	Dominant conditions	Primary design emphasis
7	Very cold; no A/B/C suffix	Control interior moisture entry and preserve exterior drying.

Moisture regimes: A = moist, B = dry, C = marine. Climate Zones 7 and 8 do not use a moisture-regime suffix.

Air control and vapor control are different

An air barrier limits airflow through the enclosure; a vapor retarder limits water-vapor diffusion through materials. These are independent properties. A membrane can be highly airtight and still allow vapor diffusion. The 2021 IECC commercial provisions recognize air-barrier materials at an air permeance no greater than 0.004 cfm/ft² at 75 Pa when tested to ASTM E2178. ^[2]

Air leakage can transport substantially more moisture than vapor diffusion. The first priority is therefore a continuous, well-detailed air-control layer. Vapor permeance should then be selected to manage the climate-specific drive without eliminating the wall's intended drying path. ^[3]

Property	What it controls	Typical reporting
Air permeance	Airflow through the membrane itself	ASTM E2178; cfm/ft ² at 75 Pa
Assembly leakage	Airflow through membrane, joints, transitions, and penetrations	ASTM E2357 or project testing

Property	What it controls	Typical reporting
Vapor permeance	Water-vapor diffusion through the material	ASTM E96; identify dry-cup/wet-cup method
Water resistance	Bulk rainwater passing through the membrane	Applicable WRB/water-resistance testing

Series terminology: very low/Class I ≤ 0.1 perm; low/Class II > 0.1 to ≤ 1 perm; moderate/Class III > 1 to ≤ 10 perms; vapor-open > 10 perms. Compare products using the same ASTM E96 procedure and tested thickness.

Why this recommendation fits Climate Zone 7

- **Air exfiltration is the critical wetting mechanism.** Interior air-control continuity at ceilings, floors, partitions, and penetrations must be exceptionally robust. ^[3]
- **Exterior permeability enables seasonal recovery.** A vapor-open exterior allows moisture stored during winter to dry outward when temperature and vapor-pressure conditions permit. ^[5]
- **Interior vapor control belongs on the warm side.** Responsive or code-compliant vapor retarders should limit winter diffusion without unnecessarily eliminating inward drying. ^[6]
- **Exterior insulation controls condensation.** PNNL Zone 7 guidance uses high exterior R-values to keep the condensing surface warmer and permit more drying-friendly interior finishes. ^[7]
- **Low exterior permeance magnifies defects.** A small air leak can deliver moisture behind a layer that prevents outward drying for months. ^[3]
- **The cladding cavity remains part of drying.** Ventilation and drainage behind cladding improve removal of rainwater and outward-diffusing vapor.

Performance comparison

Design issue	Vapor-permeable exterior	Low-perm exterior
Seasonal recovery	Allows stored winter moisture to dry outward.	Can retain moisture until inward drying becomes available.
Interior-control compatibility	Reduces double-vapor-barrier risk.	Can trap sheathing between two restrictive layers.
Defect tolerance	More forgiving of small construction and air-sealing defects.	Requires unusually reliable air control and temperature management.
Exterior insulation	Works with vapor-open mineral wool or other CI.	Can work behind sufficient CI in an engineered assembly.
Best-fit use	Conventional Zone 7 framed walls.	Perfect-wall or mass-wall designs with verified inward drying.

Comparison assumes equivalent air-barrier continuity, water resistance, adhesion, and durability. Vapor permeance alone does not determine wall performance.

Important design limits

DO NOT SPECIFY BY PERM RATING ALONE The complete wall—not one membrane—determines moisture performance. Cladding, insulation location, interior humidity, orientation, exposure, and adjacent material layers all affect wetting and drying.

- **Permeability is recovery, not prevention.** It cannot compensate for poor interior air sealing or excessive winter indoor humidity.^[3]
- **Exterior R-value must be substantial.** Condensation control depends on the ratio of exterior to total insulation and the specific framing assembly.^[7]
- **Class I interior control is not automatically best.** Very low interior permeance may inhibit summer inward drying; responsive systems can improve resilience when allowed.^[6]
- **Snow and ice affect enclosure details.** Roof-wall transitions, venting, and drainage must account for ice dams, drifting snow, and freeze-thaw exposure.^[7]
- **Use modeling for complex walls.** Double-stud walls, steel framing, high interior RH, and mass assemblies warrant hygrothermal analysis.

Recommended design and specification approach

For conventional above-grade walls in Climate Zone 7, the design team should select the air/water barrier only after confirming the intended drying direction and the vapor resistance of every adjacent layer. Submittal review should address:

- Air permeance at the installed thickness, including ASTM E2178 data and continuity details at joints, openings, penetrations, and transitions.
- Water-vapor permeance under the stated ASTM E96 procedure; do not compare dry-cup and wet-cup results as if they were equivalent.
- Compatibility with sheathing, exterior insulation, flashings, sealants, primers, transition membranes, and cladding attachments.
- A continuous drainage plane, integrated flashings, and a drainage/ventilation cavity appropriate to the cladding and exposure.
- A wall-section review confirming at least one reliable drying direction for each moisture-sensitive layer.
- Hygrothermal analysis where the wall includes reservoir cladding, low-perm layers on both sides, unusual interior humidity, mass masonry, steel framing, or atypical insulation.

Bottom line

Climate Zone 7 walls generally need a vapor-permeable exterior air/water barrier, not because permeability prevents winter wetting, but because it gives a tightly controlled and well-insulated wall a safe seasonal drying path.

RECOMMENDED POSITION Use a vapor-permeable exterior air/water barrier with robust warm-side air/vapor control and high exterior R-value. Low exterior permeance should be an engineered exception.

References

- [1] [PNNL Building America Solution Center - IECC Climate Zone Map.](#)
- [2] [International Code Council - 2021 IECC, Commercial Energy Efficiency, air-leakage provisions.](#)
- [3] [U.S. Department of Energy, Building America - Managing the Drivers of Air Flow and Water Vapor Transport.](#)
- [4] [U.S. Department of Energy, Building America - Water Management of Non-Insulating and Insulating Sheathings.](#)
- [5] [Building Science Corporation - Vapor Barriers and Wall Design.](#)
- [6] [International Code Council - 2021 IRC, Section R702.7, Vapor Retarders.](#)
- [7] [PNNL Building America Solution Center - 2021 IECC Climate Zones 7 and 8 wall assembly notes.](#)

TECHNICAL DISCLAIMER General guidance only. The design professional must confirm the complete assembly, locally adopted code, project conditions, and product compatibility. Air-barrier permeance does not correct air leaks, water leaks, inadequate flashing, or missing drainage.