TOWN OF CARY

INSPECTIONS & PERMITS DEPARTMENT

CLOSED CRAWLSPACE GUIDE

A "Closed Crawlspace" is defined in the NC Residential Code as *a foundation with wall vents that uses air sealed wall, ground and foundation moisture control, and mechanical drying potential to control crawlspace moisture. Insulation may be located at the floor level or at the exterior walls.*

Permitting

Building permits are required when a single-family residence with a ventilated crawlspace (R408) is converted to a "closed crawlspace" (R409). Some of the items that trigger the permit requirement are as follows:

- **Building permits** are always required when:
  - Closing crawlspace vents or altering them such that they are not readily openable.
  - Relocating the thermal envelope by replacing floor insulation with wall insulation.
- **Mechanical permits** are required when one of the following is done:
  - Use of supply air or creating a "conditioned" crawlspace.
  - When a fuel-fired appliance (typically gas water heater or a gas furnace) is located in the crawlspace. The primary purpose is for the Code Official to ensure that proper combustion air is supplied to the fuel-fired appliance(s). Permit applicant may be asked to provide verification that proper combustion air is being supplied to meet the manufacture's requirements for each fuel-fired appliance in the crawlspace.
- **Plumbing permits** may be required:
  - If there are alterations, modifications, or relocations of plumbing elements, components, or systems.
  - A sump or daylight drain solitarily would not require a plumbing permit.
- **Electrical permits are required** for the addition, relocation, or replacement of electrical circuits. If you are only using cord-and-plug appliances (fan or humidifier) with existing receptacles in the crawlspace, an electrical permit is usually not required. However, installation of new circuits or receptacles to service an appliance or adding a hard-wired appliance, does require an electrical permit.

Contractor Licensure Requirements

Projects under $30,000 do not require a licensed **General Contractor**. The general construction and construction management may be completed by anyone with the competency to do so. Most closed crawlspace work would not trigger the requirement for a licensed General Contractor.

Per NC General Statute Chapter 87 Article 1, a homeowner is exempt from contractor license requirements if they meet all three of the following requirements:

1) The homeowner physically performs the respective work themselves.
2) The property is their own primary residence.
3) They plan to live in the home for at least 12 months following the work.

Generally speaking, if not performed directly by the homeowner, the Electrical, Plumbing, and Mechanical (HVAC) work must be performed by licensed contractors. For further clarification:

- A licensed **Mechanical Contractor** is generally only required when:
  - Where supply air is utilized or a "conditioned" crawlspace is created, an H-3 license is generally required for this work. For additional detail, see this NC Dept of Insurance Guidance Paper.

  - However, if there is a furnace in the crawlspace, it is the responsibility of the permit holder to ensure that proper combustion air is provided for the unit. This work must be done by a licensed Mechanical Contractor or the homeowner.
  - Consult the State Board of Examiners of Plumbing, Heating, and Fire Sprinkler Contractors for complete licensing requirements and exemptions.
- A licensed **electrical contractor** is generally required (unless completed by the homeowner) for the addition, modification, or relocation of circuits or devices. This usually comes into play when a dehumidifier or fan is installed. However, if a cord-and-plug type appliance is connected to an existing receptacle device, no electrical license is required.
- A licensed **plumbing contractor** is rarely required for closed crawlspace work. Generally, daylight drains and sump pumps will not require a licensed plumber to complete the work.

Code Requirements of a Closed Crawlspace

Air Sealing (R409.1):

Closed crawlspaces shall be built to minimize the entry of outdoor air into the crawlspace:

- All cracks, joints, openings, penetrations, etc. must be air-sealed using non-porous caulk, gaskets, or sealants.
- Rockwool and fiberglass insulation is prohibited as an air sealant.

Ground Water control (R409.2):

- Closed crawlspaces must be protected from water entry by the evaporation of water from the ground surface by one of the following three means:

1) **Ground vapor retarder:** 6-mil polyethylene or equivalent with joints overlapped a minimum of 12-inches. 100% ground coverage is required. Ground surface must be graded to one or more low spots. A drain to daylight or a sump pump must be installed at each low spot.
2) **Liner:** Full interior liner is permitted by sealing the edges to walls and columns and sealing the seams. The top edge of the liner shall terminate between 3 to 4-inches from the top edge of the masonry foundation wall. The liner shall be brought up the interior columns or piers a minimum of 4-inches. 100% ground coverage is required. Ground surface must be graded to one or more low spots. A drain to daylight or a sump pump must be installed at each low spot. Code does not specify a minimum thickness for this liner so 6-mil is the minimum thickness required by code, but frequently heavier liner products (10-mil to 23-mil) are used for a more durable result.
3) **Concrete Floor Surfacing:** The ground vapor retarder may be protected from ripping and displacement by pouring an unreinforced 2-inch (minimum) thick concrete surface over the barrier. Ground surface must be graded to one or more low spots. A drain to daylight or a sump pump must be installed at each low spot.

Foundation wall drainage and water resistance (R409.3):

- Where the outside grade is higher than the inside grade, the exterior walls shall be dampproofed from the top of the footing to the finished grade.
- The building site shall be graded to drain away from the crawlspace per R401.3.
- If there is evidence that the ground water table can rise within 6-inches of the finished grade in the crawlspace or if there is evidence that the surface water does not readily drain from the building site, the grade of the crawl shall be as high as the outside finished grade (unless and approved drainage system is installed).

Moisture Vapor Control (R409.5):

- Closed crawlspaces shall be provided with mechanical drying capability to control space moisture levels. At least one of the following methods shall be required:

1) **Dehumidifier:**
    a. Minimum capacity of 15 pints per day.
    b. Condensate shall discharge to the exterior through gravity drain or condensate pump.

2) **Supply Air:**
    a. Supply air from the dwelling conditioning system shall be ducted into the crawlspace (minimum 1 CFM per 30 cubic feet of space). No return duct from crawlspace into dwelling conditioning system is allowed. The supply duct shall have a backflow damper to prevent airflow from the crawl back into the system when the fan is not running. An air relief vent may be installed. The purpose of this system is to create positive pressure in the crawlspace. This is not considered a plenum.

3) **House Air**
    a. House air shall be blown into the crawlspace with a fan at a rate of 1 CFM per 50 square feet of crawlspace.
    b. The fan motor must be rated for continuous duty. If it has a humidistat built in for shutoff at period times, it is not continuous duty.
    c. An air relief vent may be installed to the outdoors.
    d. There is no requirement for make-up air.
    e. Crawlspaces constructed in this method are not considered plenums.

4) **Exhaust Fan**
    a. Crawlspace air shall be exhausted to outside with a fan at a rate of 1 CFM per 50 square feet of crawlspace floor area.
    b. The fan motor must be rated for continuous duty. If it has a humidistat built in for shutoff at period times, it is not continuous duty.
    c. There is no requirement for make-up air.

5) **Conditioned Space**
    a. The crawlspace shall be designed as a heated and cooled, conditioned space with wall insulation installed in accordance with the requirements of R409.8. Intentionally returning air from the crawlspace to the conditioning equipment serving the dwelling shall be allowed. This method does make the crawlspace a plenum so the conditions below in the "Plenums" section shall apply.

Plenums (R409.6):

- Crawlspaces used a supply or return air plenums for distribution of heated or cooled air shall comply with the NC Mechanical Code. Such crawlspaces shall not contain plumbing cleanouts, gas lines, or other prohibited components.
- Where foam plastic (typically found in insulation components) is used in crawlspace plenums, the foam plastic shall be protected against ignition by an approved thermal barrier. See R316 for additional information on approved thermal barriers.

Combustion Air (R409.7):

- The air sealing of a closed crawlspace may result in a foundation that cannot provide adequate combustion air for fuel fired appliances (such as water heaters and gas furnaces). Therefore, appliances of this nature shall obtain combustion air directly from the outside. There are many of ways to accomplish this, but solutions may be specific to the type of system you have and other site specific conditions. Consult a Town of Cary Code Official for further information if this is a concern.
- Also, consult the NC Fuel Gas Code and NC Mechanical Code for additional requirements.

Insulation (R409.8):

- Thermal insulation for a closed crawlspace may be located in the floor system or at the exterior walls. However, if the crawlspace is intentionally heated or cooled the insulation must be located on the walls.
    - See Table R1102.1 for specific details on the minimum R-Values for insulation.

- **Wall Insulation:**
    - Minimum R-10 on the masonry wall and R-15 in the framed wall cavities per R1102.1 (or 2018 NCECC Table Table R402.1.2)
    - Where the floor above is not insulated, the walls shall be insulated.
    - The band joist area of the floor framing as well as any framed walls on top of the sill plate must be insulated.
    - Insulate crawlspace door to minimum R-2 and shall be tightly fitting.
    - Wall insulation shall be installed 3-inches below the top of the masonry foundation (leaving 3-inches of exposed masonry as a "termite inspection gap".
    - Wall insulation shall extend down to a point that is one of the following three options:
        1) 3-inches above the top of the footing or the concrete floor
        2) 3-inches above the interior ground surface
        3) 24 inches below the outside ground level

        Note #1: See the Illustrations shown on page 4 of this document for a visual representation of the three options noted above. Alternatively, see Appendix R1.2.2 of the 2018 NC Energy Conservation Code.

        Note #2: No insulation shall be required for masonry walls of 9-inches height or less.

        Note #3: Where foam plastic insulation is used, it must be tested in accordance with ASTM E84 to have a flame spread index of <= 25 and smoke development index of <= 450. Otherwise, it must be protected against ignition by a thermal barrier as noted in R409.8.2.

- **Floor insulation:**
    - When floor insulation is used as part of the thermal envelope, a minimum R-19 insulation shall be installed per R1102.1.
    - It is not required but generally advised to remove the floor insulation if the crawlspace has compliant wall insulation installed.

General:

- All debris must be removed from the crawlspace.
- The crawlspace access door (minimum dimensions to measure 18 inches x 24 inches) or minimum required per the NC Mechanical Code.

Additional Resources:

National Renewable Energy Laboratory: https://www.nrel.gov/docs/fy13osti/54859.pdf

Advanced Energy – Introduction to Design, Construction, and Performance: https://1aquq1xmkqgd37a83amhkb19-wpengine.netdna-ssl.com/wp-content/uploads/2019/12/2.pdf

Current NC Building Codes: https://www.ncosfm.gov/codes/codes-current-and-past

Town of Cary (Homeowner's Guide to Hiring Contractors): https://www.townofcary.org/services-publications/residential-permits-inspections/home-construction-projects

NCGS Chapter 87 Article 1 (General Contractors): https://www.ncleg.gov/EnactedLegislation/Statutes/HTML/ByArticle/Chapter_87/Article_1.html

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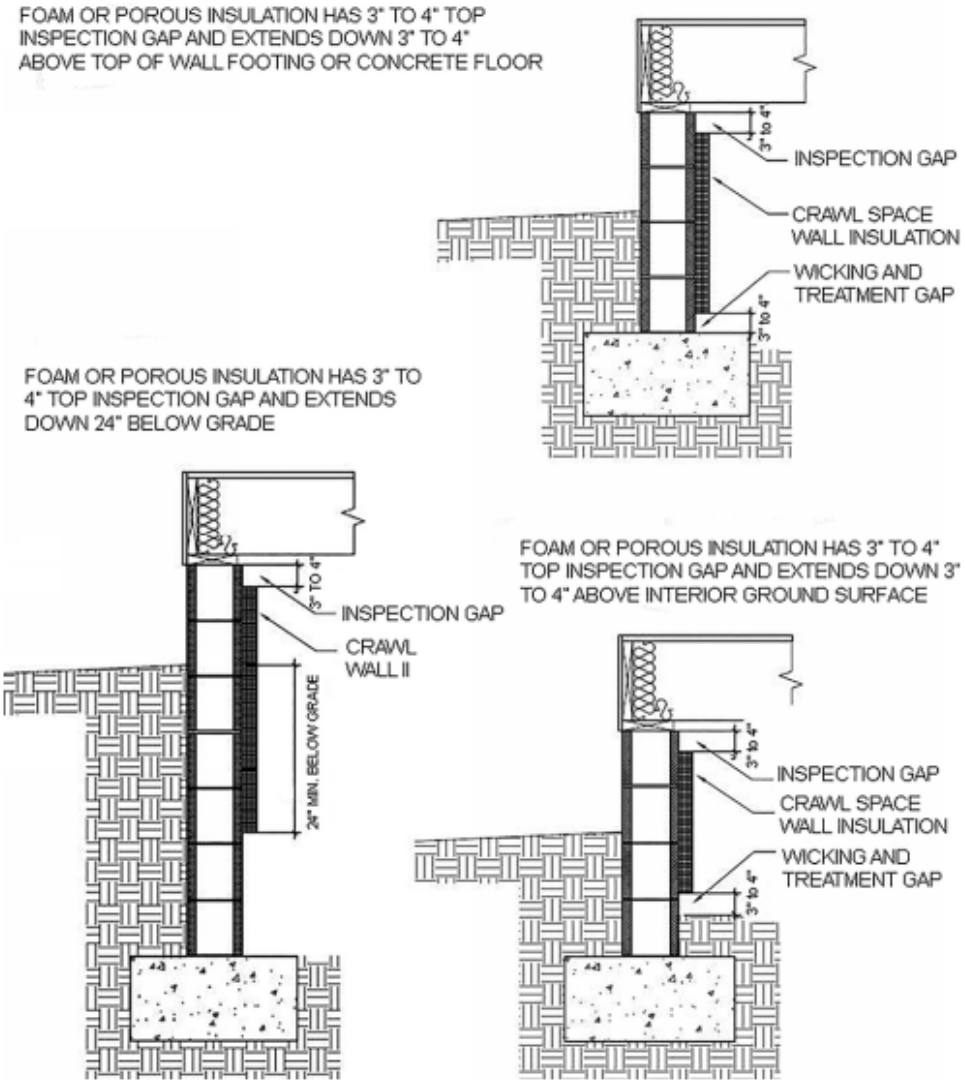
Wall Insulation Illustrations



**Insulation Illustrations from Appendix R1.2.2 (Section R402.2.11) of the 2018 NC Energy Conservation Code.*

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The guidance, rules, and requirements in this document are applicable for work performed in the Town of Cary. For work in other jurisdictions, please consult the applicable jurisdiction for their specific guidance, rules, and requirements.

For questions or comments about Closed Crawlspaces or any other Residential Alterations or Additions in the Town of Cary, please contact: Dale Jarman (Chief Residential Multi-Trade Code Official) dale.jarman@townofcary.org

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