

## CHAPTER 1 ADMINISTRATION

### SECTION 101 GENERAL

#### 101.1 Title.

These regulations shall be known as the North Carolina Mechanical Code as approved by the North Carolina Building Code Council on March 11, 2008, to be effective January 1, 2009. References to the International Codes shall mean the North Carolina Codes. The North Carolina amendments to the International Codes are underlined.

#### 101.2 Scope.

This code shall regulate the design, installation, maintenance, alteration and inspection of mechanical systems that are permanently installed and utilized to provide control of environmental conditions and related processes within buildings. This code shall also regulate those mechanical systems, system components, equipment and appliances specifically addressed herein. The installation of fuel gas distribution piping and equipment, fuel gas-fired appliances and fuel gas-fired appliance venting systems shall be regulated by the International Fuel Gas Code.

**Exception:** Deleted.

#### 101.2.1 Appendices.

Provisions in the appendices shall not apply unless specifically adopted or referenced in this code.

#### **101.5 Requirements of other State agencies, occupational licensing boards, or commissions.**

The North Carolina State Building Codes do not include all additional requirements for buildings and structures that may be imposed by other State agencies, occupational licensing boards, and commissions. It shall be the responsibility of a permit holder, design professional, contractor, or occupational license holder to determine whether any additional requirements exist.

### SECTION 103

#### DEPARTMENT OF MECHANICAL INSPECTION

Deleted. See the North Carolina Administrative Code and Policies.

### SECTION 104

#### DUTIES AND POWERS OF THE CODE OFFICIAL

Deleted. See the North Carolina Administrative Code and Policies.

### SECTION 106

#### PERMITS

Deleted. See the North Carolina Administrative Code and Policies.

### SECTION 107

#### INSPECTIONS AND TESTING

Deleted. See the North Carolina Administrative Code and Policies.

### SECTION 108

#### VIOLATIONS

Deleted. See the North Carolina Administrative Code and Policies.

### SECTION 109

#### MEANS OF APPEAL

Deleted. See the North Carolina Administrative Code and Policies.

## Chapter 2

**APPROVED.** Acceptable to the code official for compliance with the provisions of the applicable code or referenced standard.

**CLOSET.** An enclosed or recessed area used to store clothing, linens or other household items.

**REGISTERED DESIGN PROFESSIONAL.** An individual who is registered or licensed to practice their respective design profession as defined by the statutory requirements of the professional registration laws of the state or jurisdiction in which the project is to be constructed. Design by a registered design professional is not required where exempt under the registration or licensure laws.

## Chapter 3

**301.14.1 General.** Buildings or structures and the walls enclosing habitable or occupiable rooms and spaces in which persons live, sleep or work, or in which feed, food or food-stuffs are stored, prepared, processed, served or sold, shall be constructed in accordance with the provisions of the section.

**301.14.2 Foundation wall ventilation openings.** Foundation wall ventilator openings shall be covered for their height and width with perforated sheet metal plates no less than 0.070 inch (1.8 mm) thick, expanded sheet metal plates not less than 0.047 inch (1.2 mm) thick, cast-iron grilles or grating, extruded aluminum load-bearing vents or hardware cloth of 0.035-inch (0.89 mm) wire or heavier. The openings therein shall not exceed ¼ inch (6.4 mm).

**301.14.3 Foundation and exterior wall sealing.** Annular spaces around pipes, electric cables, conduits or other openings in the walls shall be protected against the passage of rodents by closing such opening with cement mortar, concrete masonry, silicone caulking or noncorrosive metal.

**304.2 Conflicts.** Deleted.

**304.3 Elevation of ignition source.** Equipment and appliances having an ignition source and located in hazardous locations and public garages, private garages, repair garages, automotive motor-fuel-dispensing facilities and parking garages shall be elevated such that the source of ignition is not less than 18 inches (457 mm) above the floor surface on which the equipment or appliance rests. Such equipment and appliances shall not be installed in Group H occupancies or control areas where open use, handling or dispensing of combustible, flammable or explosive materials occurs. For the purpose of this section, rooms or spaces that are not part of the living space of a dwelling unit and that communicate directly with a private garage through openings shall be considered to be part of the private garage.

**Exception:** Elevation of the ignition source is not required for appliances that are listed as flammable ignition resistant.

**304.3.1 Parking garages.** Connection of a parking garage with any room in which there is a fuel-fired appliance shall be by means of a vestibule providing a two-doorway separation, except that a single door is permitted where the sources of ignition in the appliance are elevated in accordance with Section 304.3.

**Exceptions:**

1. This section shall not apply to appliance installations complying with Section 304.5.
2. This does not apply to one and two family dwellings and townhouses.

**304.8 Clearances to combustible construction.** Heat-producing equipment and appliances shall be installed to maintain the required clearances to combustible construction as specified in the listing and manufacturer's instructions. Clearances to combustibles shall include such considerations as door

swing, drawer pull, overhead projections or shelving and window swing, shutters, coverings and drapes. Devices such as doorstops or limits, closers, drapery ties or guards shall not be used to provide the required clearances.

### **304.9 Under-floor and exterior grade installations.**

**304.9.1 Exterior Grade Installations.** Equipment and appliances installed above grade level shall be supported on a solid base or approved material a minimum of 2 inches (51 mm) thick.

**304.9.2 Under-floor installation.** Suspended equipment shall be a minimum of 6 inches (152 mm) above the adjoining grade.

**304.9.3 Crawl space supports.** In a crawl space, a minimum of 4 x 8 x 16 inch (102x203x406 mm) block or brick supports shall be held in place with mortar. Formed concrete or approved prefabricated steel units are acceptable.

**304.9.4 Drainage.** Below-grade installations shall be provided with a natural drain or an automatic lift or sump pump. For pit requirements see Section 303.7.

**[B] 304.10 Guards.** Guards shall be provided where appliances, equipment, fans or other components that require service and roof hatch openings are located within 6 feet (1829 mm) of a roof edge or open side of a walking surface and such edge or open side is located more than 30 inches (762 mm) above the floor, roof or grade below. The guard shall extend not less than 30 inches (762 mm) beyond each end of such appliances, equipment, fans, components and roof hatch openings and the top of the guard shall be located not less than 42 inches (1067 mm) above the elevated surface adjacent to the guard. The guard shall be constructed so as to prevent the passage of a 21-inch-diameter (533 mm) sphere and shall comply with the loading requirements for guards specified in the *International Building Code*.

**Exception:** Guards not required at the time of original installation are not required by this paragraph for equipment repaired or replaced.

**306.1.1 Central furnaces.** Deleted.

**306.3 Appliances in attics.** Attics containing appliances requiring access shall be provided with an opening and unobstructed passageway large enough to allow removal of the largest appliance. The passageway shall not be less than 30 inches (762 mm) high and 22 inches (559 mm) wide and not more than 20 feet (6096 mm) in length measured along the center line of the passageway from the opening to the appliance. The passageway shall have continuous solid flooring not less than 24 inches (610 mm) wide. A level service space not less than 30 inches (762 mm) deep and 30 inches (762 mm) wide shall be present at the front or service side of the appliance. The clear access opening dimensions shall be a minimum of 20 inches by 30 inches (508 mm by 762 mm), where such dimensions are large enough to allow removal of the largest appliance.

#### **Exceptions:**

1. The passageway and level service space are not required where the appliance is capable of being serviced and removed through the required opening.
2. Where the passageway is not less than 6 feet high (1829 mm) for its entire length, the passageway shall not be limited in length.

**306.3.1 Electrical requirements.** Deleted.

### **306.4 Appliances under floors.**

Underfloor spaces containing appliances requiring access shall be provided with an access opening and unobstructed passageway large enough to remove the largest appliance. The passageway shall not be less than 22 inches (559 mm) high and 36 inches (914 mm) wide, nor more than 20 feet (6096 mm) in length measured along the centerline of the passageway from the opening to the appliance. A level service space not less than 30 inches (762 mm) deep and 30 inches (762 mm) wide shall be present at the

front or service side of the appliance. If the depth of the passageway or the service space exceeds 12 inches (305 mm) below the adjoining grade, the walls of the passageway shall be lined with concrete or masonry. Such concrete or masonry shall extend a minimum of 4 inches (102 mm) above the adjoining grade and shall have sufficient lateral-bearing capacity to resist collapse. The clear access opening dimensions shall be a minimum of 22 inches high by 30 inches wide (559 mm by 762 mm), where such dimensions are large enough to allow removal of the largest appliance.

**Exceptions:**

1. The passageway is not required where the level service space is present when the access is open and the appliance is capable of being serviced and removed through the required opening.
2. Where the passageway is not less than 6 feet high (1829 mm) for its entire length, the passageway shall not be limited in length.

**306.4.1 Electrical requirements.** Deleted.

**306.5.1 Sloped roofs.** Where appliances, equipment, fans or other components that require periodic maintenance are installed on a roof having a slope of three units vertical in 12 units horizontal (25-percent slope) or greater and having an edge more than 30 inches (762 mm) above grade at such edge, a level platform shall be provided on each side of the appliance to which access is required for periodic maintenance. The platform shall be not less than 30 inches (762 mm) in any dimension and shall be provided with guards. The guards shall extend not less than 42 inches (1067 mm) above the platform, shall be constructed so as to prevent the passage of a 21-inch-diameter (533 mm) sphere and shall comply with the loading requirements for guards specified in the *International Building Code*.

**306.5.2 Electrical requirements.** Deleted.

**307.1 Fuel-burning appliances.** Liquid combustion by-products of condensing appliances shall be collected and discharged to an approved disposal area in accordance with the manufacturer's installation instructions. Condensate piping shall be of approved corrosion-resistant material and shall not be smaller than the drain connection on the appliance. Such piping shall maintain a minimum horizontal slope in the direction of discharge of not less than one-eighth unit vertical in 12 units horizontal (1-percent slope).

**307.2 Evaporators condensing furnances and cooling coils.** Condensate drain systems shall be provided for equipment and appliances containing evaporators, cooling coils or condensing furnances. Condensate drain systems shall be designed, constructed and installed in accordance with Sections 307.2.1 through 307.2.4.

**307.2.1 Condensate disposal.** Condensate from all condensing furnances, cooling coils and evaporators shall be conveyed from the drain pan outlet to an approved place of disposal. When unable to drain by gravity a condensate pump may be used. Where pumps are used, they shall be installed with factory equipped auxiliary high level switch and shall shut off equipment served upon activation of the auxiliary high level switch. Where damage to any building components will occur as a result of over flow from the pump, the pump shall also be located in the auxiliary drain pan or in a separate drain pan equipped with a separate drain line or water level detection device. Condensate shall not discharge into a street, alley or other areas so as to cause a nuisance.

**307.2.3 Auxiliary and secondary drain systems.** In addition to the requirements of Section 307.2.1, a secondary drain or auxiliary drain pan shall be required for each cooling or evaporator coil or fuel-fired appliance that produces condensate, where damage to any building components will occur as a result of overflow from the equipment drain pan or stoppage in the condensate drain piping. One of the following methods shall be used:

1. An auxiliary drain pan with a separate drain shall be provided under the coils on which condensation will occur. The auxiliary pan drain shall discharge to a conspicuous point of disposal to alert occupants in the event of a stoppage of the primary drain. The pan shall have a minimum depth of 1.5 inches (38 mm), shall not be less than 3 inches (76 mm) larger than the unit or the coil dimensions in width and length and shall be constructed of corrosion-resistant material. Metallic pans shall have a minimum thickness of not less than 0.0276-inch (0.7 mm) galvanized sheet metal. Nonmetallic pans shall have a minimum thickness of not less than 0.0625 inch (1.6 mm).
2. A separate overflow drain line shall be connected to the drain pan provided with the equipment. Such overflow drain shall discharge to a conspicuous point of disposal to alert occupants in the event of a stoppage of the primary drain. The overflow drain line shall connect to the drain pan at a higher level than the primary drain connection.
3. An auxiliary drain pan without a separate drain line shall be provided under the coils on which condensate will occur. Such pan shall be equipped with a water-level detection device conforming to UL 508 that will shut off the equipment served prior to overflow of the pan. The auxiliary drain pan shall be constructed in accordance with Item 1 of this section.
4. A water level detection device conforming to UL 508 shall be provided that will shut off the equipment served in the event that the primary drain is blocked. The device shall be installed in the primary drain line upstream of the primary drain line trap, the overflow drain line, or in the equipment-supplied drain pan, located at a point higher than the primary drain line connection and below the overflow rim of such pan.

## **S E C T I O N 3 0 8**

### **CLEARANCE REDUCTION FOR UNLISTED EQUIPMENT**

**308.2 Listed appliances and equipment.** Deleted.

#### **T A B L E 3 0 8 . 6**

### **CLEARANCE REDUCTION METHODS FOR UNLISTED EQUIPMENT**

**312.1 Load calculations.** Heating and cooling system design loads for the purpose of sizing systems, appliances and equipment shall be determined in accordance with the procedures described in the *ASHRAE Handbook of Fundamentals*. Heating and cooling loads shall be adjusted to account for load reductions that are achieved when energy recovery systems are utilized in the HVAC system in accordance with the *ASHRAE Handbook - HVAC Systems and Equipment*. Alternatively, design loads shall be determined by an approved equivalent computation procedure, using the design parameters specified in Chapter 3 of the *International Energy Conservation Code*. For one-and two-family dwellings and townhouses, heating and cooling equipment shall be sized based on building loads calculated in accordance with ACCA Manual J.

## Chapter 4

**403.2.1 Recirculation of air.** The air required by Section 403.3 shall not be recirculated. Air in excess of that required by Section 403.3 shall not be prohibited from being recirculated as a component of supply air to building spaces, except that:

1. Ventilation air shall not be recirculated from one dwelling to another or to dissimilar occupancies.
2. Supply air to a swimming pool and associated deck areas shall not be recirculated unless such air is dehumidified to maintain the relative humidity of the area at 60 percent or less. Air from this area shall not be recirculated to other spaces where 10 percent or more of the resulting supply airstream consists of air recirculated from these spaces.

3. Where mechanical exhaust is required by Note b in Table 403.3, recirculation of air to other spaces shall be prohibited. All air supplied to such spaces shall be exhausted, including any air in excess of that required by Table 403.3.
4. Where mechanical exhaust is required by Note h in Table 403.3, mechanical exhaust is required and recirculation is prohibited where 10 percent or more of the resulting supply airstream consists of air recirculated from these spaces.

**TABLE 403.3  
REQUIRED OUTDOOR VENTILATION AIR**

OCCUPANCY CLASSIFICATION	ESTIMATED MAXIMUM OCCUPANT LOAD, PERSONS PER 1,000 SQUARE FEET <sup>a</sup>	OUTDOOR AIR [Cubic feet per minute (cfm) per person] UNLESS NOTED <sup>e</sup>
<b>Correctional facilities</b>		
Cells		
without plumbing fixtures	20	20
with plumbing fixtures <sup>g, h</sup>	20	20
Dining halls	100	15
Guard stations	40	15
<b>Dry cleaners, laundries</b>		
Coin-operated dry cleaner	20	15
Coin-operated laundries	20	15
Commercial dry cleaner	30	30
Commercial laundry	10	25
Storage, pick up	30	35
<b>Education</b>		
Auditoriums	150	15
Classrooms <sup>f</sup>	50	15
Corridors	—	0.10 cfm/ft <sup>2</sup>
Laboratories	30	20
Libraries	20	15
Locker rooms <sup>g, h</sup>	—	0.50 cfm/ft <sup>2</sup>
Music rooms	50	15
Smoking lounges <sup>b, g</sup>	70	60
Training shops	30	20

*(no change to remainder of table)*

For SI: 1 cubic foot per minute = 0.0004719 m<sup>3</sup>/s, 1 ton = 908 kg.

1 cubic foot per minute per square foot = 0.00508 m<sup>3</sup>/(s · m<sup>2</sup>), °C = [(°F) - 32]/1.8, 1 square foot = 0.0929 m<sup>2</sup>.

a. Based upon net floor area.

b. Mechanical exhaust required and the recirculation of air to other spaces as permitted by Section 403.2.1 is prohibited (see Section 403.2.1, Items 1 and 3).

c. Spaces unheated or maintained below 50°F are not covered by these requirements unless the occupancy is continuous.

d. Ventilation systems in enclosed parking garages shall comply with Section 404.

e. Where the ventilation rate is expressed in cfm/ft<sup>2</sup>, such rate is based upon cubic feet per minute per square foot of the floor area being ventilated.

f. The sum of the outdoor and transfer air from adjacent spaces shall be sufficient to provide an exhaust rate of not less than 1.5 cfm/ft<sup>2</sup>.

g. Transfer air permitted in accordance with Section 403.2.2.

h. Mechanical exhaust is required and recirculation is prohibited except that recirculation shall be permitted where the resulting supply airstream consists of not more than 10 percent air recirculated from these spaces (see Section 403.2.1, Items 2 and 4).

i. The required exhaust system shall capture the contaminants and odors at their source.

**J. Exception:** Each school classroom's ventilation may be reduced to a minimum of 7.5-cfm/person as per ASHRAE 62, Section 6.1.3.4. Additional ventilation or exhaust systems shall be provided as required for conditions which generate unusual odors or sensory irritating contaminants. Outside air intake components (louvers, fresh air ducts) shall be sized to provide 15-cfm/person temporarily for special ventilation needs.

**405.2 Fan shutdown controls.** In Group I-2 and I-3 occupancies, each air distribution system shall be equipped with a manual emergency control to stop supply and return air in an emergency. The control device shall be mounted in a readily accessible location and be clearly identified.

**Exception:** Air-handling equipment serving a single space.

**406.1 General.** Uninhabited spaces, such as crawl spaces and attics, shall be provided with natural ventilation openings as required by the International Building Code or shall be provided with a mechanical exhaust and supply air system. The mechanical exhaust rate shall be not less than 0.02 cfm

per square foot (0.00001 m<sup>3</sup>/s • m<sup>2</sup>) of horizontal area and shall be automatically controlled to operate when the relative humidity in the space served exceeds 60 percent.

**Exception:** Except as otherwise permitted in the North Carolina Building Code.

## Chapter 5

**504.6 Domestic clothes dryer ducts.** Exhaust ducts for domestic clothes dryers shall be constructed of metal and shall have a smooth interior finish. With the exception of the transition duct, flexible ducts are prohibited. The exhaust duct shall be a minimum nominal size of 4 inches (102 mm) in diameter. The entire exhaust system shall be supported and secured in place and shall terminate not less than 12 inches above finished grade. The male end of the duct at overlapped duct joints shall extend in the direction of airflow. Clothes dryer transition ducts used to connect the appliance to the exhaust duct system shall be limited to single lengths not to exceed 8 feet (2438 mm) and shall be listed and labeled for the application. Transition ducts shall not be concealed within construction and must remain entirely within the room in which the appliance is installed.

**Exception:** Where the duct termination is less than 12 inches above finished grade an area way shall be provided with a cross sectional area not less than 200 square feet. The bottom of the duct termination shall be no less than 12 inches above the area way bottom.

**504.6.1 Maximum length.** The maximum length of a clothes dryer exhaust duct shall not exceed 45 feet (13716 mm) from the dryer location to the outlet terminal. The maximum length of the duct shall be reduced 5 feet (1524 mm) for each 45 degree (0.79 rad) bend and 10 feet (3048 mm) for each 90 degree (1.6 rad) bend. The maximum length of the exhaust duct does not include the transition duct. See Table 603.4 for gage thickness.

**Exception:** Where the make and model of the clothes dryer to be installed is known and the manufacturer's installation instructions for such dryer are provided to the code official, the maximum length of the exhaust duct, including any transition duct, shall be permitted to be in accordance with the dryer manufacturer's installation instructions. Where exhaust ducts are installed in concealed locations, the developed length of the exhaust duct system shall be indicated by permanent labels or tags installed in an observable location.

**507.2.1.1 Operation.** Deleted.

**507.2.2. Type II hoods.** Type II hoods shall be installed where cooking or dishwashing appliances produce heat, steam, or products of combustion and do not produce grease or smoke, such as steamers, kettles, pasta cookers and dishwashing machines.

**Exceptions:**

1. Under-counter-type commercial dishwashing machines.
2. A Type II hood is not required for dishwashers and potwashers that are provided with heat and water vapor exhaust systems that are supplied by the appliance manufacturer and are installed in accordance with the manufacturer's instructions.
3. Light-duty electric convection, bread, retherm or microwave ovens. The additional heat and moisture loads generated by such appliances shall be accounted for in the design of the HVAC system.
4. A Type II hood is not required for the following electrically heated appliances: toasters, steam tables, popcorn poppers, hot dog cookers, coffee makers, rice cookers, egg cookers, holding/warming ovens. The additional heat and moisture loads generated by such appliances shall be accounted for in the design of the HVAC system.
5. Low temperature (not greater than 120 degrees F) commercial chemical type dishwashers.

**507.2.3 Domestic cooking appliances used for commercial purposes.** Domestic cooking appliances utilized for commercial purposes shall be provided with Type I or Type II hoods as required for the type of appliances and processes in accordance with Sections 507.2, 507.2.1 and 507.2.2.

**Exception:** A maximum of two residential ranges (four burner) installed in dwelling units, churches, schools, day care centers, break areas, and similar installations.

**507.8 Cleaning and grease gutters.** A hood shall be designed to provide for thorough cleaning of the entire hood. Grease gutters shall drain to an approved collection receptacle that is fabricated, designed and installed to allow access for cleaning. The container shall have a minimum capacity not exceeding 1 gallon (3.8 L) unless otherwise approved by the mechanical official.

**507.13.5 Dishwashing appliances.** The minimum net airflow for Type II hoods used for dishwashing appliances shall be 100 CFM per linear foot of hood length.

**Exception:** Dishwashing appliances and equipment installed in accordance with Section 507.2.2, Exception 2 and 5.

**07.16.2 Certification.** These tests shall be witnessed by the code official, or at the code official's option, by a professional engineer who shall provide certification of performance to the code official.

**510.4 Independent system.** Hazardous exhaust systems shall be independent of other types of exhaust systems. Incompatible materials, as defined in the *International Fire Code*, shall not be exhausted through the same hazardous exhaust system. Hazardous exhaust systems shall not share common shafts with other duct systems, except where such systems are hazardous exhaust systems originating in the same fire area.

**Exception:** The provision of this section shall not apply to laboratory exhaust systems where all of the following conditions apply:

1. All of the hazardous exhaust ductwork and other laboratory exhaust within both the occupied space and the shafts is under negative pressure while in operation.
2. The hazardous exhaust ductwork manifolded together within the occupied space must originate within the same fire area.
3. Each control branch has a flow regulating device.
4. Perchloric acid hoods and connected exhaust shall be prohibited from manifolding.
5. Radioisotope hoods are equipped with filtration and/or carbon beds where required by the registered design professional.
6. Biological safety cabinets are filtered.
7. Provision is made to continuously maintain negative static pressure in the ductwork.

Contaminated air shall not be recirculated to occupied areas unless the contaminants have been removed. Air contaminated with explosive or flammable vapors, fumes or dusts; flammable, highly toxic or toxic gases; or radioactive material shall not be recirculated.

## Chapter 6

**601.4 Contamination prevention.** Exhaust ducts under positive pressure required to be sealed, chimneys, and vents shall not extend into or pass through ducts or plenums.

**Exception:** Exhaust ducts conveying environmental air. Exhaust ducts under positive pressure located inside plenums shall be sealed.

**602.2.1 Materials exposed within plenums.** Except as required by Sections 602.2.1.1 through 602.2.1.5, materials within plenums shall be noncombustible or shall have a flame spread index of not more than 25 and a smoke-developed index of not more than 50 when tested in accordance with ASTM E 84.

### Exceptions:

1. Rigid and flexible ducts and connectors shall conform to Section 603.
2. Duct coverings, linings, tape and connectors shall conform to Sections 603 and 604.
3. This section shall not apply to materials exposed within plenums in dwellings.
4. This section shall not apply to smoke detectors.
5. Combustible materials enclosed in noncombustible raceways or enclosures, approved gypsum board assemblies or enclosed in materials listed and labeled for such application.

**603.1 General.** An air distribution system shall be designed and installed to supply the required distribution of air. The installation of an air distribution system shall not affect the fire protection requirements specified in the *International Building Code*. Ducts shall be constructed, braced, reinforced and installed to provide structural strength and durability.

**603.1.1** Nothing in this section shall be deemed to preclude the use, within a conditioned space, of a fabric air distribution device that combines the function of air transport and air diffusion, provided that the materials used shall have a fire spread/smoke developed rating not greater than 25/50.

**603.1.2 Residential Garage Duct penetration.** Ducts in the garage and ducts penetrating the walls or ceilings separating the dwelling from the garage shall be constructed of a minimum No. 26 gage (0.48 mm) sheet steel or other approved material and shall have no openings into the garage.

**603.9 Joints, seams and connections.** All longitudinal and transverse joints, seams and connections in metallic and nonmetallic ducts shall be constructed as specified in SMACNA HVAC *Duct Construction Standards – Metal and Flexible* and NAIMA *Fibrous Glass Duct Construction Standards*. All joints, longitudinal and transverse seams, and connections in ductwork shall be securely fastened and sealed with welds, gaskets, mastics (adhesives), mastic-plus-embedded-fabric systems or tapes. Tapes and mastics used to seal ductwork listed and labeled in accordance with UL 181A shall be marked “181A-P” for pressure-sensitive tape, “181 A-M” for mastic or “181 A-H” for heat-sensitive tape. Tapes and mastics used to seal flexible air ducts and flexible air connectors shall comply with UL 181B and shall be marked “181B-FX” for pressure-sensitive tape or “181B-M” for mastic. Duct connections to flanges of air distribution system equipment shall be sealed and mechanically fastened. Mechanical fasteners for use with flexible nonmetallic air ducts shall comply with UL 181B and shall be marked 181B-C. Unlisted duct tape is not permitted as a sealant on any metal ducts.

**Exception:** Ducts exposed within the conditioned space they serve shall not be required to be sealed.

**603.10.1 For one-and two-family dwellings and townhouses.** Metal ducts shall be securely supported. Where hung or suspended, metal straps a minimum of 1-inch (25 mm) in width and equivalent to or heavier gauge than the duct being supported shall be used. Straps, when used, shall be at maximum 64-inch (1626 mm) intervals and shall be securely attached to the building structure. Straps shall be attached to the duct at a minimum of two points with screws or rivets. Hangar systems shall comply with this section or other approved means. Nonmetallic or listed duct systems shall be supported in accordance with the manufacturer’s installation instructions. All equipment shall be supported independently of the duct system except when the duct is used as a support base. When used as a support base, the duct shall be of sufficient strength and designed to support the weight of the unit. Listed bases shall be installed in accordance with the manufacturer’s installation instructions.

**603.12 Condensation.** Provisions shall be made to prevent the formation of condensation on the exterior of new duct. Ducts installed in attics, crawl spaces or outdoors, insulated per Section 403.2.1 or Section 503.2.7 of the Energy Code shall be deemed to meet the intent of this Section.

**604.1 General.** Duct insulation shall conform to the requirements of Sections 604.2 through 604.13 and the *International Energy Conservation Code*. Replacement or addition of cooling equipment to existing ductwork located in an attic shall require the ductwork to be insulated. Replacement of heating or the addition of cooling equipment in a crawl space shall not require the existing ductwork to be insulated.

**604.9 Thermal continuity.** Where a duct liner has been interrupted, a duct covering of equal thermal performance shall be installed.

**Exception:** See Section 604.6.

**606.1 Controls required.** Air distribution systems shall be equipped with smoke detectors listed and labeled for installation in air distribution systems, as required by this section. Duct smoke detectors shall comply with UL 268A. Other smoke detectors shall comply with UL 268.

**Exception:** Dwelling units.

**606.2.2 Common supply and return air systems.** Where multiple air-handling systems share common supply or return air ducts or plenums with a combined design capacity greater than 2,000 cfm (0.9 m<sup>3</sup>/s), the return air system shall be provided with smoke detectors in accordance with Section 606.2.1.

**Exception:** Individual smoke detectors shall not be required for any fan powered unit serving only one space. Individual smoke detectors shall not be required for each fan-powered terminal unit, provided that such units do not have an individual design capacity greater than 2,000 cfm (0.9 m<sup>3</sup>/s) and will be shut down by activation of one of the following:

1. Smoke detectors required by Sections 606.2.1 and 606.2.3.
2. An approved area smoke detector system located in the return air plenum serving such units.
3. An area smoke detector system as prescribed in the exception to Section 606.2.1.

In all cases, the smoke detectors shall comply with Sections 606.4 and 606.4.1.

**606.2.3 Return air risers.** Where return air risers serve two or more stories, smoke detectors shall be installed at each story. Such smoke detectors shall be located upstream of the connection between the return air riser and any air ducts or plenums.

**Exception:** Dwelling units.

**607.5 Location and installation.** Fire dampers, smoke dampers, combination fire/smoke dampers and ceiling radiation dampers shall be provided at the locations prescribed in this Section and shall be shown and properly identified on the building plans by the designer. Where an assembly is required to have both fire dampers and smoke dampers, combination fire/smoke dampers or a fire damper and a smoke damper shall be required.

Chapter 7

No changes were made to Chapter 7

Chapter 8

#### TABLE 803.10.4

**CHIMNEY CONNECTOR SYSTEMS AND CLEARANCES TO COMBUSTIBLE WALL MATERIALS FOR DOMESTIC HEATING APPLIANCES<sup>a,b,c,d</sup>**  
**(FOR CHIMNEY CONNECTOR SYSTEM DETAILS, SEE APPENDIX A)**

Chapter 9

**917.4 Installation of microwave oven over a cooking appliance.** The installation of a listed and labeled cooking appliance or microwave oven over a listed and labeled cooking appliance shall conform to the terms of the upper appliance's listing and label and the manufacturer's installation instructions.

**918.2 Minimum ducts sizes.** The minimum unobstructed total area of the outdoor and return air ducts or openings to a forced-air warm-air furnace shall be not less than 2 square inches per 1,000 Btu/h (4402 mm<sup>2</sup>/kW) output rating capacity of the furnace and not less than that specified in the furnace manufacturer's installation instructions. The minimum unobstructed total area of supply ducts from a forced-air warm-air furnace shall not be less than 2 square inches for each 1,000 Btu/h (4402 mm<sup>2</sup>/kW) output rating capacity of the furnace and not less than that specified in the furnace manufacturer's installation instructions.

**Exception:** The total area of the supply air ducts and outdoor and return air ducts shall not be required to be larger than the minimum size required by the furnace manufacturer's installation instructions. With addition of cooling coil the sizing criteria shall be based on 6 square inches for each 1,000 btu/h output.

**918.6 Prohibited sources.** Outdoor or return air for a forced-air heating system shall not be taken from the following locations.

1. Closer than 10 feet (3048 mm) from an appliance vent outlet, a vent opening from a plumbing drainage system or the discharge outlet of an exhaust fan, unless the outlet is 3 feet (914 mm) above the outdoor air inlet.
2. Where there is the presence of objectionable odors, fumes or flammable vapors; or where located less than 10 feet (3048 mm) above the surface of any abutting public way or driveway; or where located at grade level by a sidewalk, street, alley or driveway.
3. A hazardous or unsanitary location or a refrigeration machinery room as defined in this code.
4. A room or space, the volume of which is less than 25 percent of the entire volume served by such system. Where connected by a permanent opening having an area sized in accordance with Sections 918.2 and 918.3, adjoining rooms or spaces shall be considered as a single room or space for the purpose of determining the volume of such rooms or spaces.

**Exception:** The minimum volume requirement shall not apply where the amount of return air taken from a room or space is less than or equal to the amount of supply air delivered to such room or space.

5. A closet, bathroom, toilet room, kitchen, garage, mechanical room, boiler room or furnace room.
6. A room or space containing a fuel-burning appliance or fireplace where such room or space serves as a source of return air.

**Exceptions:**

1. This shall not apply where the fuel-burning appliance is a direct-vent appliance.
2. This shall not apply where the room or space complies with the following requirements:
  - 2.1 The return air shall be taken from a room or space having a volume exceeding 1 cubic foot for each 10 Btu/h (9.6 L/W) of combined input rating of all fuel-burning appliances therein.
  - 2.2 The volume of supply air discharged back into the same space shall be approximately equal to the volume of return air taken from the space.
  - 2.3 Return-air inlets shall not be located within 10 feet (3048 mm) of any appliance firebox or draft hood in the same room or space.
3. This shall not apply to room or spaces containing solid fuel-burning appliances, provided that return-air inlets are located not less than 10 feet (3048 mm) from the firebox of such appliances.
4. This shall not apply to rooms and spaces containing a fireplace.

**918.9 Refrigeration coils in warm-air furnaces.** When a cooling coil is located in the supply plenum of a warm-air furnace, the furnace blower shall be rated at not less than 0.5 inch water column (124 Pa) static pressure unless the furnace is listed and labeled for use with a cooling coil. Cooling coils shall not be located upstream from heat exchangers unless listed and labeled for such use. Conversion of existing furnaces for use with cooling coils shall be permitted provided the furnace will operate within the temperature rise specified for the furnace.

**918.10 Return air intake (non-engineered systems).** If only one central return air grille is installed, it shall be of proper size. The size shall be sufficient to return a volume of air compatible with the CFM requirements and the temperature rise limitations specified by the equipment manufacturer. The face velocity of return air grilles shall not exceed 450 feet per minute (fpm) (2.3 m/s). At least one separate return shall be installed on each level of a multi-level structure. For split-level and split-foyer structures one return may serve more than one level if located near the levels served and the total area of the levels does not exceed 1600 square feet (148.6 m<sup>2</sup>). Return air grilles shall not be located in bathrooms. The return air from one residential living unit shall not be mixed with the return air from other living units.

In dwellings with 1600 square feet or less of conditioned area, a central return is permitted. When the dwelling contains more than 1600 square feet of conditioned area, additional returns shall be provided. Each return shall serve not more than 1600 square feet (148.6 m<sup>2</sup>) of area and shall be located in the area it serves. Return air may travel through the living space to the return air intake if there are no restrictions, such as solid doors, to the air movement. When panned joists are used for return air, the structural integrity shall be maintained. Air capacity for joists 16 inches (406 mm) on center shall be a

maximum of 375 cfm (0.177 m<sup>3</sup>/s) for 8-inch (203 mm) joists and 525 cfm (0.248 m<sup>3</sup>/S) for 10-inch (254 mm) joists. Wiring located in spaces used for return air ducts shall comply with the North Carolina Electrical Code.

## **SECTION 927** **DUCT HEATERS**

**927.1 General.** Electric duct heaters shall be installed in accordance with the manufacturer's installation instructions and the North Carolina Electrical Code. Electric furnaces shall be tested in accordance with UL 1995.

**927.2 Installation.** Electric duct heaters shall be installed so they will not create a fire hazard. Class I ducts, duct coverings and linings shall be interrupted at each heater to provide the clearances specified in the manufacturer's installation instructions. Such interruptions are not required for duct heaters listed and labeled for zero clearance to combustible materials. Insulation installed in the immediate area of each heater shall be classified for the maximum temperature produced on the duct surface.

**927.3 Installation with heat pumps and air conditioners.** Duct heaters located within 4 feet (1219 mm) of a heat pump or air conditioner shall be listed and labeled for such installations. The heat pump or air conditioner shall additionally be listed and labeled for such duct heater installations.

**927.4 Access.** Duct heaters shall be accessible for servicing, and clearance shall be maintained to permit adjustment, servicing and replacement of controls and heating elements.

**927.5 Fan interlock.** The fan circuit shall be provided with an interlock to prevent heater operation when the fan is not operating.

## **SECTION 928** **RADIANT HEATING SYSTEMS**

**928.1 General.** Electric radiant heating systems shall be installed in accordance with the manufacturer's installation instructions and the North Carolina Electrical Code.

**928.2 Clearances.** Clearances for radiant heating panels or elements to any wiring, outlet boxes and junction boxes used for installing electrical devices or mounting lighting fixtures shall comply with the North Carolina Electrical Code.

**928.3 Installation of radiant panels.** Radiant panels installed on wood framing shall conform to the following requirements:

1. Heating panels shall be installed parallel to framing members and secured to the surface of framing members or mounted between framing members.
2. Panels shall be nailed or stapled only through the unheated portions provided for this purpose and shall not be fastened at any point closer than ¼ inch (6.4 mm) from an element.
3. Unless listed and labeled for field cutting, heating panels shall be installed as complete units.

**928.4 Installation in concrete or masonry.** Radiant heating systems installed in concrete or masonry shall conform to the following requirements:

1. Radiant heating systems shall be identified as being suitable for the installation, and shall be secured in place, as specified in the manufacturer's installation instructions.
2. Radiant heating panels or radiant heating panel sets shall not be installed where they bridge expansion joints unless protected from expansion and contraction.

**928.5 Gypsum panels.** Where radiant heating systems are used on gypsum assemblies, operating temperatures shall not exceed 125 degrees F (52 degrees C).

**928.6 Finish surfaces.** Finish materials installed over radiant heating panels or systems shall be installed in accordance with the manufacturer's installation instructions. Surfaces shall be secured so that nails or other fastenings do not pierce the radiant heating elements.

## **SECTION 929**

## **BASEBOARD CONVECTORS**

**929.1 Baseboard convectors.** Electric baseboard convectors shall be installed in accordance with the manufacturer's installation instructions and the North Carolina Electrical Code.

### Chapter 10

**1001.1 Scope.** This chapter shall govern the installation, alteration and repair of boilers, water heaters and pressure vessels.

**Exceptions:**

1. Pressure vessels used for unheated water supply.
2. Portable unfired pressure vessels and Interstate Commerce Commission containers.
3. Containers for bulk oxygen and medical gas.
4. Unfired pressure vessels having a volume of 5 cubic feet (0.14 m<sup>3</sup>) or less operating at pressures not exceeding 250 pounds per square inch (psi) (1724 kPa) and located within occupancies of Groups B, F, H, M, R, S and U.
5. Pressure vessels used in refrigeration systems that are regulated by Chapter 11 of this code.
6. Pressure tanks used in conjunction with coaxial cables, telephone cables, power cables and other similar humidity control systems.
7. Boilers that exceed one of the following (in other than one- and two-family dwellings and apartment houses of less than six families) are under the jurisdiction of the North Carolina Department of Labor in accordance with General Statute Chapter 95, Article 7A, Chapter 95-69.10:
  - (7.1.) A heat input capacity of 200,000 Btuh (58.6kW).
  - (7.2.) A water temperature of 200 degrees F (93.3° C).
  - (7.3.) A nominal water capacity of 120 gallons (454 L).

### Chapter 11

**1109.1 Testing required.** Deleted.

### Chapter 12

No changes were made to Chapter 12

### Chapter 13

**1301.2 Storage and piping systems.** Fuel-oil storage systems shall comply with Section 603.3 of the *International Fire Code*. Fuel-oil piping systems shall comply with the requirements of this code.

**Exception:** Fuel-oil storage tanks for one- and two-family dwellings and townhouses shall comply with Section 1309.

**1301.3 Fuel Type.** See Section 301.9.

## **SECTION 1309**

### **OIL TANKS FOR ONE-AND TWO-FAMILY DWELLINGS AND TOWNHOUSES**

**1309.1 Materials.** Supply tanks shall be listed and labeled and shall conform to UL 142 for aboveground tanks, UL 58 for underground tanks, and UL 80 for inside tanks.

**1309.2 Above-ground tanks.** The maximum amount of fuel oil stored above ground or inside of a building shall be 660 gallons (2498 L). The supply tank shall be supported on rigid noncombustible supports to prevent settling or shifting.

**1309.2.1 Tanks with buildings.** Supply tanks for use inside of buildings shall

be of such size and shape to permit installation and removal from dwellings as whole units. Supply tanks larger than 10 gallons (38 L) shall be placed not less than 5 feet (1524 mm) from any fire or flame either within or external to any fuel-burning appliance.

**1309.2.2 Outside above-ground tanks.** Tanks installed outside above ground shall be a minimum of 5 feet (1524 mm) from an adjoining property line. Such tanks shall be suitably protected from the weather and from physical damage.

**1309.3 Underground Tanks.** Excavations for underground tanks shall not undermine the foundations of existing structures. The clearance from the tank to the nearest wall of a basement, pit or property line shall not be less than 1 foot (305 mm). Tanks shall be set on and surrounded with non-corrosive inert materials such as clean earth, sand or gravel well tamped in place. Tanks shall be covered with not less than 1 foot (305mm) of earth. Corrosion protection shall be provided in accordance with section 1309.8.

**1309.4 Multiple tanks.** Cross connection of two supply tanks shall be permitted in accordance with Section 1309.7.

**1309.5 Oil Gauges.** Inside tanks shall be provided with a device to indicate when the oil in the tank has reached a predetermined safe level. Glass gauges or a gauge subject to breakage that could result in the escape of oil from the tank shall not be used.

**1309.6 Flood-resistant installation.** In areas prone to flooding as established by Table R301.2(1) of the International Residential Code, tanks shall be installed at or above the design flood elevation established in Section R324 of the International Residential Code or shall be anchored to prevent flotation, collapse and lateral movement under conditions of the design flood.

**1309.7 Cross connection of tanks.** Cross connection of supply tanks, not exceeding 660 gallons (2498 L) aggregate capacity, with gravity flow from one tank to another, shall be acceptable provided that the two tanks are on the same horizontal plane.

**1309.8 Corrosion protection.** Underground tanks and buried piping shall be protected by corrosion resistant coatings or special alloys or fiberglass-reinforced plastic.

Chapter 14

No changes were made to Chapter 14

Chapter 15

No changes were made to Chapter 15

## **APPENDIX A**

### **COMBUSTION AIR OPENINGS AND CHIMNEY CONNECTOR PASS-THROUGHS**

*The provisions contained in this appendix are adopted as part of this code.*

## **APPENDIX B**

### **RECOMMENDED PERMIT FEE SCHEDULE**

Deleted.

## **APPENDIX C**

### **GREASE HOOD DUCT FLANGES**

*The provisions contained in this appendix are adopted as part of this code.*

*(insert figures from 2006 NC Mechanical Code)*