



MIKE CAUSEY, INSURANCE COMMISSIONER & STATE FIRE MARSHAL  
BRIAN TAYLOR, CHIEF STATE FIRE MARSHAL

May 11, 2022

Mr. Nathan Good  
VP, Engineering  
Rheia, LLC  
4636 S. 35<sup>th</sup> Street, Suite 2  
Phoenix, Arizona 85040

**RE: 2018 NC Residential Code and 2018 NC Energy Conservation Code  
2018 NCRC N1103.3.1 and 2018 NCECC R403.3.1 Insulation (Mandatory)**

Mr. Good:

This letter is in response to your request for formal interpretation dated April 15, 2022 that was received in NCDOI by email on April 18, 2022. Your request for formal interpretation states:

"I represent Rheia, an innovative new supply air distribution system for residential new construction. Rheia is active in 18 states across the country, and several builders we work with would like to use our system in North Carolina.

Rheia supply ducts are uninsulated and always routed within the building thermal envelope, through floor cavities between two conditioned, livable floor areas, and through interior walls between two conditioned, livable rooms. 2018 North Carolina Residential Code N1103.3.1 does not require ducts within conditioned space to be insulated. The same code section requires supply ducts within semi-conditioned spaces to be insulated to a minimum R-4.

We received an Informal Interpretation from David Rittlinger of the North Carolina Department of Insurance stating the wall and floor cavities are semi-conditioned space. Chapter 2 defines semi-conditioned space as "A space within the building thermal envelope that is not directly heated and/or cooled." Directly heated and/or cooled is not defined in chapter 2.

Mr. Rittlinger explained how the North Carolina code is derived from the ICC code books. The ICC code books do not have the term 'semi-conditioned space', so the floor and wall cavities fall directly under the definition of conditioned space. The 2018 IRC Commentary Book further explains the intent of the definition to include a space that contains uninsulated ducts. See attachment.

We are seeking a Formal Interpretation indicating floor and wall cavities that are within the building thermal envelope and surrounded by livable space should be considered conditioned space, allowing our uninsulated ducts to be run in those areas.

If there are any questions, please direct your reply to Nathan Good at [ngood@rheiacomfort.com](mailto:ngood@rheiacomfort.com) or 602-448-5870.”

**Remarks:**

Code sections noted in this letter are referring to the 2018 edition of the NC Residential Code and 2018 NC Energy Conservation Code unless otherwise noted.

Attachment A is comprised of the request for formal interpretation as well as all supporting information submitted with the request.

**Code Analysis:**

2018 NCRC N1103.3.1 (R403.3.1) Insulation (Mandatory) states the following:

**N1103.3.1 (R403.3.1) Insulation (Mandatory).** Supply and return ducts in unconditioned space and outdoors shall be insulated to a minimum R-8. Supply ducts inside semi-conditioned space shall be insulated to a minimum R-4; return ducts inside conditioned and semi-conditioned space are not required to be insulated. Ducts located inside conditioned space are not required to be insulated other than as may be necessary for preventing the formation of condensation on the exterior of cooling ducts.

2018 NCECC R403.3.1 Insulation (Mandatory) states the following:

**N1103.3.1 (R403.3.1) Insulation (Mandatory).** Supply and return ducts in unconditioned space and outdoors shall be insulated to a minimum R-8. Supply ducts inside semi-conditioned space shall be insulated to a minimum R-4; return ducts inside conditioned and semi-conditioned space are not required to be insulated. Ducts located inside conditioned space are not required to be insulated other than as may be necessary for preventing the formation of condensation on the exterior of cooling ducts.

*Comments: Supply ducts inside semi-conditioned space shall be insulated to a minimum R-4. Return ducts inside semi-conditioned space are not required to be insulated.*

2018 NCRC Chapter 2 Definitions states the following:

**SEMI-CONDITIONED SPACE.** A space within the building thermal envelope that is not directly heated and/or cooled.

2018 NCECC Chapter 2 Definitions states the following:

**SEMI-CONDITIONED SPACE.** A space within the building thermal envelope that is not directly heated and/or cooled.

*Comments: Semi-conditioned spaces are not directly heated and cooled but are within the building thermal envelope. Examples of semi-conditioned spaces include encapsulated attics and crawl spaces, rooms without air distribution but within the building thermal envelope and spaces above ceilings and within walls that are within the building thermal envelope.*

2018 NCRC R102.1 General states the following:

**R102.1 General.** Where there is a conflict between a general requirement and a specific requirement, the specific requirement shall be applicable. Where, in any specific case, different sections of this code specify different materials, methods of construction or other requirements, the most restrictive shall govern.

*Comments: The definition of semi-conditioned space is the specific definition that is applied to the specific code requirement to provide insulation.*

**Conclusions:**

Because wall and floor cavities are within the building thermal envelope but are not directly heated and cooled, they are semi-conditioned spaces and therefore R-4 insulation for all supply ductwork is required. Use of this product for return ducts in semi-conditioned spaces and supply and return ducts in conditioned spaces is approved as it meets all the code requirements in being listed to UL-181 and since insulation is not required for return ducts in semi-conditioned spaces and supply and return ducts in conditioned spaces unless condensation can occur on the exterior of cooling ducts.

Please call if you have comments or questions.

Sincerely,

A handwritten signature in black ink that reads "D.B. Rittlinger". The signature is written in a cursive, flowing style.

David B. Rittlinger, PE, LEED AP  
Chief Code Consultant  
NCDOT-OSFM Engineering & Codes Division

cc: File  
Bridget Herring, Chair – BCC  
Danny Priest, Vice-Chair – BCC  
David Smith, Chair – BCC Residential Standing Committee  
Dick Flowers, Chief Mechanical Inspector, City of Raleigh, NC

**ATTACHMENT A**



**APPENDIX E  
APPEALS  
NORTH CAROLINA  
BUILDING CODE COUNCIL  
325 North Salisbury Street, Room 5\_44  
Raleigh, North Carolina 27603  
(919) 647-0095**

APPEAL TO NCDOI/NCBCC      Hearing Date \_\_\_\_\_ / \_\_\_\_\_ / \_\_\_\_\_  
GS 153A-374, GS 160A-434      GS 143-140, GS 143-141  
Formal Interpretation by NCDOI \_\_\_\_\_      Appeal of Local Decision to NCBCC \_\_\_\_\_  
Appeal of Local Decision to NCDOI  \_\_\_\_\_      Appeal of NCDOI Decision to NCBCC \_\_\_\_\_

**APPELLANT** Nathan Good, PE      **PHONE (** 602 **)** 448 **-** 5870 **x** \_\_\_\_\_  
**REPRESENTING** Rheia, LLC  
**ADDRESS** 4636 S. 35th St., Suite 2  
**CITY** Phoenix      **STATE** AZ      **ZIP** 85040  
**E-MAIL** ngood@rheiacomfort.com      **FAX (** \_\_\_\_\_ **)** \_\_\_\_\_ - \_\_\_\_\_  
North Carolina State Building Code, Volume 2018 Residential - Section N1103.3.1 (R403.3.1)

REQUEST ONE:       Formal Interpretation by NCDOI       Appeal of Local Decision to NCBCC  
                          Appeal of Local Decision to NCDOI       Appeal of NCDOI Decision to NCBCC

Type or print. Include all background information as required by the referenced General Statutes and the attached policies. Attach additional supporting information.

See attached letter.

REASON:

Signature Nathan Good      DATE: 04/15/2022      **APPEAL TO NCDOI/NCBCC**  
**FORM 3/14/17**

## **202.9 Appeals**

**202.9.1 Engineering Division.** A written technical interpretation shall be provided as specified in Section 203.2.1.2. Any person may appeal in writing an order, decision, or determination pertaining to the code or any state building law by filing written notice with the Commissioner of Insurance or his designee within ten (10) days after the order, decision, or determination. A copy of the appeal shall be furnished to each party.

(General Statutes 143-140, 153A-374 and 160A-434)

### **203.2.1 Interpretations**

**203.2.1.1 Informal Interpretations.** The Engineering Division shall provide informal interpretations on code related matters either by e-mail, letter or telephone. These informal interpretations may be accepted by the local code enforcement official or party requesting the interpretation. Either party may request a formal interpretation of the code.

**203.2.1.2 Formal Interpretations.** Any person may request in writing a formal interpretation of the code. The request shall be addressed to the Chief Code Consultant for the Department of Insurance. The request shall be specific and shall reference the code sections in question. All formal interpretations shall be in writing. A formal interpretation shall be binding on all parties unless appealed to the Building Code Council as specified in Section 201.9.2. Formal interpretations determined to be of a general nature may be posted on the Department website. (General Statute 143-140)

**203.2.2 Appeals.** Any person may appeal in writing an order, decision, or determination of a code enforcement official pertaining to the code or any state building law. The appeal shall be addressed to the Chief Engineer for the Department of Insurance by filing written notice within ten (10) days after the order, decision, or determination. The appeal shall contain the type and size of the building in question, the location of the building, and shall reference the code sections in question. The decision shall be in writing and shall set forth the facts found. The decision rendered shall be based on the technical provisions of the code, public health and safety and shall be construed liberally to those ends. A decision shall be binding on all parties unless appealed to the Building Code Council as specified in Section 201.9.2. A copy of the appeal and written decision shall be furnished to each party. (General Statutes 153A-374 and 160A-434)

**202.9.2 Building Code Council.** The Building Code Council shall hear appeals from the decisions of State enforcement agencies relating to any matter related to the code. Any person wishing to appeal a decision of a State enforcement agency to the Building Code Council shall give written notice of appeal as follows:

**202.9.2.1** Twenty one (21) copies including an original of the Notice of Appeal shall be filed with the Building Code Council c/o NC Department of Insurance, Engineering Division, 325 North Salisbury Street, Room 5\_44, Raleigh, NC 27603 and one (1) copy shall be filed with the State enforcement agency from which the appeal is taken.

**202.9.2.2** The Notice of Appeal shall be received no later than thirty (30) days from the date of the decision of the State enforcement agency.

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**202.9.2.3** The Notice of Appeal shall be legibly printed, typewritten or copied and shall contain the following:

- (1) Name, address of the party or parties requesting the appeal.
- (2) The name of the State enforcement agency, the date of the decision from which the appeal is taken, and a copy of the written decision received from the enforcement agency.
- (3) The decision from which the appeal is taken shall be set forth in full in the Notice of Appeal or a copy of the decision shall be attached to all copies of the Notice of Appeal.
- (4) The contentions and allegations of fact must be set forth in full in a clear and concise manner with reference to the sections of the code in controversy.
- (5) The original Notice of Appeal shall be signed by the party or parties filing appeal.
- (6) The Notice of Appeal shall be received by the first day of the month prior to the Building Code Council's quarterly scheduled meeting in order to be placed on the agenda for that meeting. The Chairman may schedule a special meeting to hear an appeal.

**202.9.2.4** Upon the proper filing of the Notice of Appeal, the Building Code Council Secretary shall forward one (1) copy of the Notice of Appeal to each member of the Building Code Council. The Chairman may appoint a Hearing Committee to hear appeals. The Secretary shall send notice in writing to the party or parties requesting an appeal and to the Building Code Council Hearing Committee members at least fifteen (15) days prior to the Hearing Committee meeting. A written decision of the Hearing Committee meeting shall be provided to all Building Code Council Members. The actions of the Hearing Committee shall be final, unless appealed to the full Building Code Council in writing within 30 days of the Hearing Committee's action. If a Hearing Committee consists of at least seven Council members, it will constitute a quorum of the full Council. Further appeals shall be as specified in Section 202.9.3.

**202.9.2.5** The Building Code Council shall, upon a motion of the State enforcement agency or on its own motion, dismiss appeals for the following reasons:

- (1) Not pursued by the appellant or withdrawn;
- (2) Appeal not filed in accordance with these rules; or
- (3) Lack of jurisdiction.

**202.9.2.6** When the Building Code Council finds that a State enforcement agency was in error in its interpretation of the code, the Building Code Council shall remand the case to the agency with instructions to take such actions as the Building Code Council directs. When the Building Code Council finds on appeal that materials or methods of construction proposed are equivalent to those required by the code, the Building Code Council shall remand the case to the State enforcement agency with instructions to permit the use of such materials or methods of construction. The Building Code Council shall immediately initiate procedures for amending the code to permit the use of such materials or methods of construction.

**202.9.2.7** The Building Code Council shall provide a written decision setting forth the findings of fact and the Building Code Council's conclusions to each party or parties filing the appeal and to the State enforcement agency from which the appeal was taken.

**202.9.3 Superior Court.** Whenever any person desires to appeal a decision of the Building Code Council or a decision of a State or local enforcement agency, he may appeal either to the Wake County Superior Court or the Superior Court of the county in which the proposed building is to be situated in accordance with the provisions of Chapter 150B of the General Statutes.  
(General Statute 143-141(d))

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April 18, 2022



North Carolina Building Code Council  
325 N Salisbury St., Room 5\_44  
Raleigh, NC 27603

Re: Appeal of Local Decision – Use of Uninsulated Ducts Within the Building Thermal Envelope

Dear Code Council,

I represent Rheia, an innovative new supply air distribution system for residential new construction. Rheia is active in 18 states across the country, and several builders we work with would like to use our system in North Carolina.

Rheia supply ducts are uninsulated and always routed within the building thermal envelope, through floor cavities between two conditioned, livable floor areas, and through interior walls between two conditioned, livable rooms. 2018 North Carolina Residential Code N1103.3.1 does not require ducts within conditioned space to be insulated. The same code section requires supply ducts within semi-conditioned spaces to be insulated to a minimum R-4.

Chapter 2 of the 2018 NC Residential Code defines conditioned space as *"A space within a building that is provided with heating or cooling equipment or systems capable of maintaining, through design or heat loss/gain, 50°F (10°C) during the heating season or 85°F (29°C) during the cooling season, or communicates directly with a conditioned space. Spaces within the building thermal envelope are considered conditioned space."* The floor and wall cavities that we run our ducts through meet every aspect of this definition.

We received an Informal Interpretation from David Rittlinger of the North Carolina Department of Insurance stating the wall and floor cavities are semi-conditioned space. Chapter 2 defines semi-conditioned space as *"A space within the building thermal envelope that is not directly heated and/or cooled."* Directly heated and/or cooled is not defined in chapter 2.

Mr. Rittlinger explained how the North Carolina code is derived from the ICC code books. The ICC code books do not have the term 'semi-conditioned space', so the floor and wall cavities fall directly under the definition of conditioned space. The 2018 IRC Commentary Book further explains the intent of the definition to include a space that contains uninsulated ducts. See attachment.

We are seeking a Formal Interpretation indicating floor and wall cavities that are within the building thermal envelope and surrounded by livable space should be considered conditioned space, allowing our uninsulated ducts to be run in those areas.

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If there are any questions, please direct your reply to Nathan Good at [ngood@rheiacomfort.com](mailto:ngood@rheiacomfort.com) or 602-448-5870.

Sincerely,

Nathan Good, PE  
VP, Engineering

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or indirectly heated or cooled through uninsulated walls, floors, uninsulated ducts or uninsulated heating, ventilating and air-conditioning (HVAC) piping. Boundaries that define the building envelope include the following:

- Building assemblies separating a conditioned space from outdoor ambient weather conditions.
- Building assemblies separating a conditioned space from the ground under or around that space, such as the ground around the perimeter of a slab or the soil at the exterior of a conditioned basement wall. Note that the code does not specify requirements for insulating basement floors unless such floors are heated slabs.
- Building assemblies separating a conditioned space from an unconditioned garage, unconditioned sunroom or similar unheated/uncooled area.

This code specifies requirements for ceiling, wall, floor, basement wall, slab-edge and crawl space wall components of the building envelope. In some cases, it may be unclear how to classify a particular part of a building. For example, skylight shafts have properties of a wall assembly but are located in the ceiling assembly. Because many of these items are not addressed specifically in the code, the building official should make the determination as to the appropriate classification and construction. Where no distinction exists between roof and wall, such as in an A-frame structure, the building official should determine the appropriate classification. Historically, some codes have designated a wall as having a slope of 60 degrees or greater from the horizontal plane. In such situations, where the wall slope is less than 60 degrees, then classification as a "roof" is appropriate. Because the code is silent on this issue, other options such as stating that the roof could be considered to begin at a point 8 feet (2439 mm) above the floor surface of the uppermost story could be used. The phrase "exempt...space" in the definition of "Building thermal envelope" refers to spaces identified as exempt from this scope of this chapter (see commentary, Section N1107).

**CIRCULATING HOT WATER SYSTEM.** A specifically designed water distribution system where one or more pumps are operated in the service hot water piping to circulate heated water from the water-heating equipment to fixtures and back to the water-heating equipment.

- ❖ The definition specifies the system elements and configuration necessary to qualify as a circulation hot water system. These systems are not to be confused with those hot water systems used for space conditioning. Circulating systems allow for quick delivery of hot water at a faucet because it is readily available in the circulating element of the system. The definition is consistent with industry standards.

**CLIMATE ZONE.** A geographical region based on climatic criteria as specified in this code.

- ❖ Climate zones are used throughout the code to provide regionally appropriate design standards. The climate zones are specified in Section N1101.7. See the commentary to Section N1101.7.

**CONDITIONED FLOOR AREA.** The horizontal projection of the floors associated with the *conditioned space*.

- ❖ The conditioned floor area is the total area of all floors in the conditioned space of the building.

**CONDITIONED SPACE.** An area, room or space that is enclosed within the *building thermal envelope* and that is directly heated or cooled or indirectly heated or cooled. Spaces are indirectly heated or cooled where they communicate through openings with conditioned spaces, where they are separated from conditioned spaces by uninsulated walls, floors or ceilings, or where they contain uninsulated ducts, piping or other sources of heating or cooling.

- ❖ A conditioned space is typically any space that does not communicate directly to the outside; that is, a space that is not directly ventilated to the outdoors and meets one of the following criteria:

1. The space has a heating or cooling supply register.
2. The space has heating or cooling equipment designed to heat or cool the space, or both, such as a radiant heater built into the ceiling, a baseboard heater or a wall-mounted gas heater.
3. The space contains uninsulated ducts or uninsulated hydronic heating surfaces.
4. The space is inside the building thermal envelope. For example:
  - A basement with insulated walls but without insulation on the basement ceiling.
  - A closet on a home's exterior wall that is insulated on the exterior surface of the closet wall.
  - A space adjacent to and not physically separated from a conditioned space (such as a room adjacent to another room with a heating duct but without a door that can be closed between the rooms).
  - A room completely surrounded by conditioned spaces.

The builder/designer has some flexibility in defining the bounds of the conditioned space as long as the building envelope requirements are met. Spaces that are not conditioned directly but have uninsulated surfaces separating them from conditioned spaces are included within the insulated envelope of the building. For example, an unventilated crawl space below an uninsulated floor is considered part of the conditioned space, even where no heat is directly