COMMERCIAL ENERGY CODE
BUILDING ENVELOPE
2015 IECC & ASHRAE 90.1 -2013

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www.southface.org

https://www.southface.org/resources/georgia-energy-code-resources/

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ABOUT SOUTHFACE

Building a Regenerative Economy, Responsible Resource Use
& Social Equity Through a Healthy Built Environment for All
LEARNING OBJECTIVES

• Learn more about the building envelope
• Learn about ducted vs. non-ducted return plenums

ESTABLISHING THE BUILDING ENVELOPE
DESIGNING THE AIR BARRIER

• Air barrier components must be identified or noted in construction documents
• Joints, intersections, and penetrations of air barrier components (incl. lighting fixtures) detailed
• Air barrier must extend over all surfaces of building envelope at lowest floor, exterior walls, and ceiling or roof
• It must be designed to resist pressures changes from wind, stack effect, and mechanical ventilation

Acceptable air barrier materials/assemblies
• 3/8" plywood & OSB
• ½" XPS & poly-iso
• ½" Gyp board
• ½" Cement board
• Built up, modified bit, & adhered single-ply roof membranes
• ½" cement parge, stucco or gyp board
• Concrete
• Sheet metal
• 1" (1.5") Closed cell foam
• 4.5" Open cell foam
• CMU walls – painted/grouted
• Sheet steel/aluminum

AIR BARRIER INSTALLATION

The following areas are to be wrapped, sealed, caulked, gasketed, or taped:
• Joints around fenestration and door frames (both manufactured and site-built)
• Junctions between walls and
  • Foundations
  • Building corners
  • Roofs or ceilings
• Penetrations for roofs, walls, and floors
• Building assemblies used as ducts or plenums
• Joints, seams, connections between planes, and other changes in continuous air barrier materials
THE DATA

Southface’s research indicated that buildings without clearly defined envelopes were three times leakier than those with a well-defined envelope. There was no apparent correlation between age, type of construction, location, etc.

RETURN PLENUMS

Ducted vs. non-ducted
IMPACTS OF NON-DUCTED RETURN AIR PLENUMS

- Reduced HVAC system costs of about 10% to 20% of the total HVAC system cost.
- Reduced efforts for coordination of overhead utilities.
- Assumed reduced fan energy costs due to lower pressure drop of the plenum return system.

PROBLEMS OF NON-DUCTED RETURN AIR PLENUMS

What could possibly go wrong here?
PROBLEMS OF NON-DUCTED RETURN AIR PLENUMS

- Cavities above suspended ceilings are used as equipment tunnels and chases causing major air leakage.
- These areas are highly (de)pressurized, which exacerbates the air leakage.
- They are often adjacent to unconditioned spaces (storage, plant, warehouse, etc.).

WATER, WATER EVERYWHERE

Roof leak or something else?
C403.2.9 Duct and plenum insulation and sealing

Supply and return air ducts and plenums shall be insulated with a minimum of R-6 insulation where located in unconditioned spaces and where located outside the building with a minimum of R-8. Where located within a building envelope assembly, the duct or plenum shall be separated from the building exterior or unconditioned or exempt spaces by a minimum of R-8 insulation.

IAQ CHALLENGES

- Ceiling insulation **shall not** be installed on a suspended ceiling with removable ceiling panels
BUILDING ENVELOPE: ROOFS

Note: Energy codes ban insulation on top of suspended ceiling
(90.1 section 5.8.1.8; IECC section C402.2.2)

- **Unacceptable Design:**
  Batts over suspended ceiling tiles
  - Poor pressure boundary caused by tile grid, porous tiles, lighting vent holes
  - Poor durability - maintenance disrupts batts, exposure to fiberglass dust
  - Many thermal breaks due to ductwork, light fixtures, grid, and support wires

BUILDING ENVELOPE EXAMPLE: ROOFS

- **Unacceptable Design:** Batts over suspended ceiling tiles
**BUILDING ENVELOPE EXAMPLE: ROOFS**

- **Okay Design:**
  Insulation above hard ceiling
  - Example: taped gypsum; similar to residential construction
  - Ductwork is inside but must limit and seal HVAC, plumbing, and electrical penetrations through pressure boundary
  - Thermal bridging from metal roof trusses

- **Very Good Design:**
  Spray foam insulation against underside of roof deck
  - Minimal thermal breaks and continuous pressure boundary
  - HVAC equipment and ductwork located within conditioned space
  - Good durability
  - Retrofit option
BUILDING ENVELOPE EXAMPLE: ROOFS

- Best Design:
  Rigid insulation above roof deck
  - No thermal breaks and continuous pressure boundary
  - HVAC equipment and ductwork located within conditioned space
  - Good durability

HEALTH CARE FACILITIES

- The Facility Guidelines Institute standards were adopted in Georgia in 2018.
- Those standards require ducted returns in many healthcare-related facilities to reduce the spread of infections.
CASE STUDIES

CASE STUDY #1

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CASE STUDY #2

• Where is the air barrier?

CASE STUDY #3

• Where is the air barrier?
• Where is the return plenum?
CONCLUSIONS

“The bitterness of poor quality remains long after the sweetness of low price is forgotten.”
~ Benjamin Franklin