



### What are buried ducts?

“Buried ducts” refers to ducts entirely or partly buried in attic/ceiling insulation. While the concept is not new, the prescriptive requirements in the 2018 International Energy Conservation Code (IECC) and in the 2018 WSEC-Residential (2018 WSEC-R) to achieve Option 4.1 energy credits are new and, unfortunately, can be confusing.

Section R403.3.6 defines partially or completely buried ducts in ceiling insulation and Section R403.3.6.1 further describes “deeply buried ducts,” as follows:

**Section 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.

**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.

**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.

### What does Section R403.3.6 mean?

The first requirement of Section R403.3.6 is clear: The duct must have a minimum of R-8 duct insulation all around it.

The second requirement results in three possible cases, not all of which meet the requirements of “deeply buried ducts.” Note that the ceiling insulation may be both above and below the duct provided the total is not less than R-19.

The three cases are:

- **Case 1:** Partially buried ducts with R-19 ceiling insulation below the duct. No ceiling insulation above the duct.  
Case 1 does not meet the requirements of “deeply buried ducts” in Option 4.1 in our opinion.
- **Case 2:** Buried ducts with ceiling insulation both on top **and** under the duct totaling R-19. The amount above and below may vary, as long as the sum is at least R-19.  
Case 2 meets the requirements of Option 4.1 provided ceiling insulation surrounds the duct, the bottom of the duct is no more than 5.5 inches above the ceiling, and there are at least 3.5 inches of ceiling insulation over the top of the duct.
- **Case 3:** R-19 ceiling insulation above the duct with the bottom of the duct in contact with the ceiling sheetrock.  
Case 3, with all of the insulation on top of the duct, is preferred for ducts that run parallel to ceiling trusses or joists.



### Does Option 4.1 have typos? Yes.

There are two typos in the description of Option 4.1 in 2018 WSEC-R.

First, Option 4.1 erroneously refers to Section R403.3.7. The question is: Was the intended reference Section R403.3.6 or the more strict description in Section R403.3.6.1? The State Building Code Council has not yet issued a correction of the typo or a clarification of what is intended by the phrase “deeply buried ducts.” Until a clarification is provided, we note that the text of Option 4.1 specifies “deeply buried ducts” and Section R403.3.6.1 also describes “deeply buried ducts.” This lends support to the intended reference being Section R403.3.6.1.

The second error is that most of the text pertains to Option 4.2, not 4.1. Everything below the reference to Section R403.3.6.1 (corrected) should be relocated to Option 4.2.

Therefore, it is our opinion that Option 4.1 should be corrected to read **in full**:

All supply and return ducts located in an unconditioned attic shall be deeply buried in ceiling insulation in accordance with Section ~~R403.3.7~~ R403.3.6.1.

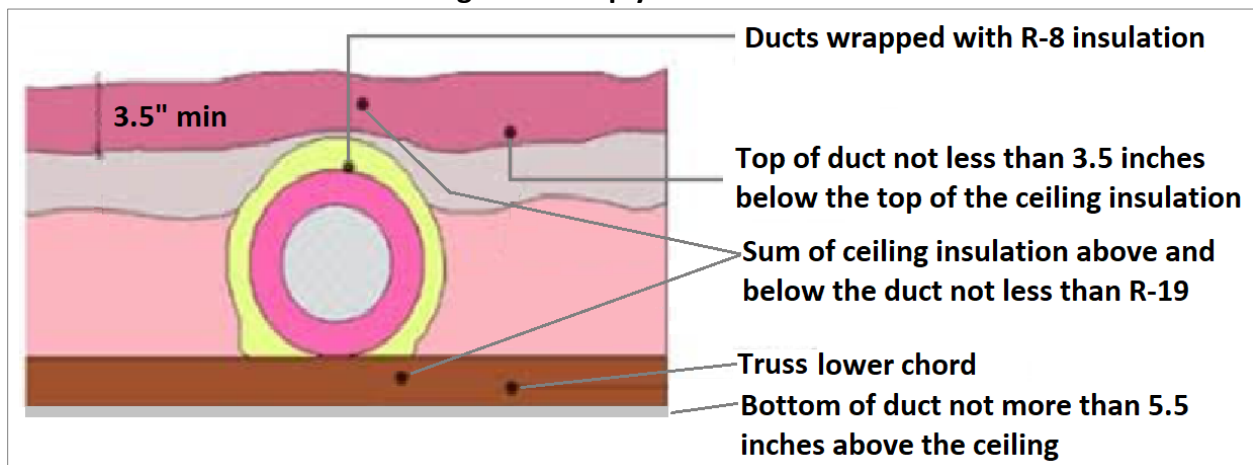
### What are the requirements of Option 4.1 “Deeply Buried Ducts”?

Assuming Section R403.3.6.1 is the intended reference, to achieve Option 4.1 credits the ducts must be:

- Installed in accordance with Section R403.3.6, which requires:
  - Ducts wrapped with R-8 insulation, and
  - Sum of ceiling insulation above and below the duct must be at least R-19, in addition to the R-8 duct insulation;
- 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.

These requirements are illustrated in Figure 1.

Figure 1. Deeply buried ducts





**Is R-19 required under a buried duct? No.**

A frequent source of confusion is the assumption that R-19 is required under a buried duct or that 5.5 inches of clearance is required between the duct and the ceiling. Figure 2, which shows the three possible cases, makes clear that this assumption is not true. In fact, from an energy perspective, Case 3 is preferred wherever possible and practical because the duct is thermally connected to the conditioned space by touching the ceiling drywall and the R-19 all above the duct provides the greatest thermal separation from the unconditioned attic space.

**Can I qualify for Option 4.1 if I have some ducts in an unconditioned crawlspace, in addition to the deeply buried ducts in the attic?**

To qualify for this option, only up to 10 linear feet of return duct and 5 linear feet of supply duct may be outside of the conditioned space. These ducts must have both their transverse and longitudinal joints sealed with mastic.

Note the air handler must be located within the conditioned space.

**Can you stack (or cross over) deeply buried ducts? Yes, but....**

If ducts cross over each other, this may indicate poor duct design. We suggest redesigning the ducts to eliminate the cross-overs. To bury ducts that cross over, each of the two ducts would need to meet the requirements above. For example, both ducts would need to be wrapped with R-8 duct insulation and be surrounded in ceiling insulation. The lower duct could be in contact with the sheetrock and the upper duct would have to have at least 3.5 inches of insulation over it.

**Do all the ducts need to be located in the attic to qualify for Option 4.1?**

Option 4.1 only requires that those ducts that are located in an unconditioned attic be deeply buried. It does not prohibit there being ducts in other locations.

For example, a two-story home has ducts serving the second floor located in the attic and ducts serving the first floor located in the floor between the first and second floor. This home will qualify for Option 4.1 by deeply burying those ducts located in the attic.



Figure 2. Three possible cases for buried ducts

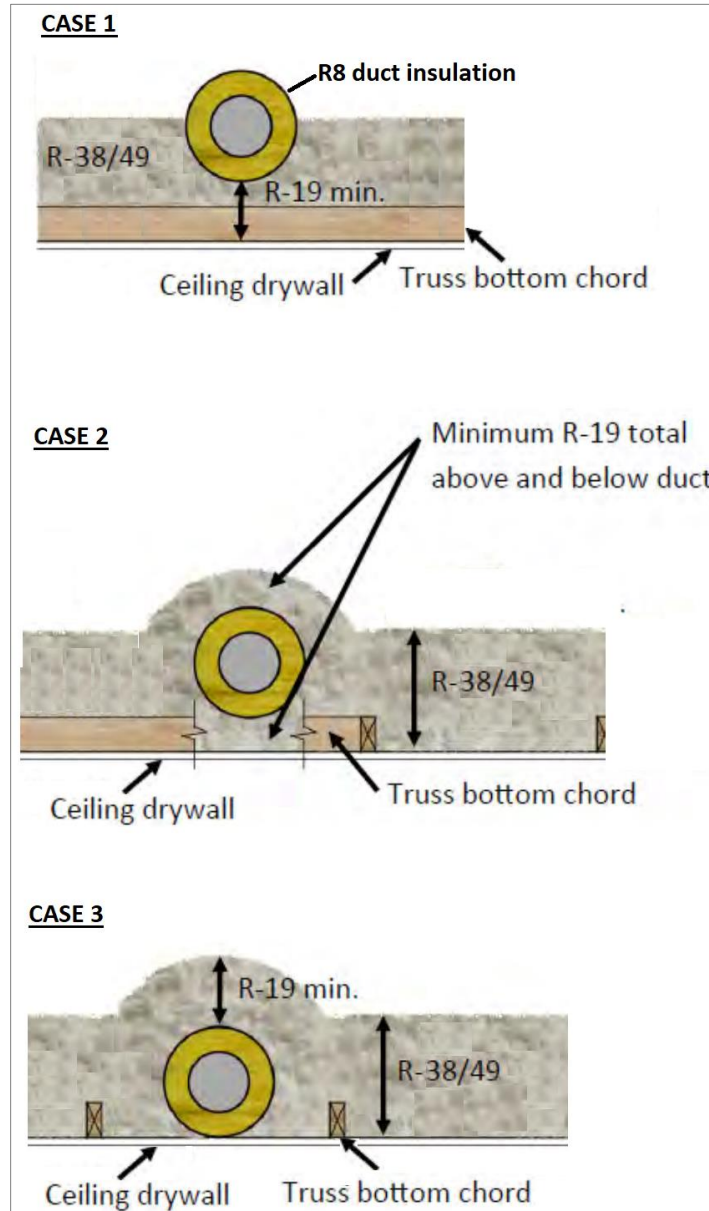


Figure 2 is derived from: "[Buried Ducts: Advantages, Challenges, and New Options in the 2018 IECC](#),"  
Craig Drumheller, National Association of Home Builders, 2017.



### For more information

- A very good [webinar](#) and accompanying [slide deck](#) by Craig Drumheller are available from the National Association of Home Builders. Figure 2 was derived from materials presented in this slide deck.
- This on-demand training from BetterBuiltNW covers both ducts inside and deeply buried ducts: [Building with Ducts in Conditioned Spaces](#).
- See also Section R403.3.6 in [Chapter 4 of the 2018 IECC](#), which has a third requirement for supply ducts for Climate Zones 1A, 2A and 3A.
- Email your question to us at [energycode@energy.wsu.edu](mailto:energycode@energy.wsu.edu) or call (360) 956-2042.
- Visit the WSUEPs Energy Code website at [www.energy.wsu.edu/BuildingEfficiency/EnergyCode.aspx](http://www.energy.wsu.edu/BuildingEfficiency/EnergyCode.aspx).

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