

# Insulation and Installation of HVAC Equipment and Duct Systems

The 2023 Oregon Residential Specialty Code (ORSC) introduced new requirements for the insulation and installation of heating, ventilating and air-conditioning (HVAC) equipment and duct systems, along with revisions to the existing requirements. This technical bulletin is intended to provide guidance on the requirements for HVAC equipment and duct systems in the 2023 ORSC.

## Insulation of ducts

In accordance with ORSC Section N1105.2, all new duct systems or new portions of duct systems exposed to unconditioned spaces, and buried ductwork within insulation where specific requirements are met, shall be insulated to a minimum R-8.

Where a furnace, air conditioner or heat pump is being replaced or added, existing ductwork is not required to be insulated to the current code.

Ducts located inside the building thermal envelope, as well as ventilation exhaust and intake ductwork are not required to be insulated.

## Installation of ducts and air handling equipment

In accordance with ORSC Section N1105.3, for new construction and additions, all new duct systems, air handling equipment, and appliances shall be located **fully** within the building thermal envelope.

Because it is not always technologically or economically feasible, or practical to construct **all ductwork fully** within the building thermal envelope, the following exceptions have been included in the code:

1. Ventilation exhaust and intake ductwork is not required to be deeply buried or located inside the building thermal envelope.
2. Up to 10 feet of the HVAC ductwork, insulated to a minimum R-8 in accordance with ORSC Section N1105.2, is permitted to be located outside of the building thermal envelope.
3. HVAC supply and return ductwork is permitted to be deeply buried in the attic insulation where specific requirements listed in ORSC Section N1105.3.1 are met **and two measures** are selected for compliance in ORSC Table N1101.1(2). [See page 6.](#)
4. HVAC supply and return ductwork is permitted to be located in an unvented crawlspace not within the building thermal envelope where specific requirements listed in ORSC Section N1105.3.2 are met **and two measures** are selected for compliance in ORSC Table N1101.1(2). [See page 8.](#)
5. HVAC supply and return ductwork is permitted to be deeply buried in the insulation of a vented crawlspace where specific requirements listed in ORSC Section N1105.3.3 are met **and two measures** are selected for compliance in ORSC Table N1101.1(2). [See page 7.](#)

These exceptions are explained further and illustrated in the figures below.

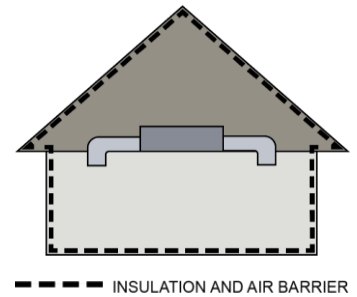
# Common approaches using attic, garage, and underfloor spaces

## Unvented attic

In an unvented attic the thermal boundary is at the roof plane instead of the ceiling because the insulation, air barrier and vapor retarder are all attached to roof framing.

One way to create a conditioned attic is with spray foam applied to the underside of the roof sheathing. It's possible to accomplish the same thing with blown-in insulation although additional framing would be required to hold full insulation depth.

An unvented and insulated attic can be used to house the HVAC system and all (or most) of the ducts. Ducts located within an unvented attic are not required to be insulated or deeply buried.

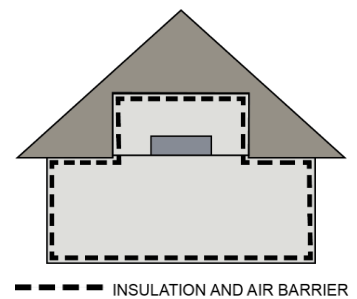


## Attic with an insulated enclosure

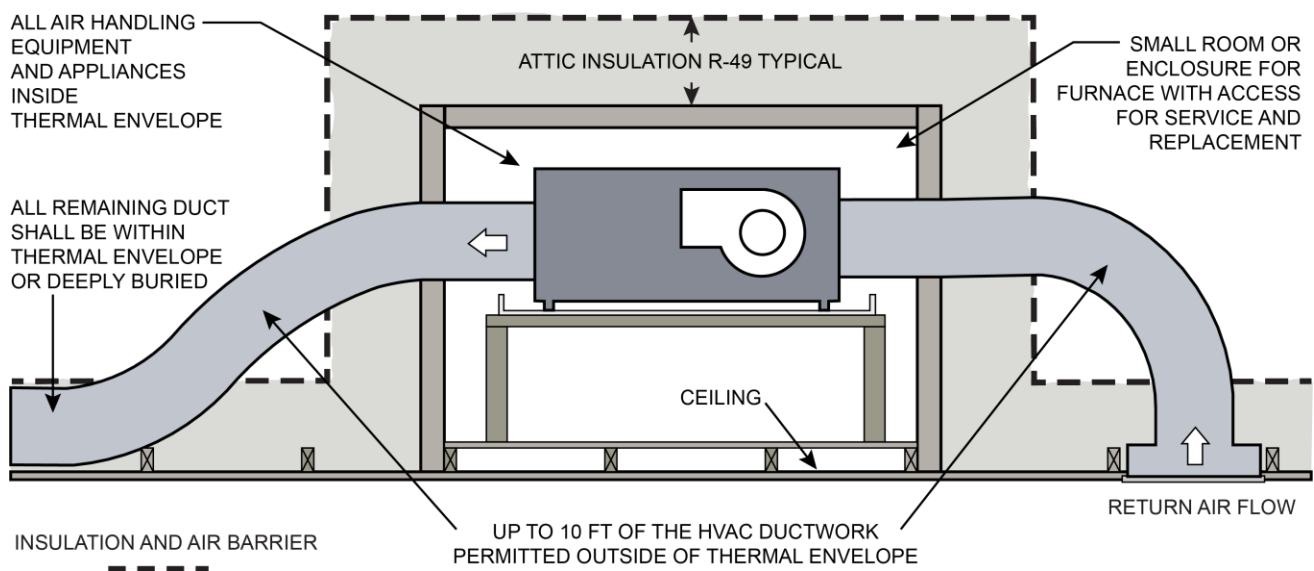
In this scenario, the thermal boundary is extended into the attic by creating a small room or enclosure with a complete and continuous thermal barrier. This space can be used to house the HVAC system and all (or most) of the ducts. The space can also be large enough to locate the furnace and other equipment. The required access for service and replacement shall be provided in accordance with the ORSC.

Up to 10 feet of the ductwork is permitted outside of the building thermal envelope, provided that the exposed ductwork is insulated to a minimum of R-8.

See Figures 7 through 9 for the requirements related to ducts buried deeply in the attic insulation.



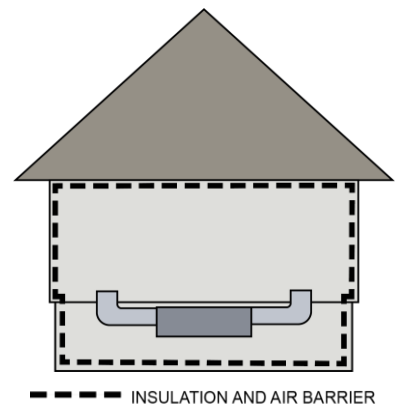
**Figure 1: Small insulated room or enclosure in attic space**



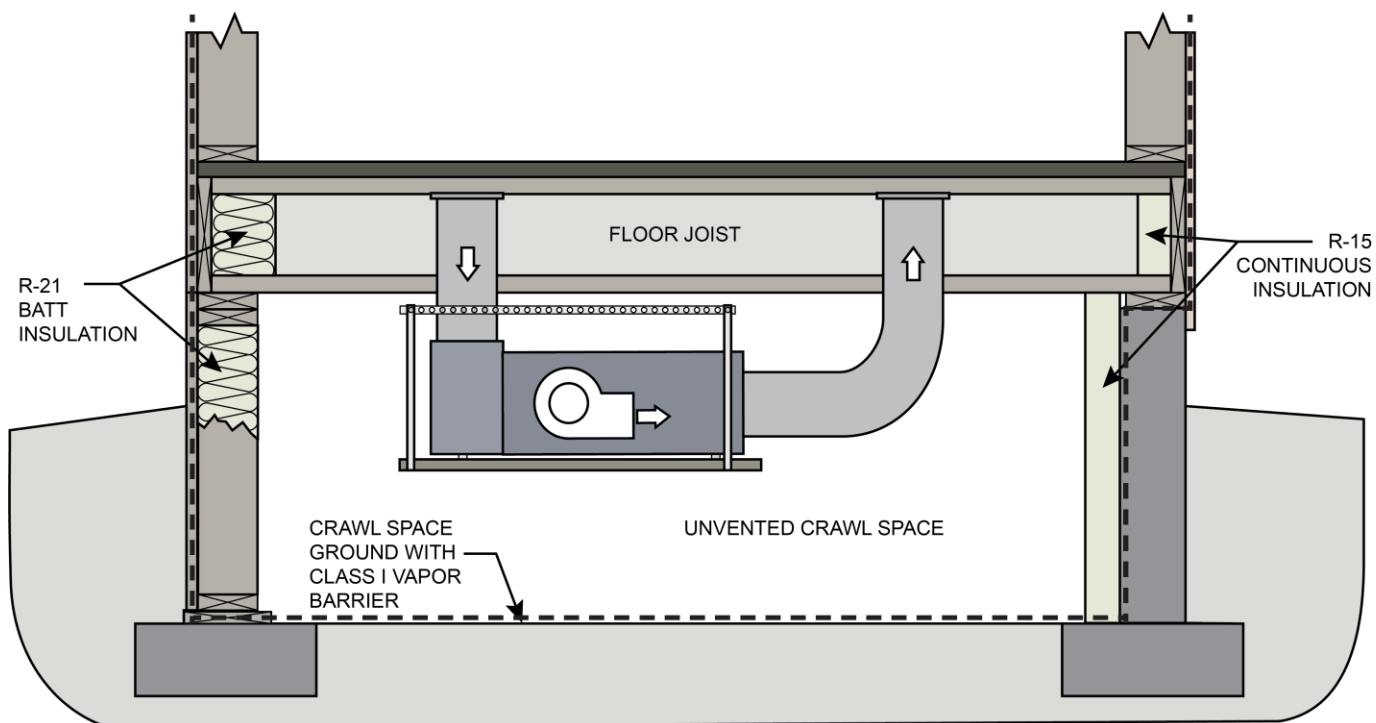
## Unvented underfloor space

An unvented and insulated underfloor space can be used to house the HVAC system and all (or most) of the ducts. Ducts located within this space are not required to be insulated or deeply buried.

This can be accomplished by adding either R-15 continuous insulation (c.i.) or R-21 blown/batt (in framed cavities) to the below grade walls. Continuous insulation may be located on the exterior or interior of the below grade wall in accordance with ORSC Section N1104.2.6. Figure 2 shows the requirements for this scenario.



**Figure 2: Installation in unvented crawl space**

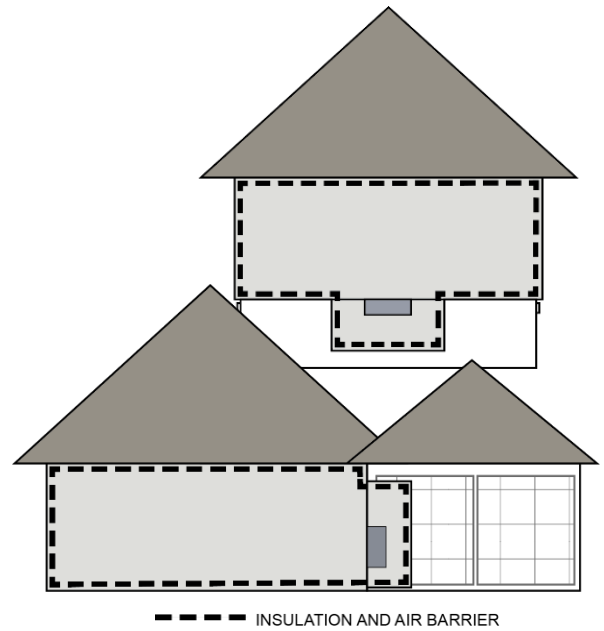


### Garage or underfloor with an insulated enclosure

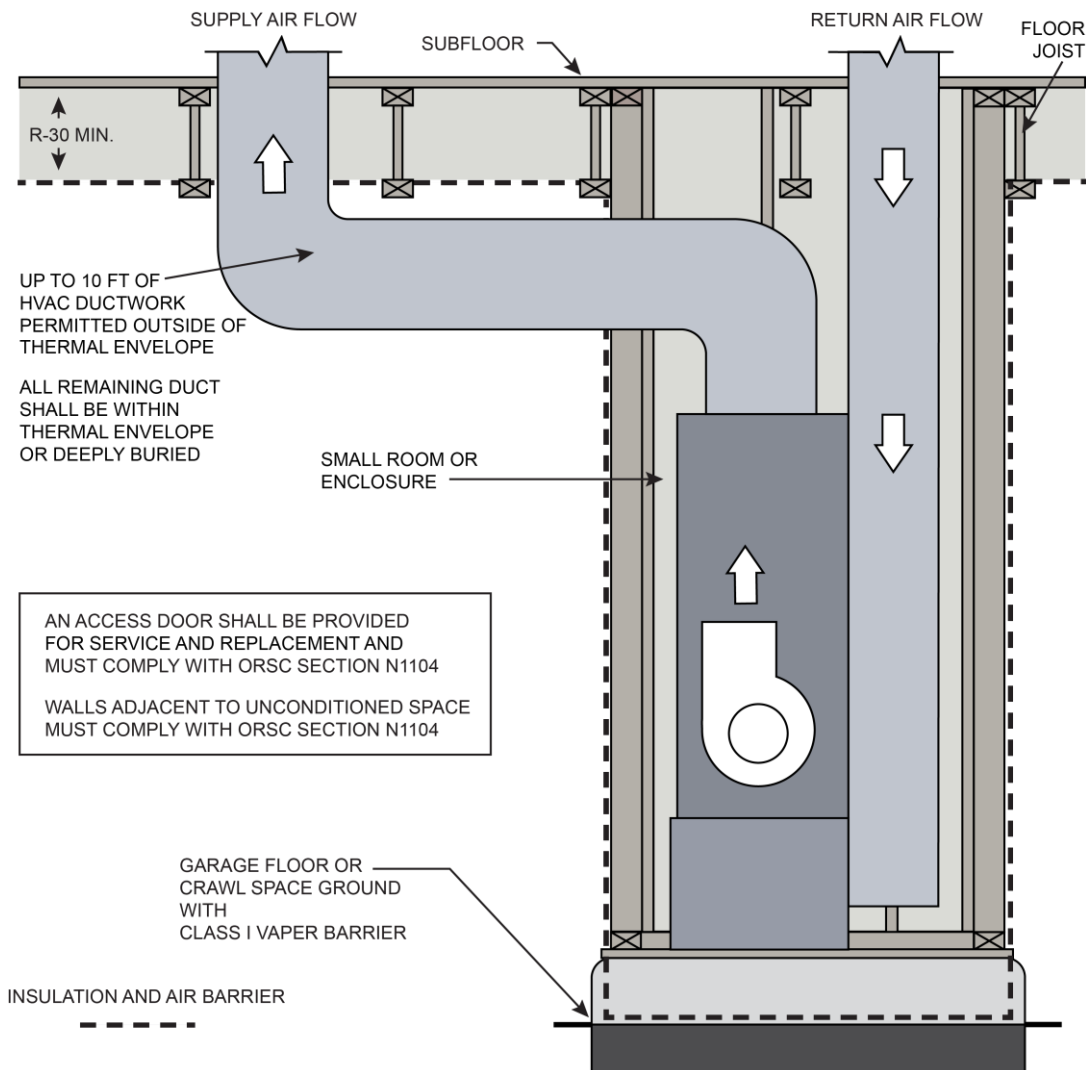
In this scenario, the building thermal envelope is extended into the garage or crawlspace. When using garage or underfloor spaces for locating ductwork, air handling equipment and appliances, there are a few options to prescriptively meet the requirements.

Up to 10 feet of the ductwork is permitted outside of the thermal envelope, provided that all exposed ductwork is insulated to a minimum of R-8.

Ventilation exhaust and intake ductwork is not required to be deeply buried or located inside the building thermal envelope. See Figure 10 for the requirements related to ducts buried deeply in the crawlspace insulation.



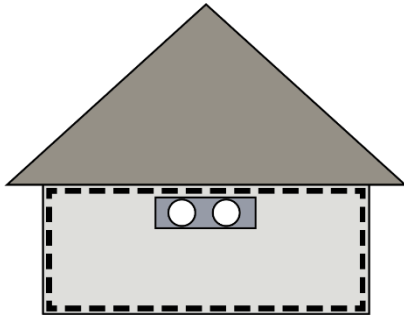
**Figure 3: Small insulated room or enclosure in garage or crawlspace**



# Common approaches for installation of ducts inside

The following are common approaches to installing ducts inside the building thermal envelope and the exceptions for deeply buried ducts in vented attics or vented crawlspaces.

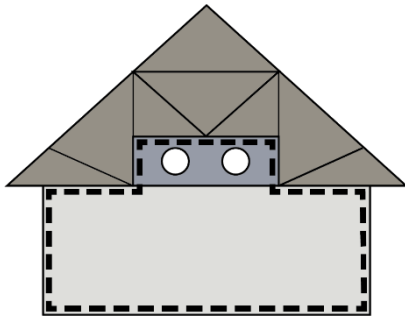
--- INSULATION AND AIR BARRIER



**Figure 4: Ducts in a dropped ceiling**

**Application:** This approach is appropriate for single-story homes with 9- or 10-foot plate heights. It is also useful in two-story designs and for branch ducts in a house that may use a different approach.

**Description:** The key element is to run ductwork in soffits or bulkheads built within the building thermal envelope. These building cavities, and the ducts, are now surrounded by the building air barrier and full insulation. One good location for a dropped ceiling is a central hall adjacent to several bedrooms. The space above the ceiling allows easy access to each of the bedrooms.



**Figure 5: Ducts in an inverted soffit or modified truss**

**Application:** This approach is appropriate for single-story homes with plate heights as low as 7½ feet. It is also useful for branch ducts in a house.

**Description:** Duct chases are created by extending the building thermal envelope into the attic. These extensions are surrounded by the building air barrier and insulation. An inverted soffit would typically be located near the center line of the long axis of the floor plan because it would serve as the main supply trunk. An inverted soffit is invisible from the living space and adequate design flexibility, especially when parallel to the trusses.



**Figure 6: Ducts between floors**

**Application:** This approach works only with two-story homes.

**Description:** To some extent the space between floors may already be used to run ducts, pipes, and wires. While ducts easily run between floor joists, it can be very difficult to run ducts across joists. Use of open web floor trusses can allow unrestricted access to rooms on the upper and lower floors.

## Ducts deeply buried in attic insulation

In accordance with ORSC Sections N1105.3, HVAC supply and return ductwork is permitted to be deeply buried in the attic insulation where specific requirements listed in ORSC Section N1105.3.1 are met **and two measures** are selected for compliance in ORSC Table N1101.1(2).

**N1105.3.1 Deeply buried duct in attic.** Ducts deeply buried in *attic* insulation shall be in accordance with all of the following when using Section N1105.3, Exception 3:

1. Insulation shall be installed to fill gaps and voids between the duct and the ceiling, and a minimum of R-19 insulation shall be installed above the duct between the duct and unconditioned *attic*.
2. All ductwork in the attic shall be insulated to R-8.
3. Insulation depth marker flags shall be installed on the ducts every 10 feet (3048 mm) or as approved by the *building official*.

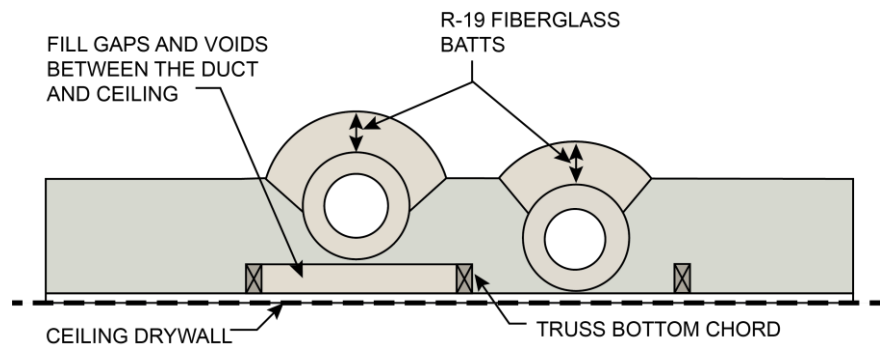
**Exception:** HVAC ductwork shall be permitted to be located outside of the building thermal envelope where the duct is insulated to a minimum of R-27 with a Class II or III vapor retarder.

The following are examples of compliance with ORSC Section N1105.3.1.

**Figure 7**

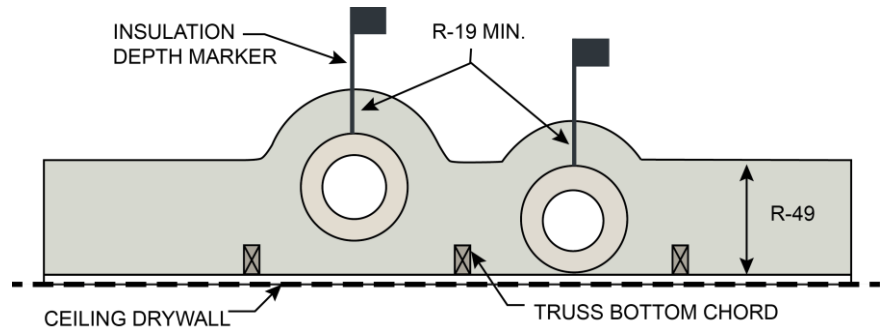
Install insulation to fill gaps and voids between the duct and the ceiling.

Install a minimum of R-19 insulation above the R-8 duct adding additional separation between the ductwork and the unconditioned attic.



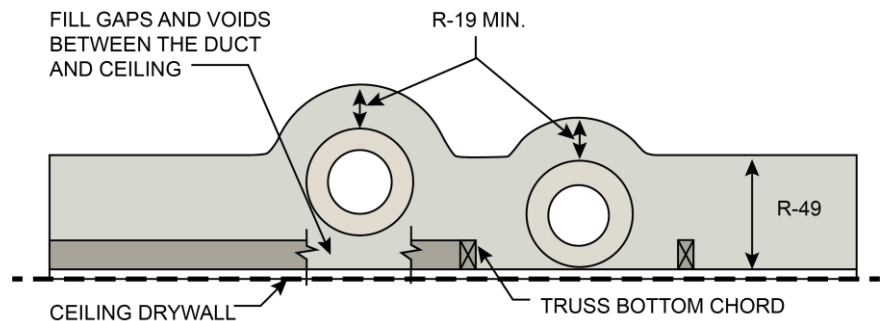
**Figure 8**

Fiberglass batt material may be used to achieve the R-19 insulation level above the duct.



**Figure 9**

Install insulation depth marker flags on the ducts every 10 feet or as approved by the building official.



## Ducts deeply buried in crawlspace insulation

In accordance with ORSC Sections N1105.3, HVAC supply and return ductwork is permitted to be deeply buried in the crawlspace insulation where specific requirements listed in ORSC Section N1105.3.3 are met **and two measures** are selected for compliance in ORSC Table N1101.1(2).

**N1105.3.3 Deeply buried duct in vented crawlspace.** Ducts deeply buried in crawlspace insulation shall be in accordance all of the following when using Section N1105.3, Exception 3:

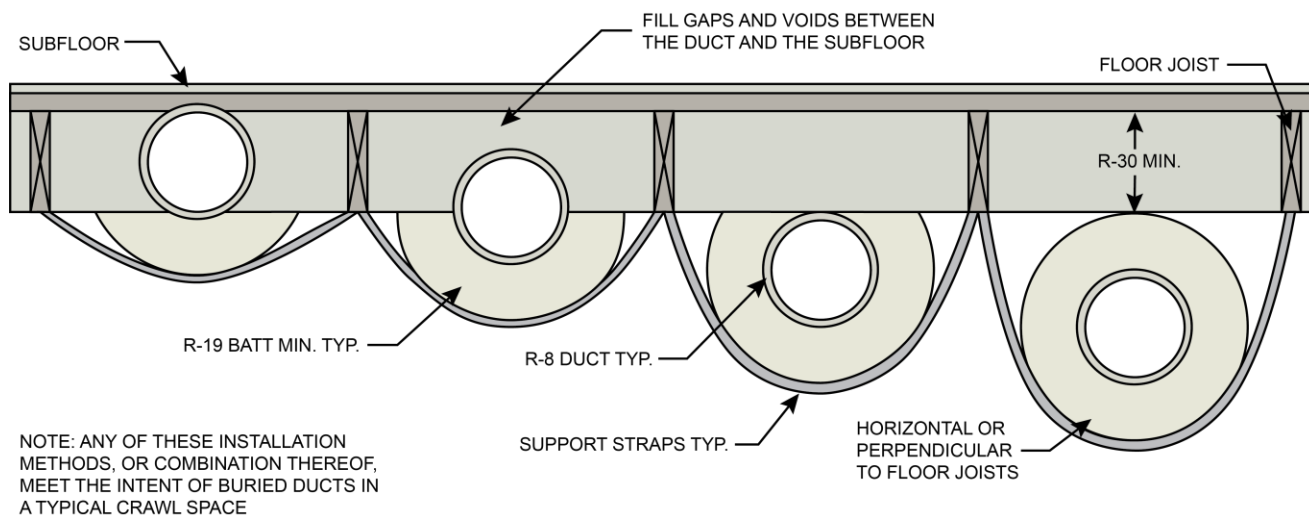
1. Insulation shall be installed to fill gaps and voids between the duct and the floor above, and a minimum of R-19 insulation shall be installed below the duct and between the duct and unconditioned crawlspace.
2. All ductwork in the crawl space shall be insulated to R-8.
3. The floor between the crawlspace and the dwelling shall be insulated with minimum R-30.

**Exception:** HVAC ductwork shall be permitted to be located outside of the building thermal envelope where the duct is insulated to a minimum of R-27 with a Class II or III vapor retarder.

In a vented underfloor space, batt insulation may be used to achieve the R-19 insulation level around the entire surface area of the duct not in contact with the required R-30 floor insulation. Floor insulation shall be installed to fill any gaps and voids between the duct and the floor.

Depth marker flags are not required as long as the additional batt insulation is clearly marked as R-19 and there is minimal compression of the batt by support straps or other material.

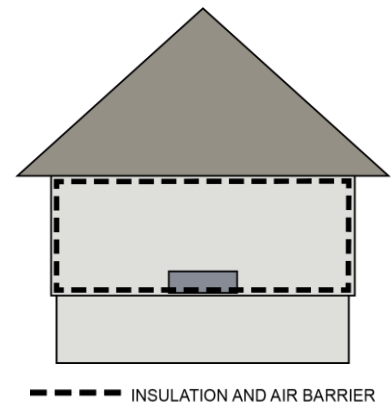
**Figure 10: Buried duct in underfloor space**



## Unvented crawlspace outside the building thermal envelope

Ducts are permitted to be located in an unvented crawlspace outside of the building thermal envelope where specific requirements listed in ORSC Section N1105.3.2 are met **and two measures** are selected for compliance in ORSC Table N1101.1(2).

All exposed ductwork is insulated to a minimum of R-8.



**N1105.3.2 Ducts in an unvented crawlspace outside the building thermal envelope.** Ducts located in an unvented crawlspace outside of the *building thermal envelope* shall be in accordance with all of the following when using Section N1105.3, Exception 3:

1. In addition to meeting Section R408.3, all seams of the vapor barrier shall overlap a minimum of 12 inches (305 mm) and be sealed with tape or other approved method.
2. All ductwork in the crawlspace shall be insulated to R-8.
3. The floor between the crawlspace and the dwelling shall be insulated with minimum R-30.

## Use of building cavities for air ducts or plenums

### New construction

The use of building cavities for air ducts, or plenums is not allowed in new construction or in an addition to an existing structure, except where allowed in other applicable sections of the code (See ORSC Section M1601.1.1.1).

### Existing buildings

The use of building cavities for air ducts or plenums is allowed in the alteration or remodel of an existing structure. Gypsum products are permitted to be used to construct air ducts or plenums provided that the air temperature does not exceed 125°F (52°C) and exposed surfaces are not subject to condensation. For stud wall cavities and the spaces between solid floor joists to be utilized as air ducts or plenums shall comply with five separate conditions. (See Section M1601.1.1.2)

## Joints, seams and connections of ductwork

In accordance with ORSC Section M1601.4.1, tape shall not be used to seal metal ductwork, or be used as the sealing method between metal duct and flexible or fibrous duct. Tape is only allowed to be used with metal duct at connections to equipment requiring future replacement.

Joints, longitudinal and transverse seams, and connections of ductwork shall be securely fastened and may only be sealed with welds, gaskets, mastics (adhesives), mastic-plus-embedded-fabric systems, liquid sealants, or approved equivalents.