



*Greater efficiency supports patient care.*

## CHECK AND REPAIR THERMAL ENVELOPE

*All ECM content was independently developed and reviewed to be vendor-, product-, and service provider-neutral.*

### DESCRIPTION

Improve energy efficiency and reduce the risk of compromised indoor air quality by regularly inspecting the building thermal envelope for gaps, cracks, and faulty or missing insulation and addressing any problems found.

### PROJECT TALKING POINTS

- Openings in the thermal envelope waste energy and introduce health and safety risks by:
  - Allowing heating and cooling to escape, wasting energy.
  - Allowing unfiltered air into the building.
  - Compromising pressure relationships of affected rooms.
  - Providing pathways for pests to enter the building.
  - Allowing mold and mildew growth in concealed, moist areas.
- Diagnostic tools such as thermal imaging cameras can help identify weak components of the thermal boundary.
  - Combining a thermal imaging camera with the use of a blower door can help identify even the smallest weakness in the envelope.

### TRIPLE BOTTOM LINE BENEFITS

- **Cost benefits:** Sealing leaks can provide significant energy savings, which result in cost savings.
- **Environmental benefits:** Reducing energy use always reduces emissions.
- **Social Benefits:** Depending on the improvements made to the envelope, thermal comfort may be improved, enhancing patient and staff experience.

### COMMISSIONING CONNECTIONS

The ASHE [Health Facility Commissioning Guidelines](#) and accompanying [Health Facility Commissioning Handbook](#) are good information sources for undertaking this performance improvement measure.

- 3.13 Facilitate Pressure Testing
- 3.13.1 Code Requirements – Current codes require controlled pressure relationships between critical health care spaces such as operating rooms, procedure rooms, airborne

infection isolation (All) Rooms, and between protective environments (PE) rooms and adjacent spaces.

- 3.13.4 Steps for Testing the Building Envelope – Controlling building pressure is also critical to efficient and comfortable building operation. To ensure the building envelope is properly sealed, the commissioning process should include building pressure testing. The recommended pressure testing process for the building envelope includes these steps:
  1. Close all doors and opening to the building.
  2. Verify that all exhaust fans are operating at the proper airflow.
  3. Increase the air-handling unit outdoor airflow until the building pressure relationship is positive 0.01 in. w.g. The building pressure relationship should be determined using a properly installed building pressure transmitter that measures the average differential pressure at the ground-level entrances to the building.
  4. Record the outdoor airflows, building pressure, and outdoor air temperature.
  5. If the outdoor airflow is excessive, the contractor [during construction] should identify and seal envelop leaks.
  6. The testing and sealing process is then repeated until the amount of outdoor airflow is acceptable.
- 3.14 Review Record Drawings – The health facility commissioning authority (HFCxA) should review the record drawings with O&M personnel. The HFCxA should identify know discrepancies between these documents and as-installed conditions for resolution.

## **PURCHASING CONSIDERATIONS**

- Consider the return on investment for selecting different insulation types. Initial cost may be higher for certain types, but the payoff in energy and occupant comfort may outweigh the upfront capital.

## **HOW-TO**

1. Create a team including the commissioning agent, building engineer, infection control, and building maintenance personnel.
2. Develop a thermal envelope inspection work plan, schedule, and documentation deliverables, assigning roles and responsibilities to appropriate team members.
3. Visually inspect the current state of the building thermal envelope. At a minimum, document deterioration, evidence of moisture penetration, and/or evidence of pests in the following:
  - Roof assemblies
  - Vapor barriers
  - Diffusion retarders
  - Air barrier systems
  - Rain-screen layers
  - Flashing
  - Cladding and siding
  - Windows
  - Curtain-wall assemblies
  - Doors (entrance, exit, deck, and roof access doors)
  - Thermal bridges

- Utility penetrations
4. In locations where the thermal envelope appears to have been breached, conduct testing for air leakage using blower door and/or infrared methods.
  5. Seal cracks and leaks to prevent excessive air infiltration/exfiltration, heat gains/losses, and moisture penetration.
  6. Install insulation in strategic locations to reduce unwanted thermal gains or losses.
  7. Coordinate envelope inspections with performance improvement measures.
  8. Consider installing sunscreens on exterior windows or curtain walls where solar heat frequently increases the temperature of specific areas.

## TOOLS

- California Commissioning Collaborative
  - [Existing Building Commissioning Toolkit](#): Includes a savings calculation tool, energy analysis tool as well as relevant guidelines.

If you have an ROI tool, calculator, or similar resources to share, please [contact us](#) or participate in the discussion below.

## REGULATIONS, CODES AND STANDARDS, POLICIES

- American Society for Healthcare Engineering ([www.ashe.org](http://www.ashe.org))
  - [Health Facility Commissioning Guidelines](#)
- American Society of Heating, Refrigerating and Air-Conditioning Engineers ([www.ashrae.org](http://www.ashrae.org))
  - [Guideline 0-2005: The Commissioning Process](#)

## CROSS REFERENCES: LEED

- [LEED for Existing Buildings: Operations + Maintenance](#)
  - Energy & Atmosphere Prerequisite 1: Energy Efficiency Best Management Practices—Planning, Documentation, & Opportunity Assessment
  - Energy & Atmosphere Prerequisite 2: Minimum Energy Performance
  - Energy & Atmosphere Credit 1: Optimize Energy Efficiency Performance
  - Energy & Atmosphere Credit 2.1: Existing Building Commissioning—Investigation & Analysis
  - Energy & Atmosphere Credit 2.1: Existing Building Commissioning—Implementation
  - Energy & Atmosphere Credit 3.1: Performance Measurement—Building Automation System
  - Energy & Atmosphere Credit 5: Measurement & Verification
- [LEED for Healthcare: New Construction and Major Renovations](#)
  - Energy & Atmosphere Prerequisite 1: Fundamental Commissioning of Building Energy Systems
  - Energy & Atmosphere Prerequisite 2: Minimum Energy Efficiency Performance
  - Energy & Atmosphere Credit 1: Optimize Energy Efficiency Performance

- Energy & Atmosphere Credit 3: Enhanced Commissioning
- Energy & Atmosphere Credit 5: Measurement and Verification

## ECM SYNERGIES

- [Establish baseline for current energy consumption.](#)
- [Retro-Commission HVAC controls.](#)
- [Practice preventive maintenance of major HVAC equipment.](#)

## EDUCATION



### [Energy University Courses](#)

The American Society for Healthcare Engineering (ASHE) has approved the courses below for continuing education credits. ASHE issues credits in quarter-hour increments, and a total of 10 contact hours equals 1 continuing education credit.

#### **Industrial Insulation III: Inspection and Maintenance**

#### **Industrial Insulation II: Design Data Calculations**

## RESOURCES

- U.S. Department of Energy, Energy Efficiency & Renewable Energy Building Technologies Program tools:
  - [Building Envelope Critical to High-Performance Hospitals](#)
  - [Energy Smart Hospitals: Retrofitting Existing Facilities](#)
  - [Hospitals Realize Fast Paybacks from Retrofits and O&M Solutions](#)
- U.S. Environmental Protection Agency (EPA), ENERGY STAR Tools:
  - [Energy Star Building Upgrade Manual](#)
- National Institute of Building Sciences ([www.nibs.org](http://www.nibs.org))
  - [HVAC Integration of the Building Envelope](#), Whole Building Design Guide
- California Commissioning Collaborative
  - [California Commissioning Guide: Existing Buildings](#)
- U.S. Department of Energy, Energy Efficiency & Renewable Energy Building Technologies Program tools:
  - [Commissioning Existing Hospital Buildings Aids Peak Energy Performance](#)

**ECM DESCRIPTOR:** Energy

**LEVEL:** Beginner

**CATEGORY LIST:**

- Building and Maintenance

- Commissioning
- Envelope

**IMPROVEMENT TYPE:**

- Commission/Retro-Commission
- Retrofit/Renovations
- New Buildings
- Operations and Maintenance

**ECMATRIBUTES:** Repair or Optimize Existing Systems (fix what you have)

**DEPARTMENT:** Engineering/Facilities Management

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