BuildUp MN

Whole-Building Air Leakage Compliance: Testing and Air Barrier Verification

Understanding whole-building air leakage requirements, verification pathways, exceptions and project team responsibilities under the 2024 Minnesota Commercial Energy Code.

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BuildUp MN is a statewide program under Minnesota's Efficient Technology Accelerator (ETA), a partnership funded by the state's participating investor-owned utilities (IOUs) and consumer-owned utilities (COUs), administered by the Minnesota Department of Commerce, Division of Energy Resources (DER), and implemented by Center for Energy and Environment (CEE).

Overview

The goal of this guide is to help project teams successfully comply with whole-building air leakage requirements. It provides an overview of energy code requirements, key decision points, responsibilities, and documentation needed to demonstrate compliance. ***It does not replace*** the energy code itself or provide detailed procedures for conducting air leakage testing or air barrier inspections. This resource represents BuildUp MN's own unofficial interpretation of the energy code and is advisory only and non-binding.

Why air leakage control matters

An airtight building envelope reduces the heating and cooling energy lost to uncontrolled air leakage, which lowers utility costs. It also improves occupant comfort and building durability by reducing drafts and temperature swings and protects building durability by limiting moisture movement that can lead to condensation and mold. Airtightness is also critical to proper HVAC system sizing and operation. HVAC systems are sized using an assumed whole-building air leakage rate, so achieving that rate keeps equipment within its intended operating range and ensures reliable performance in extreme weather.

Because air leakage has such a large effect on energy use and HVAC performance, related code requirements have become more stringent over time. With the adoption of the 2024 Minnesota Commercial Energy Code, project teams must now validate that continuous air barriers perform as intended through third-party testing or verification. Successful compliance with these requirements involves decisions that need to be made well before construction begins. The approach selected by the project team can affect the construction documents, specifications, project schedule, responsibilities, and coordination between the design and construction teams.

Start with the code requirements

The 2024 Minnesota Commercial Energy Code requires a continuous air barrier and establishes requirements for whole-building air leakage testing, including specific exceptions that provide an alternative approach to demonstrating compliance.

These requirements establish the framework for designing, installing, and verifying the building's air barrier. The project team should review the requirements and select a compliance approach early in design, then coordinate incorporation of the associated documentation, responsibilities, and verification into construction activities and project schedules.

Key code sections:

- **Section 5.4.3.1 Continuous Air Barrier (Mandatory)**
  The building envelope must include a continuous air barrier. The project must also demonstrate compliance with the applicable air leakage requirements.

- **Section 5.4.3.1.1 Whole-Building Air Leakage (Mandatory)**
  The code establishes requirements for demonstrating compliance with applicable air leakage performance criteria, including whole-building pressurization testing as the primary method. Buildings must be tested according to an appropriate standard and meet the required air leakage rate, subject to specific exceptions and alternative verification provisions.

- **Section 5.4.3.1.2 Continuous Air Barrier Design and Installation (Mandatory)**
  This section establishes requirements for the design and installation of the continuous air barrier to help ensure that the air barrier remains continuous across the building envelope, including at joints, transitions, and penetrations. It addresses how air barrier continuity is incorporated into the building design and carried through construction.

Choose a Compliance Approach

The project team must determine how the project will demonstrate air leakage compliance. Depending on the project size and type, compliance with whole-building air leakage requirements may be demonstrated by one of the following approaches:

Option 1: Air leakage testing (5.4.3.1.1, Exceptions 1, 2, and 4):

A qualified, independent third-party conducts a whole-building air leakage test. The measured air leakage rate of the building envelope must be less than 0.40 cfm/ft^2 at a pressure differential of 75 Pa.

Planning considerations may include:

- Identifying a qualified testing provider
- Choosing an appropriate test procedure (ASTM E779 or ASTM E1827)
- Incorporating testing requirements into project specifications and contracts
- Coordinating the timing of testing with completion of all air barrier components and construction activities
- In the event of a failure, allowing time to remediate identified deficiencies, document and submit corrective actions for review and approval by the code official and building owner
- Delivering testing (and retesting) reports to building owner and retaining with project records
- Submitting testing documentation to the code official (if requested)

Notable Exceptions to 5.4.3.1.1:

- **Exception 1**, for buildings over 50,000 ft^2 of gross conditioned floor area, pressurization testing can be conducted on portions of the building to calculate an area-weighted average air leakage rate.
- **Exception 2**, Where the measured air leakage rate exceeds 0.40 cfm/ft^2 but does not exceed 0.60 cfm/ft^2, the team can send a report to the code official and the building owner explaining how the leaks will be sealed. That report is enough to meet the requirement without retesting.
- **Exception 4**, For buildings or portions of buildings that contain Group R or Group I occupancies, individual units can be tested.

Option 2: Continuous air barrier design and installation verification program (5.4.3.1.1 Exception 3, 5.9.1.2):

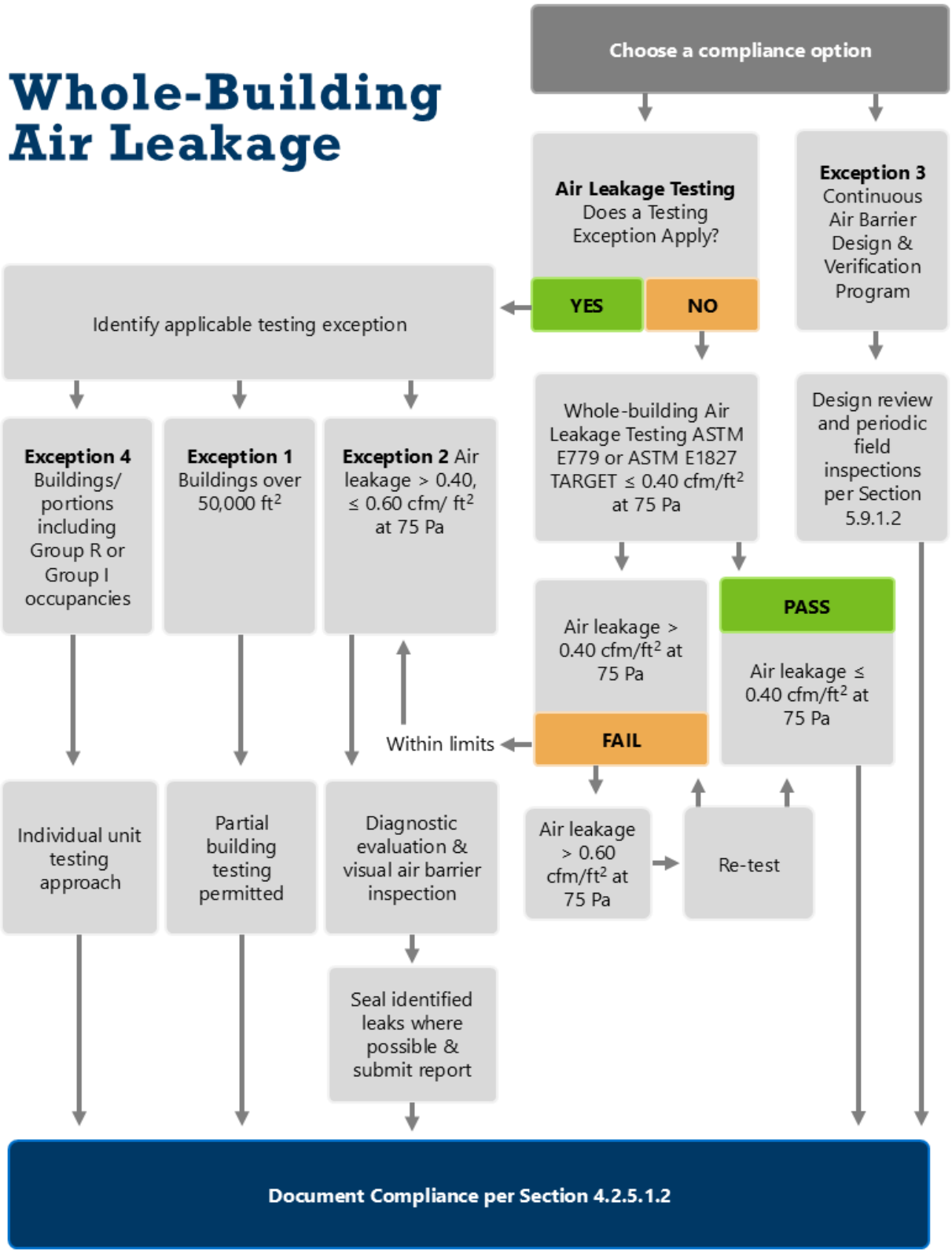
This exception allows project teams to comply with whole-building air leakage requirements without conducting air leakage testing. An independent third-party reviews the project documents during design and conducts inspections during the construction process to verify that the continuous air barrier has been appropriately designed and installed.

Planning considerations may include:

- Establishing inspection or verification responsibilities
- Incorporating testing requirements into project specifications and contracts
- Identifying the required third-party verifier
- Coordinating a design review
- Coordinating periodic field verification with construction activities
- Inspection of the air barrier while it remains accessible; document and repair noncompliant conditions as necessary to verify a continuous, sealed assembly that meets code requirements and resists the specified positive and negative building pressures
- Delivering design review and inspection results to the building owner
- Submitting verification documentation to the code official (if requested)

Project teams need to select a compliance approach early enough to incorporate the compliance path activities into the design, specifications, contracts, schedule, and team responsibilities.

Available compliance options for whole-building air leakage requirements.



Plan For Testing or Verification

Coordinate the air leakage compliance approach early and carry the associated requirements, responsibilities, and documentation through each phase of the project.

During early design, the project team should discuss the air leakage compliance approach as part of establishing the building's overall energy code compliance path (prescriptive or performance). Once the team selects an approach, integrate the associated requirements, activities, and milestones into the project schedule and coordinate them across design, permitting, procurement, and construction, and closeout.

Design - *Decide*

- Select the compliance approach.
- Coordinate with the building owner to confirm that a testing or verification provider is engaged under contract. The provider must be an independent third-party, not involved in the building's design.
- Incorporate the selected compliance approach and its requirements into the design documents.

Permitting - *Prepare*

- Document the selected compliance approach.
    - Identify the selected approach in the construction documents, typically on the code review drawing sheets, specifications or energy code legend.
        - As a best practice, include Section 07 27 00 – Air Barriers to identify code requirements for the building air barrier system, performance criteria, and requirements for continuity, transitions, accessories, installation, and field quality control.
        - If using whole-building air leakage testing, include Section 07 05 23 – Pressure Testing an Air-Barrier System for Airtightness to outline testing protocols and procedures.
    - Provide the total surface area of the air barrier; testing agency will utilize determination of the area for the pass/fail criteria.
    - As a best practice, include air barrier drawings that identify the location of the building air barrier in plans, detail and section views.
- Confirm roles and responsibilities with the owner, contractor, and testing or verification provider.
- Confirm that testing or verification activities appear in the relevant contracts and scopes of work.

Construction - *Verify*

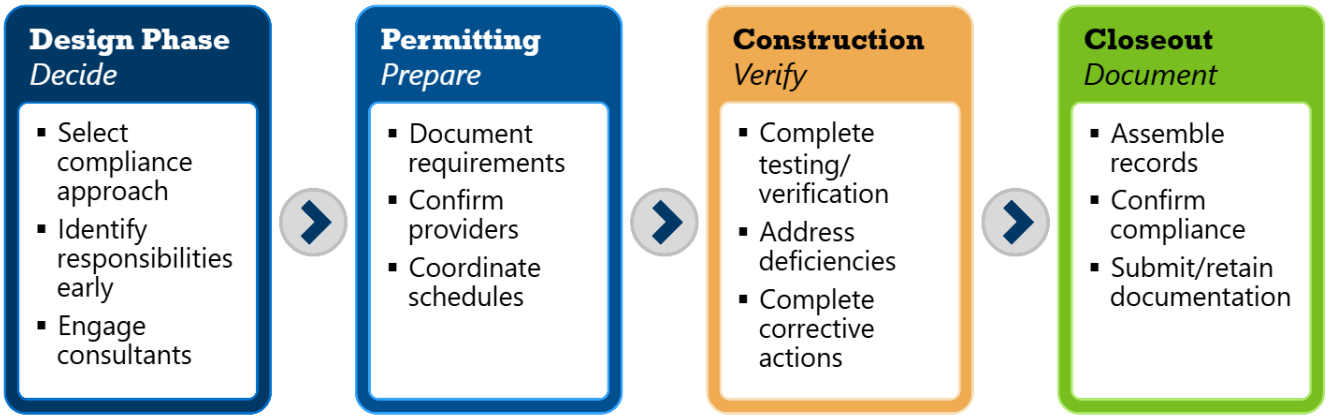
- Coordinate required periodic field inspections or testing with the construction schedule and relevant project participants.

- Document identified deficiencies and corrective actions.
    - Track outstanding deficiencies through resolutions.
- Maintain testing and verification records throughout construction.

Closeout - *Document*

- Coordinate with the testing or verification provider to ensure they compile the required final documentation in accordance with the applicable code requirements (Section 4.2.5.1.2) and provide it to the building owner.
- Provide compliance documentation to the code official upon request.

Use the Air Leakage Planning Roadmap to see what needs to happen throughout design, permitting, construction, and closeout.



Define Roles and Responsibilities

Successful air leakage compliance depends on several members of the project team working together. Assign roles before work starts so every task has a clear owner and responsibilities are understood.

Project role	Potential responsibilities
Owner / Owner's Representative	Establish project requirements; ensure appropriate providers are included in project scope.
Architect / Design Team	Identify air leakage compliance approach; incorporate requirements into construction documents.
General contractor	Implement construction document air barrier requirements; coordinate construction sequencing; communicate requirements to subcontractors; coordinate verification/testing.

Third-party verifier	Review design and conduct required field verification; facilitate documentation of deficiency remediation; satisfy code documentation requirements. The provider must be an independent third-party, not involved in the building's design and typically under contract with the building owner.
Testing agency	Conduct required air leakage testing and provide testing documentation to owner; if failure occurs, perform diagnostics to identify deficiencies and facilitate documentation of remediation.

Roles & Responsibilities Matrix

Use the matrix to identify who is responsible for each major air leakage compliance activity.

Activity	Owner	Architect	GC	Verifier	Testing Agency
Select approach	□	□	●	●	●
Engage qualified provider	□	□	●		
Air barrier design review		□	●	□	
Construction coordination		□	□	□	●
Field verification		●	□	□	
Air leakage testing		●	□		□
Corrective actions		●	□	□	□
Final documentation	●	□	□	□	□

Lead □ **Support** ●

Responsibilities vary by project. Use this matrix to identify and document who is responsible for each activity.

Document Compliance

Document air leakage requirements in the construction documents, then retain records demonstrating completed testing or verification.

The project team should maintain documentation showing how the project addressed air leakage requirements. Depending on the selected compliance approach and project requirements, documentation may include the following:

Construction Documents (at Time of Permit Application)

- **Section 4.2.5.1.1: Information on Building Permit Application**
    - Selected air leakage compliance approach
    - Identification of the verification/testing provider, as applicable
    - Air barrier design details clearly showing the location of the air barrier and how continuity is maintained

Testing and Verification Documentation (After Testing/Verification)

- **Section 4.2.5.1.2: FPT and Verification Documentation**
    - Inspection, testing reports and verification results
    - Air barrier design review documentation, where applicable
    - Deficiency and corrective action documentation, where applicable
    - Final verification documentation, including provider certification of completed testing and verification
    - A plan for completing any deferred testing, including required conditions, where applicable

Completed testing and verification documentation must be provided to the building owner and retained with project records. A copy must be submitted to the code official if requested.

Use BuildUp MN's Energy Code Legend Template as a starting point for documenting key energy code measures in a clear, condensed format.

Common pitfalls and strategies to avoid them

Many air leakage compliance challenges can be avoided through early planning, clear communication, and consistent documentation. The following examples highlight where issues can arise and how project teams can address them.

The provider has not been hired

If the project team does not identify verification or testing needs early, finding a qualified provider and coordinating required activities after construction has started can be difficult. Late planning may also result in incomplete or inaccurate plan submissions or require the project team to revise its compliance approach.

- **Strategy:** Identify the applicable requirements and coordinate with the owner to ensure they engage the testing or verification provider early enough to inform the compliance approach, project documentation, responsibilities, and schedule.

Testing is scheduled too late in construction

Air leakage testing must occur at an appropriate stage of construction. If the building is not ready, the testing provider may need to postpone testing. If testing reveals deficiencies late in the project, corrective work can delay project completion.

- **Strategy:** Coordinate with the testing provider and construction team to schedule testing after completion of the air barrier system and as soon as practical, allowing time to address deficiencies before project closeout.

Periodic inspection is not clearly defined

Early coordination with the code official can help establish expectations for the number and timing of observations. Because cladding can conceal the air barrier as construction progresses, observations must be aligned with the construction schedule. "Periodic inspections" generally implies more than one inspection but less than continuous observation. However, Section 5.1.9.2 requires inspections while the continuous air barrier remains accessible, which could be interpreted as requiring inspection of the entire assembly. The project's size, complexity, and schedule should inform the frequency of inspection. The project team should coordinate observations to cover as much of the air barrier as practical, with particular attention to locations where discontinuities commonly occur, including wall-to-foundation transitions, parapets, inside and outside corners, entrances, canopies, and eaves as examples. Inspection milestones should be established with the construction team and incorporated into the project schedule so critical areas are not concealed before they can be reviewed.

- **Strategy:** Confirm inspection expectations with the code official and verification provider early. Coordinate inspection expectations and milestones with the construction team and incorporate them into the project schedule so the provider can review critical air barrier transitions before they are concealed.

The air barrier is not clearly documented

If the drawings and specifications do not clearly identify the air barrier and detail its continuity, the construction team may interpret the requirements inconsistently. For projects using the Section 5.9.1.2 verification program, unclear documentation can also make the required design review more difficult and time-consuming and will lead to confusion during construction about how to maintain continuity.

- **Strategy:** Clearly identify the air barrier in the drawings and specifications, including how continuity will be maintained at transitions, penetrations and other critical details. Coordinate with the verification provider as needed to ensure the documentation supports the required design review and construction implementation.

Requirements are lost during handoff

As the project moves from the architect to the contractor and subcontractors, the team may lose sight of the original design intent. Air barrier requirements should be clearly communicated through drawings, specifications, meetings, and construction coordination. Field inspection can become difficult, cumbersome, and time-consuming if requirements are lost or changed after plans are approved.

- **Strategy:** Communicate air barrier requirements and responsibilities through drawings, specifications, project meetings, and construction coordination. Ensure the contractor, relevant subcontractors and verification provider understand the applicable requirements and that any approved changes are communicated to everyone responsible for implementation.

Documentation is treated as an afterthought

If the project team does not establish documentation requirements and assign responsibility for maintaining records early, important information may be missed or difficult to locate at closeout.

- **Strategy:** Confirm documentation requirements and assign responsibility for collecting, maintaining, and submitting records. Coordinate with the testing or verification provider to obtain test results, verification records, identified deficiencies, corrective actions, and other required compliance documentation throughout construction.

Whole-building testing and continuous air barrier verification are confused

Section 5.9.1.2 describes an alternative continuous air barrier design and installation verification program. Project teams may misinterpret this provision as an additional requirement when reading it without first establishing how it relates to the whole-building air leakage testing requirements.

- **Strategy:** First identify the applicable requirements and exceptions in Section 5.4.3.1.1. Next, confirm which compliance approach applies to the project and communicate that approach to the project team and code official. Projects using whole-building air leakage testing do not also need to complete the Section 5.9.1.2 verification program.

The required design review is not completed early enough

For projects using the Section 5.9.1.2 verification program, the required design review must occur early enough to inform the design and project documentation. If the team overlooks this step, the project may face delays or need to reassess how to demonstrate compliance.

- **Strategy:** Confirm the required design review, its timing, and the provider's role during design. If the design review has not occurred, consult the verification provider and code official to determine the appropriate next steps and whether the project can still complete the required verification or needs to pursue whole-building testing.

Additional resources

Use these resources for additional information and detailed requirements.

Minnesota compliance resources

- BuildUp MN Energy Code Legend Template
  Provides an editable starting point for documenting energy-code requirements on the drawings.
- BuildUp MN Resource Library
  Includes additional compliance guides, graphics, checklists, and training materials.

Whole-Building testing standards and protocols

- **ASTM E779** — Standard Test Method for Determining Air Leakage Rate by Fan Pressurization.
- **ASTM E1827** — Standard Test Methods for Determining Airtightness of Buildings Using an Orifice Blower Door.
- **ASTM E3158** — Standard Test Method for Measuring the Air Leakage Rate of a Large or Multizone Building - Large commercial and complex building resource.
- **ASTM E1186** — Standard Practices for Air Leakage Site Detection in Building Envelopes and Air-Barrier Systems - Diagnostic evaluation and locating leakage paths resource.
- U.S. Army Corps of Engineers Air Leakage Test Protocol for Building Envelopes, Version 3
  Provides detailed procedures for planning, preparing, conducting and reporting large-building air-leakage tests.

Industry guidance and training

- Air Barrier Association of America Resource Library
  Includes air-barrier specifications, technical articles, testing guidance and quality-assurance resources.