



# Code Amendment Proposal Application

Proposal 4

Department of Consumer & Business Services

Building Codes Division

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Read the entire code amendment proposal application before completing this form. Please complete all parts before submitting your proposal and refer to the provided checklist.

## APPLICANT INFORMATION

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Representing (if applicable): New Buildings Institute		Work phone: 503-761-7339
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## PROPOSAL INFORMATION

Specialty code: Oregon Reach Code
Code section(s): 5.4.3.1
Briefly explain the subject of your proposal: Air Barrier Testing

## INSTRUCTIONS AND CHECKLIST


Fill in all the information above and submit this page, signed and dated, with the required supplementary information for Parts I, II, and III listed in the following checklist. This application may be submitted by mail to the mailing address above, or by email to [BCD.PTSPtech@oregon.gov](mailto:BCD.PTSPtech@oregon.gov).

### Checklist:

- Part I** Code amendment language is attached in the proper format.
- Part II** Amendment proposal requirements for amending the code have been reviewed.
- Part III** Amendment proposal criteria questions have been answered and are attached.

**Note:** One application is required for each code section you are proposing to amend. If this proposal requires changes in other sections of the code for alignment, include those changes as part of this application.

## APPLICANT SIGNATURE

Signature: 	Date: 2/24/2022
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# Oregon Reach Code Proposal: Air Barrier Testing

## Part I: Code Amendment Language

Section 5.4.3.1, Revise text as follows:

### **5.4.3.1 Continuous Air Barrier**

The *exterior building envelope* and the *semiexterior building envelope* shall have a *continuous air barrier* complying with Sections 5.4.3.1.1 and 5.4.3.1.2.

#### **Exceptions to 5.4.3.1**

1. *Semiheated spaces* in Climate Zones 0 through 6, except as required to complete the *continuous air barrier* of an adjacent *conditioned space*.
2. Single wythe concrete masonry *buildings* in Climate Zone 2B.

#### **5.4.3.1.1 Whole-Building Air Leakage**

Whole-building pressurization testing shall be conducted in accordance with ASTM E779~~2~~ or ASTM E1827 by an independent third party. The measured air leakage rate of the *building envelope* shall not exceed 0.25 ~~0.40~~ cfm/ft<sup>2</sup> (1.25 L/s m<sup>2</sup>) under a pressure differential of 0.3 in. of water (75 Pa), with this air leakage rate normalized by the sum of the above-grade and below-grade *building envelope* areas of the *conditioned space* and *semiheated space*. Where a *building* contains both *conditioned space* and *semiheated space*, compliance shall be shown

- a. separately for the *conditioned space* and for the *semiheated space*, with the air leakage rate for the *conditioned space* normalized by the *exterior building envelope* area of the *conditioned space* and the air leakage rate for the *semiheated space* normalized by the *semiexterior building envelope* area of the *semiheated space*; or
- b. for the *conditioned space* and for the *semiheated space* together, with the air leakage rate for the overall *space* normalized by the sum of the *exterior building envelope* area and the *semiexterior building envelope* area minus the *semiexterior building envelope* area that separates the *conditioned space* from the *semiheated space*.

If the tested rate exceeds 0.25 cfm/ft<sup>2</sup>, corrective actions must be made and the test completed again. A test above 0.25 cfm/ft<sup>2</sup> will not be accepted. Reporting shall be in compliance with Section 4.2.5.1.2.

#### **Exceptions to 5.4.3.1.1**

1. For *buildings* having over 50,000 ft<sup>2</sup> of *gross conditioned floor area*, air leakage testing shall be permitted to be conducted on less than the whole *building*, provided the following portions of the *building* are tested and their measured air leakage is area-weighted by the surface areas of the *building envelope*:
  - a. The entire *floor* area of all *stories* that have any *spaces* directly under a *roof*.
  - b. The entire *floor* area of all *stories* that have a *building entrance* or loading dock.
  - c. Representative *above-grade wall* sections of the *building* totaling at least 25% of the *wall* area enclosing the remaining *conditioned space*. Floor area tested per (a) and (b) shall not be included in the 25%.

2. For *high-rise buildings* and buildings having over 100,000 ft<sup>2</sup> of gross conditioned floor area, which do not enclose Group R or Group I occupancies, whole building pressurization testing shall not be required, provided an *approved* third party verify the design and installation of the ~~continuous air barrier design and installation verification program~~ in accordance with Section 5.9.1.2.

3. For buildings enclosing Group R or Group I occupancies, air leakage testing shall be permitted to be conducted on less than the whole building, provided the measured air leakage rate of the enclosure area of the dwelling or sleeping unit does not exceed 0.20 cfm/ft<sup>2</sup> (1.0 L/s m<sup>2</sup>) under a pressure differential of 0.2 in. of water (50 Pa). Where multiple dwelling units or sleeping units are contained within one building thermal envelope, their measured air leakage shall be area-weighted by the surface area of each tested unit's enclosure area. Testing shall be conducted in accordance with ASTM E779, ANSI/RESNET/ICC 380, or ASTM E1827 by an independent third party and without simultaneously testing adjacent units. Units shall be tested separately as follows:

- a. Where buildings have fewer than eight total dwelling or sleeping units, each unit shall be tested.
- b. For buildings with eight or more dwelling or sleeping units, the greater of seven units or 20 percent of the units in the building shall be tested, including a top floor unit, a ground floor unit and a unit with the largest enclosure area. For each tested unit that exceeds the maximum air leakage rate, an additional two units shall be tested, including a mixture of unit types and locations.
- c. For portions of the building not enclosing Group R or Group I occupancies, at least 25% of the wall area enclosing the remaining conditioned space shall be tested and shall not exceed 0.25cfm/ft<sup>2</sup> (1.25 L/s m<sup>2</sup>) under a pressure differential of 0.3 in. of water (75 Pa). Where these portions exceed 100,000 ft<sup>2</sup> of gross conditioned floor area, pressurization testing shall not be required, provided an approved third party has verified the design and installation of the continuous air barrier design and installation verification program in accordance with Section 5.9.1.2.

Add new language to Chapter 12 Normative Reference:

Reference	Title
<u>ANSI/RESNET/ICC 380</u>	<u>Standard for Testing Airtightness of Building, Dwelling Unit, and Sleeping Unit Enclosures, Airtightness of Heating and Cooling Air Distribution Systems, and Airflow of Mechanical Ventilation Systems</u>

## Part II - Code Amendment Proposal Requirements

To the best of our knowledge, this proposal aligns with all statutes and rules governing the Oregon state building code

## Part III - Code Amendment Proposal Criteria

This amendment requires air leakage testing for all commercial buildings less than 100,000 square feet and includes specific air leakage testing guidance for multifamily buildings. These changes align with changes to air infiltration testing requirements considered in ASHRAE 189.1 and with the multifamily testing requirements in the 2021 IECC.

Air leakage can be a significant source of energy waste in buildings, contributing to higher heating and cooling costs for building owners and occupants, and increasing risk related to comfort and durability. Air tightness testing can result in more attention to envelope assembly air barrier sealing and significantly reduced building leakage. Adequate control over air leakage can provide many benefits, including reduced HVAC equipment sizing, better building pressurization, and energy savings due to reduced heating and cooling of infiltrated outside air. In moist climates, ensuring lower air leakage through whole-building testing can also result in better humidity control and reduced risk of durability issues. While it is important that the materials and assemblies have limited leakage, that alone does not guarantee a low leakage building. Recent research shows that 40% of buildings constructed without an envelope consultant have air leakage exceeding the currently optional test standard requirements, while buildings with envelope consultants all had leakage below 0.25 cfm/ft. Testing is the most reliable means of ensuring that the intent of this code section—limiting unintended energy waste in buildings due to air infiltration—will be achieved. Durston and Heron’s review (2012) of the 0.25cfm/ft<sup>2</sup> requirement by the U.S. Department of Defense (DOD) shows that without testing, the range of building leakage can exceed the requirement by more than double (0.9 cfm/ft). However, with testing included as part of the construction process, the average leakage of buildings was determined to be below the 0.25 cfm/ft limit and in many cases lower leakage levels in the range of 0.15 cfm/ft<sup>2</sup> can be achieved. Therefore, a test limit of 0.25 cfm/ft is considered to be both a realistic and achievable goal.

This amendment proposes exempting testing for high-rise buildings and buildings of 100,000 ft<sup>2</sup> because of the technical and practical issues with testing these large buildings. This amendment also proposes different test procedures and thresholds for multifamily structures (Group R and I occupancies) that align with the test procedures outlined in the 2021 IECC to reflect current industry practice in blower door testing for the multifamily market. The original air leakage testing threshold for residential buildings of 0.30 cfm/square foot tested at 50 Pascals was lowered to 0.19 cfm/square foot for consistency with the 0.25 cfm/square foot threshold tested at 75 Pascals for non-residential buildings

This measure will increase the cost of construction of new commercial buildings as whole building air leakage testing will be required except for primarily residential buildings (Group R and I building occupancies). Based on a national survey of professional commercial building air barrier testing companies, it was determined that the cost of air leakage testing fell into three ranges:

- \$350 or \$120 to \$70 per thousand square feet for buildings up to 5000 square feet
- \$500 to \$150 per thousand square feet for buildings between 5000 and 50,000 square feet
- \$150 to \$90 per thousand square feet for buildings between 50,000 and 100,000 square feet, with decreasing costs for larger buildings.

As demand for air leakage testing in commercial buildings increases, more companies will enter the market to provide these services. Therefore, a gradual decrease in cost is expected as more companies are available to do the testing.

An analysis of energy impact shows that annual energy savings from air barrier improvement resulting from testing due to the measure ranges from \$5.07 to \$71.88 per thousand square feet of floor area in offices in climate zones where testing is recommended.

A measure is cost-effective when the SIR is greater than 1.0, indicating that the present value of savings is greater than the incremental cost. Under ASHRAE 90.1 criteria, cost-effectiveness is proven when the simple payback is shorter than the scalar threshold of 22.2 years. Based on the cost-effectiveness analysis results, air barrier testing is specified for buildings that have both an SIR greater than 1 and a simple payback that is less than the 90.1 scalar threshold based on climate zone and building size.