

National Association of Home Builders

# Ducts in Conditioned Space- Sort of?

## The Energy Code Perspective

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# What are Buried Ducts?



# Buried Ducts are...

## Ducts Buried within Attic Insulation



*Image courtesy of Home Innovation Research Labs<sup>1</sup>*

# Why the Need for the Code Change?

- Some Jurisdictions do not allow builders to bury ducts
  - Concerns about condensation
  - Concerns about reduced efficiency
- There was no guidance in the code on how to address condensation
- No credit for the energy efficiency provided by buried ducts was clearly provided in the code
- There was a desire to have an alternate equivalence to a duct being in conditioned space.



# Buried Ducts In Attic Insulation Changes to the 2018 IECC

- Three Code Change Proposals- Three purposes
- RE99 – Explicitly allow buried ducts
- RE110 – Get performance credit for buried ducts
- RE100 – Set alternate criteria for ducts in conditioned space

**RE99-16**  
R403.3.6 (New) [IRC N1103.3.6 (New)], R403.3.6.1 (New) [IRC N1103.3.6.1 (New)]


**RE100-16**  
R403.3.6 (New) [IRC N1103.3.6 (New)], R403.3.6.1 (New) [IRC N1103.3.6.1 (New)]

**RE110-16**  
R403.3 (IRC N1103.3), R403.3.6 (New) [IRC N1103.3.6 (New)], R403.3.6.1 (New) [IRC N1103.3.6.1 (New)]

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2015 International Energy Conservation Code

National Association of Home Builders



# Push for improved energy efficiency- Builders need to get credit for the increased efficiency

Codes continue to drive to higher efficiency with push to net zero homes on the horizon.

Duct delivery efficiency can be improved in some cases....

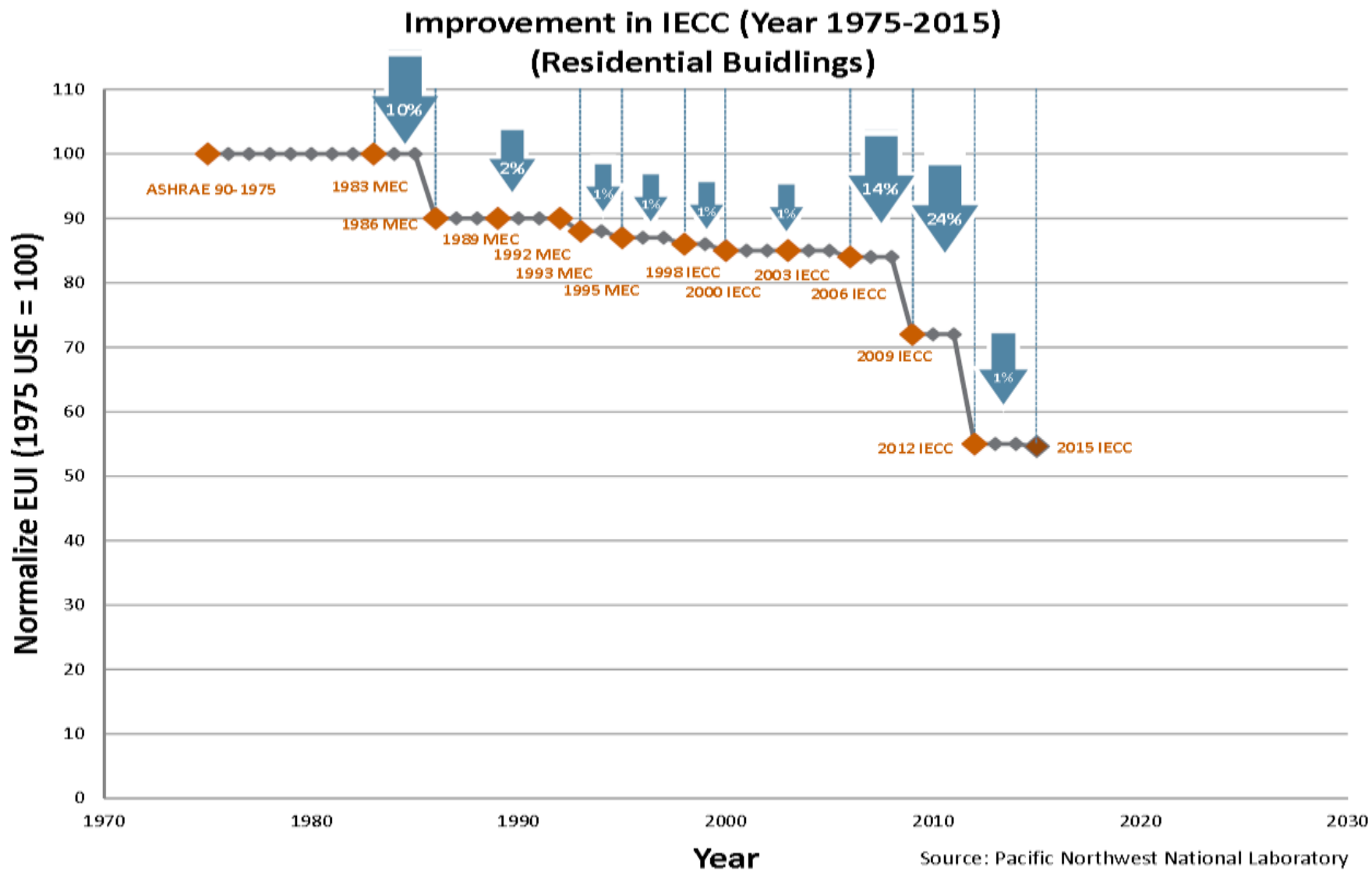
-However, this can have significant impact on the building design- especially in non-basement markets.

-Other practices exist to achieve comparable duct performance, but may also involve redesign of the home or different trade coordination.

Burying ducts has been researched to be an energy efficient approach for ductwork in the attic, and can be done through small modifications of current practice and at low installed cost.



# Energy Code Efficiency Improvements



# Ducts buried under insulation in a vented attic is a viable builder practice (option)

- Ducts placed on the ceiling drywall or over the bottom truss chords.
- Attic insulation covers (buries) the ducts.
- Reduces thermal losses from ducts located in vented attics.
- Must consider condensation in humid climates



*Image courtesy of Home Innovation Research Labs<sup>1</sup>*

<sup>1</sup>Home Innovation Research Labs. TechSpecs A Builder's Blueprint for Construction Technologies (January 6, 2017). HVAC Ducts Buried Within Ceiling Insulation in a Vented Attic (Buried Ducts).



# Buried ducts have been explicitly approved as an option in the 2018 IECC

Prior code editions did not disallow the use of buried ducts, but did not specify conditions for performance and compliance

2018 code now recognizes the practice of buried ducts, specifying:

- Insulated duct R-value by climate zone (moisture concerns)
- Duct coverage level with attic insulation (energy performance)
- Energy credit options within modeling software

# Code Requirements: Ducts buried within ceiling insulation

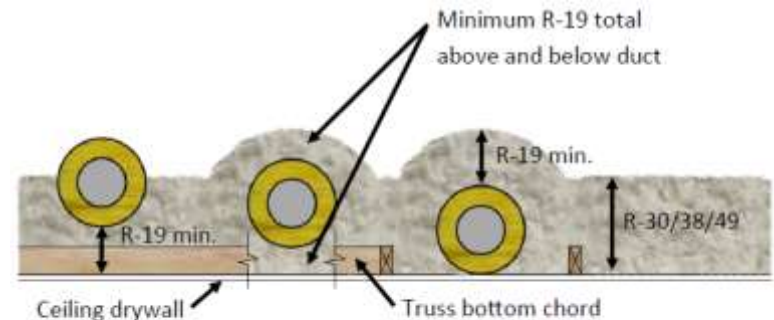
*Ducts may be partially or fully buried under attic insulation.*

## 1. Duct Insulation:

- Minimum of R-8 for supply and return ducts; however...
- CZ's 1A, 2A, 3A require R-13 for buried supply ducts.

## 2. Ceiling Insulation:

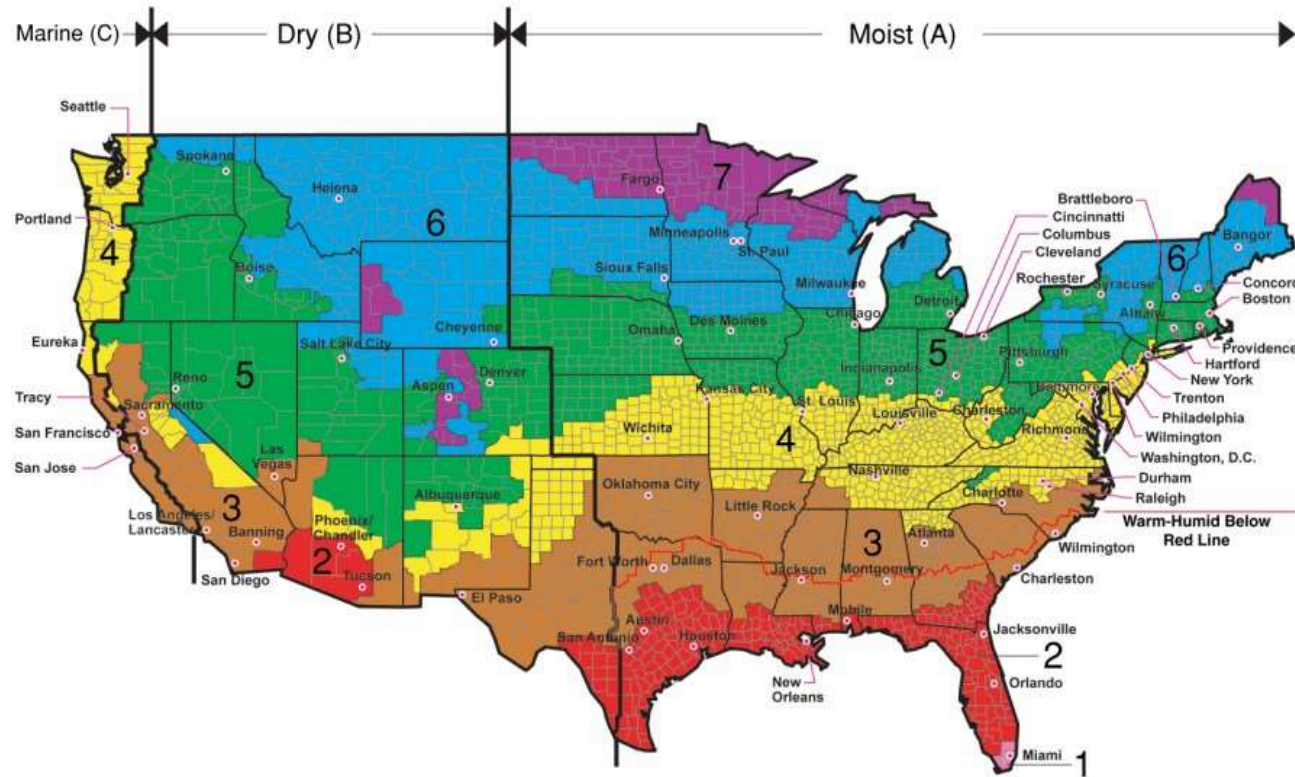
- Above and below duct should total R-19, not including duct R-value



**Figure 2.** Example partially buried duct (left), buried duct across the truss bottom truss chord (middle), and buried duct on the ceiling (right).

<sup>1</sup>Home Innovation Research Labs. TechSpecs A Builder's Blueprint for Construction Technologies (January 6, 2017). HVAC Ducts Buried Within Ceiling Insulation in a Vented Attic (Buried Ducts).

# Moisture Map



Climate Zones 1A, 2A and 3A

All buried ducts must be R-13 or greater

All other Climate Zones

All buried ducts must be R-8 or greater

# RE99- Ducts Buried Within Ceiling Insulation

**R403.3.6 Ducts buried within ceiling insulation.** Where supply and return air ducts are partially or completely buried in ceiling insulation, such ducts shall comply with all of the following:

1. The supply and return ducts shall have an insulation *R*-value not less than R-8.
2. At all points along each duct, the sum of the ceiling insulation *R*-value against and above the top of the duct, and against and below the bottom of the duct, shall be not less than R-19, excluding the *R*-value of the duct insulation.
3. In *Climate Zones* 1A, 2A and 3A, the supply ducts shall be completely buried within ceiling insulation, insulated to an *R*-value of not less than R-13 and in compliance with the vapor retarder requirements of Section 604.11 of the *International Mechanical Code* or Section M1601.4.6 of the *International Residential Code*, as applicable.

**Exception:** Sections of the supply duct that are less than 3 feet (914 mm) from the supply outlet shall not be required to comply with these requirements.

*2018 IECC- International Code Council*

# Code Requirements: Deeply buried duct effective R-value

*Ducts installed as “deeply buried” may claim an effective R-value of 25.*

## 1. General requirements/duct insulation:

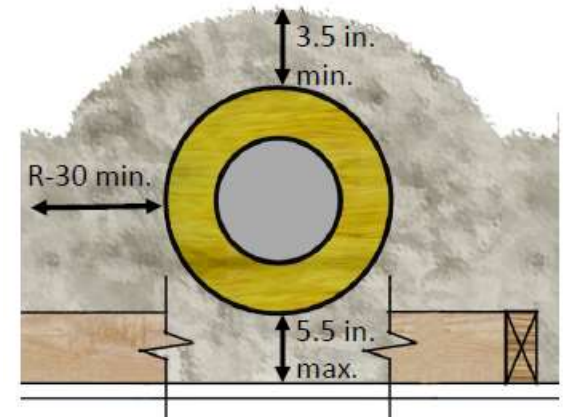
- Follow general requirements and duct insulation described previously

## 2. Duct Location:

- On or within 5.5” of ceiling drywall

## 3. Ceiling Insulation:

- R-30 surrounding duct
- Top of the duct is 3.5” below insulation



*Image courtesy of Home Innovation Research Labs<sup>1</sup>*

<sup>1</sup>Home Innovation Research Labs. TechSpecs A Builder's Blueprint for Construction Technologies (January 6, 2017). HVAC Ducts Buried Within Ceiling Insulation in a Vented Attic (Buried Ducts).

# RE110- Deeply Buried Ducts

## R403.3.6.1 Effective *R*-value of deeply buried ducts.

Where using a simulated energy performance analysis, sections of ducts that are: installed in accordance with Section R403.3.6; located directly on, or within 5.5 inches (140 mm) of the ceiling; surrounded with blown-in attic insulation having an *R*-value of R-30 or greater and located such that the top of the duct is not less than 3.5 inches (89 mm) below the top of the insulation, shall be considered as having an effective duct insulation *R*-value of R-25.

2018 IECC- International Code Council



# Code Requirements: Ducts located in conditioned space

*Buried ducts may be considered ducts in the conditioned space when installed as:*

## 1. General requirements/duct insulation:

- Follow general requirements and duct insulation describe previously

## 2. Air Handler Location:

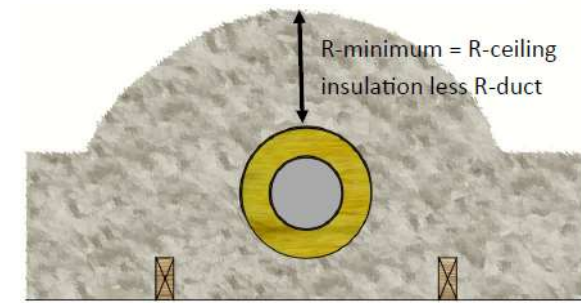
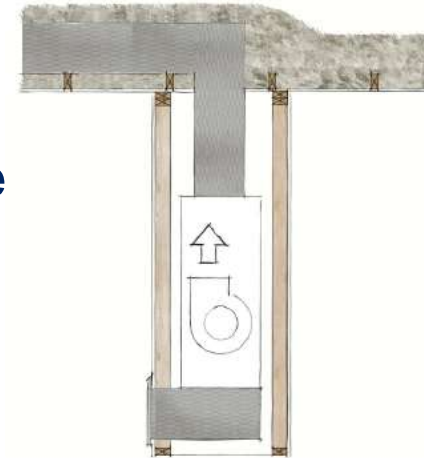
- Within the conditioned space

## 3. Duct Leakage:

- Rough-in or post-construction total system leakage to outside of 1.5cfm/100 sf CFA

## 4. Ceiling Insulation:

- Insulation R-value against and above the duct  $\geq$  ceiling R-value – duct R-value



# RE100- Ducts in Conditioned Space

**R403.3.7 Ducts located in conditioned space.** For ducts to be considered as inside a conditioned space, such ducts shall comply with either of the following:

1. The duct system shall be located completely within the continuous air barrier and within the building thermal envelope.
2. The ducts shall be buried within ceiling insulation in accordance with Section R403.3.6 and all of the following conditions shall exist:
  - 2.1. The air handler is located completely within the *continuous air barrier* and within the building thermal envelope.
  - 2.2. The duct leakage, as measured either by a rough-in test of the ducts or a post-construction total system leakage test to outside the building thermal envelope in accordance with Section R403.3.4, is less than or equal to 1.5 cubic feet per minute (42.5 L/min) per 100 square feet (9.29 m<sup>2</sup>) of conditioned floor area served by the duct system.
  - 2.3. The ceiling insulation *R*-value installed against and above the insulated duct is greater than or equal to the proposed ceiling insulation *R*-value, less the *R*-value of the insulation on the duct.

# Implementing buried ducts with today's code

The 2018 IECC has just been published, jurisdictions currently are on previous code versions.

Buried ducts can still be implemented using a provision for alternative compliance.

- IRC R104.11 Alternative materials, design, and methods of construction and equipment
- Approval through a building official- typically building officials are friendly to options included in newer editions

# Performance Path or ERI Compliance

The 2018 code, as described, enables reduced energy usage options that can be claimed toward compliance when using the Performance Path or the Energy Rating Index

Based on installation, this includes:

- A deeply buried R-8 duct can use an R-25 exposed duct when performance modeling
- A duct system that is covered with sufficient insulation and leaks less than 1.5 cfm/100ft<sup>2</sup> may model the ducts in conditioned space.

# Energy Simulations Using the Performance Path and ERI

Configuration	Energy Rating Index Path		IECC Performance Path	
	A	B	A	B
Attic Exposed (R-8 exposed, 4% leakage)	68	71	0%	0%
Buried Ducts (eff R-25 exposed, 4% leakage)	66	69	2%	3%
Buried Ducts (eff R-25 exposed, 3% leakage)	65	68	4%	4%
Buried Ducts (eff R-25 exposed, 2% leakage)	64	67	6%	6%
Buried Ducts (eff R-25 exposed, 1% leakage)	63	67	8%	7%
Buried Ducts (eff R-25 exposed, 0% leakage)	62	66	10%	8%
Ducts In Conditioned Space (testing exemption)	62	68	-6%	-3%
Ducts In Conditioned Space (tested 0 leakage)	62	64	-2%	-3%

# Conclusions

The 2018 IECC has improvements that will allow buried ducts

Code changes also give energy efficiency credit for deeply buried ducts- around 3% or 2 ERI points

Properly installed ducts can be considered “in conditioned space” which works in the ERI path, however, caution should be used when considering this option in the performance path. It may be beneficial to consider the ducts outside conditioned space.





**Thank You.**

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