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### Engineer's Corner

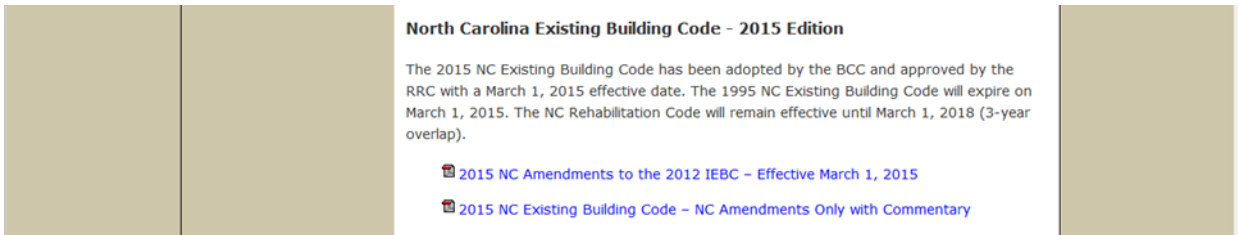
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# Introduction

## Feature Articles

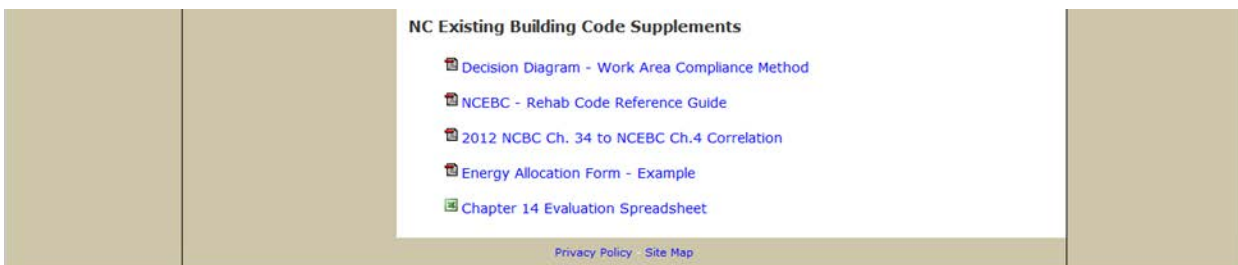
### 2015 Existing Building Code - Update

The commentary for the NC amendments to the NC Existing Building Code has been posted at the following link. You, the reader, will need to scroll down the page until the title “ North Carolina Existing Building Code – 2015 Edition” is in view. See partial screen print below. [http://www.ncdoi.com/OSFM/Engineering\\_and\\_Codes/Default.aspx?field1=Codes\\_-\\_Current\\_and\\_Past&user=State\\_Building\\_Codes](http://www.ncdoi.com/OSFM/Engineering_and_Codes/Default.aspx?field1=Codes_-_Current_and_Past&user=State_Building_Codes)



There are also supplemental documents for the NC Existing Building Code (NCEBC) that have been posted at to the following link. Once you select the link, you will have to scroll down the page until you get to the title “NC Existing Building Code Supplements”. See partial screen print below.

[http://www.ncdoi.com/OSFM/Engineering\\_and\\_Codes/Default.aspx?field1=Code\\_Enforcement\\_-\\_Design\\_Tools&user=Code\\_Enforcement\\_Resources](http://www.ncdoi.com/OSFM/Engineering_and_Codes/Default.aspx?field1=Code_Enforcement_-_Design_Tools&user=Code_Enforcement_Resources)



### Building Code Council Approved Rule Changes

At the December 2014 NC Building Code Council meeting, there were 19 D-Items, and 18 of these were adopted at this quarterly meeting. Please refer to the following link to review the list of D-Items from the December 2014 Building Code Council Meeting:

[http://www.ncdoi.com/OSFM/Engineering\\_and\\_Codes/Documents/BCC\\_Minutes/2014%2012%2009~December%209,%202014.pdf](http://www.ncdoi.com/OSFM/Engineering_and_Codes/Documents/BCC_Minutes/2014%2012%2009~December%209,%202014.pdf)

Assuming the BCC-approved D-Items are approved by the Rule Review Commission, the adopted rules will be placed on the NCDOT Engineering website. The compilation of previously approved rules is located in the document “**2014-2016 Approved Cumulative Amendments**”. See Cumulative Supplements article under the Engineering Department section for link.

The full review of the 18 approved code amendments is left to the reader, but one of the more notable code amendments is Item D-10 which updates the Span Tables of Appendix N of the Residential Code. This amendment had an effective date of April 1, 2015. The excerpt of this amendment is reprinted below for convenience.

**Item D-10 Request by Steve Knight, PE, BCC Structural Committee Chair, to amend the 2012 NC Residential Code, Appendix N, Tables N-1 and N-2 as follows:**

**Appendix N: Delete Tables N-1 and N-2 and substitute tables at the following link:**

[http://www.ncdoi.com/OSFM/Engineering\\_and\\_Codes/Documents/BCC\\_Minutes/2014%2006%2014~June%2010,%202014%20\(Items%20B-11%20through%20B-21,%20for%20public%20comment\).pdf](http://www.ncdoi.com/OSFM/Engineering_and_Codes/Documents/BCC_Minutes/2014%2006%2014~June%2010,%202014%20(Items%20B-11%20through%20B-21,%20for%20public%20comment).pdf)

Another notable amendment is Item D-17 which updates the standards commonly referenced by the NC Fire Protection code. Approximately seventy-five referenced NFPA standards were updated, including the commonly used NFPA 13, NFPA 13D, NFPA 13R and NFPA 72. The link following the adopted proposal is a link to a pdf document that contains other referenced standards, and to see this particular change, scroll down to the 38<sup>th</sup> page. This amendment has an effective date of Jan 1, 2016. Prior to that date, it can be used via NC Administrative code Section **102.5 Interim Use of approved Rules**.

**Item D-17 Request by Wayne Hamilton, NC Fire Service Code Revision Committee, to amend the 2012 NC Fire Code, Chapter 47 as follows:**

**The complete list of revised standards is published at the following link:**

[http://www.ncdoi.com/OSFM/Engineering\\_and\\_Codes/Documents/BCC\\_Minutes/2014%2006%2014~June%2010,%202014%20\(Items%20B-11%20through%20B-21,%20for%20public%20comment\).pdf](http://www.ncdoi.com/OSFM/Engineering_and_Codes/Documents/BCC_Minutes/2014%2006%2014~June%2010,%202014%20(Items%20B-11%20through%20B-21,%20for%20public%20comment).pdf)

## **Qualification Board Minutes**

Minutes

The minutes of the January 27, 2015 Board Meeting are available at the following link:

[http://www.ncdoi.com/OSFM/Engineering\\_and\\_Codes/Documents/COQB\\_Minutes/2015%2001%2027~January%2027,%202015.pdf](http://www.ncdoi.com/OSFM/Engineering_and_Codes/Documents/COQB_Minutes/2015%2001%2027~January%2027,%202015.pdf)

The minutes of the April 28, 2015 Board Meeting will be available upon Board approval at the July 28, 2015 meeting.

## Training Summary

Since the adoption of the 2012 NC Code, 661 Standard courses were taught at NC Community Colleges across the state. However, 224 more were offered, but had to be canceled due to lack of attendance. These classes are open to the public, and are an excellent chance for a code official to get trained or for anyone associated with the building trade to obtain the same basic training the code officials receive. For locations of all the NC Community Colleges (and proximity to Authorities Having Jurisdiction) see the interactive map on the COQB home page at the link below (scroll down to the bottom of the web page after you click the link). Clicking on a diamond symbol will “pop-up” additional information. Please note that not all Community Colleges offer all Standard Courses:

[http://www.ncdoi.com/OSFM/Engineering\\_and\\_Codes/Default.aspx?field1=Code\\_Officials\\_Qualification\\_Board\\_USER&user=Code\\_Officials\\_Qualification\\_Board](http://www.ncdoi.com/OSFM/Engineering_and_Codes/Default.aspx?field1=Code_Officials_Qualification_Board_USER&user=Code_Officials_Qualification_Board)

## **Model Code Development – ICC Hearings Available On-Line**

The International Code Council (ICC) hearings for the 2018 model codes took place this past quarter in Memphis, TN. The hearings were available to the general public via streaming video, and the archived streaming video available for the proposed

changes to the model code available on-line for viewing for those with voting privilege. The proposed changes in written format and the unofficial results are available at the following links.

### Proposed Changes (2018 I-Codes)

<http://www.iccsafe.org/codes-tech-support/codes/code-development/20152017-code-development-group-a/>

(Scroll down a little when you get to the website)

### Unofficial Results of Proposed Changes

<http://www.iccsafe.org/wp-content/uploads/2015CAH-Results.pdf>

Watching the discussion during the code hearings gives the viewer a greater understanding of certain code changes, and the overall format of the codes. For instance, a common complaint about the code is: “it doesn’t tell me how to do it, it just says what I can’t do”. Detailed installation instructions are not in the code on purpose. Although there may be some prescriptive language, the code is still not designed as an installation manual. As an example, there were several proposed changes to the International Mechanical Code that would have clarified the installation of flexible ductwork by adopting installation techniques from the **ADC – Flex Duct Installation Document**, into the code. The ICC code panel really thought it was good language, but in the end did not adopt the installation language but instead chose to continue directing the code user back to the installation instructions. In other words, the code does not have detailed installation instructions on purpose. By watching this code change proposal and others on streaming video, we can all “get it from the horse’s mouth”.

The links to the archived code hearings are included below. Please understand these links may be temporary and will become inoperative after several months, and DOI does not have control over the links.

### Archived Code Hearing Discussions

To get into the site that has the archived hearing discussion, the reader has to provide a username and password. Those readers of this newsletter that have voting authorization can access the site. However, at the time of this writing, ICC was having difficulties with the video at the time of this newsletter.

[https://av.iccsafe.org/eweb/DynamicPage.aspx?Site=icc-cdp&WebCode=LoginRequired&URL\\_success=https%3A%2F%2Fcdpaccess.com%2F%3FToken%3D%7BToken%7D](https://av.iccsafe.org/eweb/DynamicPage.aspx?Site=icc-cdp&WebCode=LoginRequired&URL_success=https%3A%2F%2Fcdpaccess.com%2F%3FToken%3D%7BToken%7D)

## Department Notes

### Engineering Department

#### New Code Interpretations Posted

Since the last Engineering Newsletter was posted, the following web interpretations have been posted to the interpretations webpage, at the following link:

[http://www.ncdoi.com/OSFM/Engineering\\_and\\_Codes/Default.aspx?field1=Code\\_Interpretations&user=State\\_Building\\_Codes](http://www.ncdoi.com/OSFM/Engineering_and_Codes/Default.aspx?field1=Code_Interpretations&user=State_Building_Codes)

Energy 402.3.6 - Window Replacement for Residential Buildings.doc

Residential 1102.3.6 - Window Replacement for Residential Buildings.doc

Residential 0409.5 - Closed Crawl Space Moisture Control - Permitting and H3 Licensure

## Cumulative Supplements

Cumulative code changes and their adoption dates can be found on the DOI website at:

[http://www.ncdoi.com/OSFM/Engineering\\_and\\_Codes/Default.aspx?field1=Codes\\_-\\_Current\\_and\\_Past&user=State\\_Building\\_Codes](http://www.ncdoi.com/OSFM/Engineering_and_Codes/Default.aspx?field1=Codes_-_Current_and_Past&user=State_Building_Codes)

You may have to scroll down on the screen that is accessed at the above link to see another link to the “**2012-2015 Approved Cumulative Amendments.**” The batch of code changes that had effective dates on or before January 1, 2015, is in the “2012-2015 Approved Cumulative Amendments” document. Starting with the September 2014 code changes, another document has been added, titled “**2014-2016 Approved Cumulative Amendments**” that will accumulate all the changes with effective dates taking place on or before January 1, 2016.

Remember; refer to NC Administrative Code section **102.4 Effective date of rules**, and **102.5 Interim use of approved rules** for clarification of effective dates and the process for using approved rules prior to the effective date.

## Qualifications Assurance Section – COQB, HILB & PYRO

May 1<sup>st</sup> marked the start of the annual renewal period for nearly 4,000 code officials holding Standard Certificates. In order to renew a certificate the inspector must have met the annual CE requirement (6 hours per Type/Trade) **and** paid the renewal fee. Jurisdictions may log in to the system and pay for any inspector who has that jurisdiction listed as the Primary Employer. In order to maintain accurate records, a **Certificate Of Employment (COE)** form must be on file verifying actual/current employment. The last page of this newsletter includes a copy of the COE that must be submitted – either scanned and uploaded locally with a notary seal OR emailed ATTN: [terri.tart@ncdoi.gov](mailto:terri.tart@ncdoi.gov) .

May and June are also a time of increased activity for initial and renewal applications for Pyrotechnic Display and Proximate Operator & Assistant licenses due to the many summer fireworks events beginning July 4<sup>th</sup>. Many Fire Code Officials will be permitting and approving shows and sites for Pyrotechnic Licensees both on State Owned property and private property. This is an area of government/industry cooperation that staff will be further involved.

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## NC Building Code Training

The bulk of the winter and spring continuing education seminars have been completed, but there are still courses available by many third-party trainers and individual jurisdictions. The most up-to-date training schedule for all training methods is available at the following link:

[http://www.ncdoi.com/OSFM/Engineering\\_and\\_Codes/Default.aspx?field1=Code\\_Education\\_-\\_Student\\_Main&user=Code\\_Education\\_Resources](http://www.ncdoi.com/OSFM/Engineering_and_Codes/Default.aspx?field1=Code_Education_-_Student_Main&user=Code_Education_Resources)

Once the web page is accessed, click the “**FIND A CLASS**” button to refine your search. As discussed in the Feature Articles section, please consider the use of the Standard Classes if you are a design professional, contractor, or code official, as they are an underutilized offering.

The annual education seminars for the NCBIA, NC PIA, and NCMIA are quickly approaching July 26-29<sup>th</sup>, Jun 14-17<sup>th</sup>, and August 2-5<sup>th</sup>, respectively. The links to their websites are:

<http://www.ncbia.org/>

<http://ncpia.us/>

<http://ncmia.com/>

#### Summary of Training Since 2012 Code Cycle Became Effective

Code Courses Offered Since 2012	Courses Offered	Courses Canceled (insufficient attendees)
Standard Courses	661	224
Continuing Ed Courses	2142	133

[Note: Standard code courses and most continuing education courses are open to the public and can be taken by persons other than code officials.]

### Engineer’s Corner

Condensate Freeze Protection (Warning: Contents are Cold)

We don’t need to be reminded that coffee is hot, although from time-to-time court cases covered by the media seem to indicate otherwise. When it comes to warnings for cold; mother nature does not provide us with clear labels, but we have sources available to us to aid the design process. This was discussed in last May’s Engineering Newsletter; here is a link to said document:

May 2014 Engineering Newsletter – Engineer’s Corner, Weather Data

[http://www.ncdoi.com/OSFM/Documents/Engineering\\_Newsletters/2014%2005%2006~May%206,%202014%20-%20DOI%20ENGINEERING%20NEWSLETTER\\_.pdf](http://www.ncdoi.com/OSFM/Documents/Engineering_Newsletters/2014%2005%2006~May%206,%202014%20-%20DOI%20ENGINEERING%20NEWSLETTER_.pdf)

As discussed in last year’s article, North Carolina is the site of the world’s largest climate data storage site. The National Climatic Data Center (NCDC) in Asheville, NC has data that is less than an hour old all the way to data that is centuries old. Much of the data we commonly use in the HVAC industry, such as ACCA and ASHRAE, has its roots with the National Climatic Data Center (NCDC). One of the more common tables we are familiar with is the Climatic Data Tables in ASHRAE Handbook of Fundamentals. This is the 97.5% and 99% design table people are mostly familiar with, but may not be familiar with how much information is available in the full text of the ASHRAE Handbook of Fundamentals Chapter for Weather data. A snapshot of the 99% winter temperature data is shown in Table 1: 99% Data for Select NC Cities.

What does the 99% data mean?

This data indicates that every part of North Carolina is, in a typical year, subject to cold snaps that are well below freezing AND that can last over 20 hrs, and up to 60 hrs when looked at over a ten-yr time frame. For instance, 1% of the hours in a typical year in Raleigh/Durham will be at or below 23.6F, which equates to 88 hrs per year. The typical duration of the temperature being at or below 23.6F is 20 hrs in any given year, with time frames up to 60 hrs in any ten-year time period. In other words, it is not unexpected to have freezing conditions that last for over a day. Short-term blips below freezing tend to not cause

problems because there is residual heat in the area, but when it gets below freezing and stays below freezing for a day, design and installation shortcomings will happen.

**Table 1: 99% Data for Select NC Cities**

North Carolina <sup>1,2,4</sup>	Heating DB (99%)	Hours per winter this temperature or lower occurs: <sup>3</sup>	Duration of any given Cold Snap <sup>5</sup>
Asheville	18.9	88 hrs	≈ 20 – 60 hrs
Charlotte	25	88 hrs	≈ 20 – 60 hrs
Fayetteville	26.4	88 hrs	≈ 20 – 60 hrs
Raleigh/Durham	23.6	88 hrs	≈ 20 – 60 hrs
Greenville	24.8	88 hrs	≈ 20 – 60 hrs
Wilmington	27.7	88 hrs	≈ 20 – 60 hrs

<sup>1</sup> Source: 2013 ASHRAE Handbook of Fundamentals

<sup>2</sup> Time period: Based on data from the 1986 – 2010 time frames, [ASHRAE 2013,p14.5]

<sup>3</sup> This is derived from 1% times 8760 hrs in a year equals 88 hours (0.01 x 8760 = 87.6 hrs).

<sup>4</sup> The 1993 ASHRAE handbook used the rationale that 99% was for the winter months only, so the time duration was shorter, 22 hrs, but the temperatures were quite lower also. Therefore although some of the increase in temperature is due to unexplained climatic temperature rise, much of the temperature rise in this table is simply due to broadening the category of 1% from only the winter months to including the entire year.

<sup>5</sup> The duration of a cold snap (temperature at or below 99%) can vary from approximately 20 hrs in any given year to 60 hrs in any ten-yr span [2013 ASHRAE Fundamentals, p 14.15]

## Design Conditions

The mechanical code does not address outside air temperature to use for freeze protection, only for heat gain/loss of the structure itself does the NC Mechanical Code Section 312 references the use of ACCA Manual J. ACCA Manual J uses the 99% Design temperature for determining the temperature difference between the outside of the house and the inside of the house.

***However, there are no limits in the code that restrict the designer from recognizing that a unit installed outside the thermal envelope will be subject to temperatures at or below the 99% level.***

Using the 99% weather data provides insight to the expected low temperatures in any given year, but what resources are available to let designers estimate the reoccurrence of bitter cold temperatures that may affect a heating system installed outside the thermal envelope? Chapter 14 has a section devoted to design conditions for extreme annual conditions. These values are intended for continuous operation and serviceability regardless of whether the heating or cooling loads are being

met [ASHRAE Fundamentals p. 14.6]. The temperatures are given in a CD ROM, and are called the 5-, 10-,20-, and 50- year return periods. The use and selection of these is “beyond the code”, but the intent of this article is to disseminate sources of data that can be used for system designs.

### Field Installation Combinations

There are numerous conceivable combinations of location, drain routing and drain line termination for condensing appliances. We have attached a table that has some of the more common locations identified and some suggestions. The table is by no means an installation manual, but may be of some use in illustrating other options. Please note that in areas of the country where condensing appliances have been the norm for 20+ years,[Home Energy Magazine November/December 1994, www.homeenergy.org] historically the appliance is located inside the thermal envelope, and drained to either the sewer, storm drain or other below-grade drain. In areas where the appliance has traditionally been installed outside of the thermal envelope, such as in an uninsulated attic or uninsulated equipment room, you do not have the luxury of the passive freeze protection offered by having the appliance indoors. Thus, active freeze protection means like heat tracing, as identified in the installation manual, may be required as part of the overall solution. Some houses are simply more challenging than others due to their layout, and obviously new installations provide more flexibility than existing installations.

<i>Furnace (or Cat IV water heater) Installation location</i>	Area of Freeze Exposure Comments	
	<i>Vent and condensate drain line</i>	<i>Indoor/outdoor interface of condensate drain line</i>
Appliance outside of thermal envelope and condensate draining to exterior of building	Follow manufacturer’s installation instructions for protection of potential freezing within the vent and vent drain. Could include insulation and heat tracing.	Any exposed pipe can be upsized and raised above grade with good drainage away from building to prevent ice stalagmites from forming, and/or heat trace <sup>2</sup> exterior portion to manufacturer’s recommendations.
Appliance installed within the thermal envelope and drained to dedicated dry well or French drain.	N.A. – located within thermal envelope	N.A.-drains below frost line
Appliance within the thermal envelope and drain to building drain system where allowed by local water authority	N.A. – located within thermal envelope	N.A. – located within thermal envelope
Appliance installed within thermal envelope and drained outside <sup>1</sup>	N.A. – located within thermal envelope	Any exposed pipe can be upsized and raised above grade with good drainage away from building to prevent icicle stalagmites from forming, and/or heat trace exterior portion to manufacturer’s recommendations.
Appliance installed outside of thermal envelope and drain to dedicated dry well or French drain.	Follow manufacturer’s installation instructions for protection of potential freezing within the vent and vent drain. Could include insulation and heat tracing.	N.A.-below frost line

<sup>1</sup>Any drain not connected to the building drain must be a dedicated drain and collect only condensate, and not a floor drain.



<sup>2</sup>Any heat trace must be compatible with the drain material, which is typically PVC for residential construction. There are cables made for gravity-drain plastic piping.

## Observations from the Field

Code officials get to see a lot of different designs, and here are some of the observations that the reader may find of use:

- Designs that kept the condensate as warm as possible for as long as possible were less prone to freezing.
  - This is largely backing up what the manufacturer's installations are saying, and why the manufacturer may require insulating the vent pipe in addition to the condensate pipe for its entire length.
  - Run the condensate lines inside interior walls where possible before draining to the exterior. Remember, insulation slows the loss of heat, but does not stop it.
- When terminating drain outside, designs that used 2- 45° pipe fittings instead of a 90° seemed to freeze less.
- Wind makes a difference. Drain lines exposed to windy areas were observed to freeze more than areas protected from wind.
- Sun makes a difference. Drain lines on shaded sides of buildings were observed to freeze more than areas that received sunshine.
- There are several manufacturers' that make heat cables listed for installation inside the drain line. These should be carefully researched and explored as an option in existing installations for applicability.
- If using a condensate pump, verify it is meant for the application, and consider locating it within conditioned space, and making sure any pumped condensate cannot sit in piping and freeze in between pump cycles. Surges of water are less prone to freezing than slow trickles.
- Any code-required auxiliary drainage means must be adhered to.

## Code Interface

As discussed briefly, the Code typically does not have detailed installation instructions in the body of the code, but instead references the manufacturer's installation instructions. However, please note that the Plumbing Code does not prohibit draining condensate to the building drain; but instead recognizes the authority having jurisdiction to accept the condensate is typically the local water authority, not the building code official. We encourage the code official, homeowner and installing contractor to clarify the local water authority's ordinances. See NC Plumbing Code Sections 101.6, 302.1, and Section 701.4, and 701.5.

If the local water authority has provisions for accepting only the condensation from the products of combustion and not the cooling coil condensate, two condensate streams may need to be planned for in regards to primary drainage and secondary drainage. Refer to NCFGC 502.1 for water heaters and NC FGC 307 for Category IV condensing appliances. This section further reference NCMC Section 307 for auxiliary protection.

