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Kitchen Exhaust Makeup Air Exceptions

Code: 2018 Mechanical Code **Date:** March 18, 2019
Section: 505.2, M1503.4 Residential Code

Question:

What are examples of (1) direct vent, (2) power-vent, (3) unvented, and (4) electric appliances with regards to the Exception of 505.2, shown in Table 1?

505.2 Makeup air required. Exhaust hood systems capable of exhausting in excess of 400 cubic feet per minute (0.19 m^3/s) shall be provided with makeup air at a rate approximately equal to the exhaust air rate that is in excess of 400 cubic feet per minute (0.19 m^3/s). Such makeup air systems shall be equipped with a means of closure and shall be automatically controlled to start and operate simultaneously with the exhaust system. **Exception:** Where all appliances in the house are direct-vent, power-vent, unvented, or electric, makeup air shall be provided where exhaust fans are capable of exhausting more than 600 cubic feet per minute (0.28 m^3/s). Exhaust hood systems capable of exhausting more than 600 cubic feet per minute shall be provided with makeup air at a rate approximately equal to the exhaust air rate that is in excess of 600 cubic feet per minute.

Table 1: NCMC Section 505.2

Answer:

(1) Direct vent.

Direct vent[i] is an appliance that completely isolates the inside space from all combustion and exhaust air. It is a defined code and industry term which has been used since at least 1991 in the North Carolina Codes. There should be no ambiguity about whether an appliance is direct-vent or not, as the installation instructions of any listed appliance should very clearly illustrate whether it is or not, and how it needs to be installed to be considered a direct-vent appliance. Many appliances can be installed as vented or direct-vent, but in order to be direct-vent they need to be installed in accordance with the installation instructions for the direct-vent option. See Figure 2 for diagram of direct vent appliance.

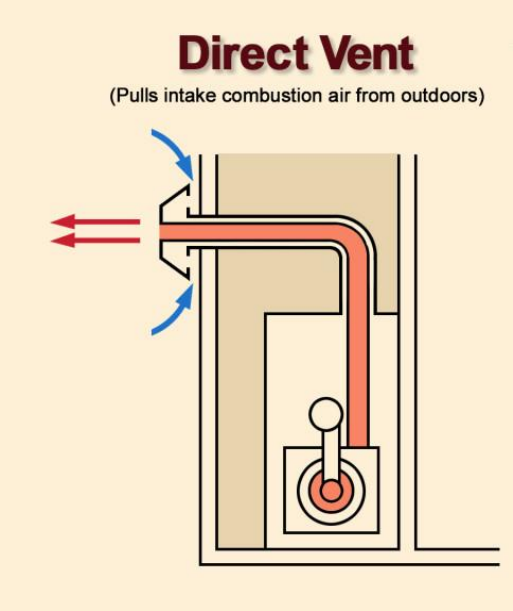


Figure 1: Direct-vent diagram

It may be easier for people unfamiliar with the industry-defined terms to read the definition from the 1971 NC Mechanical Code, which used the term "sealed combustion system appliance"

SEALED COMBUSTION SYSTEM APPLIANCE[ii]. A self-contained appliance which by its inherent design is constructed so that all air supplied for combustion, the combustion system for the appliance, and all products of combustion are completely isolated from the atmosphere of the space in which it is installed.

(2)Power-vent.

Caution: A fan-assisted Category I fuel-burning appliance is NOT a power-vented appliance. This type of appliance is still a natural draft appliance.

Power-vent[iii] is an appliance that does not rely upon natural draft to remove the products of combustion from the appliance to the outdoors. Unlike a direct-vent appliance, a mechanical draft appliance may have some or all of its combustion air taken from indoors. However, the fan is supposed to be powerful enough to not require any help from natural draft in order to properly exhaust the products of combustion. A power-vent is a subcategory of a mechanical draft system. Of the three subcategories under Mechanical Draft system, all are acceptable as meeting the meaning of power-vent as used in the Exception to 505.2. See Figure 2 for example of the power-venting portion of a power-vented appliance. The power venting may come in several different configurations, the induced draft is shown.

Note: A fuel-fired dryer, for purposes of this section, could be considered a power-vented appliance, but it also is listed as an example of appliances not required to be vented in NCFGC Section 501.8, Item 4. Of course, Item 4 requires the dryer to be vented in accordance with 614. Therefore, it is vented, just not via natural draft methods.

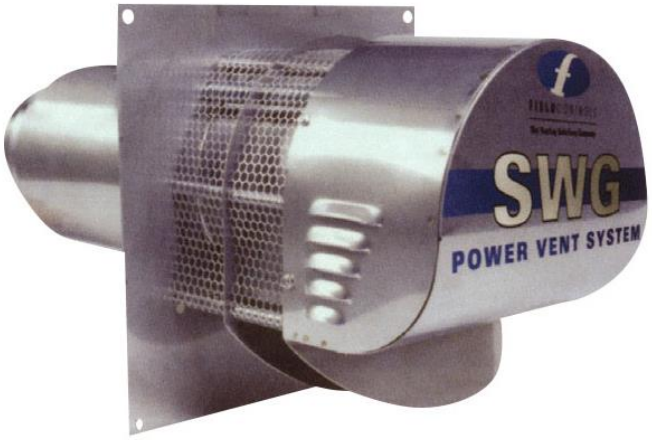


Figure 2: Diagram of Direct Vent for a Power Vented Appliance (appliance not shown)

(3)Unvented

An unvented fuel-burning appliance is one that is, of course, not required to be vented by the manufacturer or minimum code. See NC Fuel Gas Code Section 501.8[iv]. An example of this would be a listed domestic gas range or a listed unvented gas room heater. Therefore, in determining whether or not the Exception to 505.2 can be used, a fuel-fired domestic range in and of itself ***would not disallow*** the Exception to 505.2. See Figure 3 for examples.

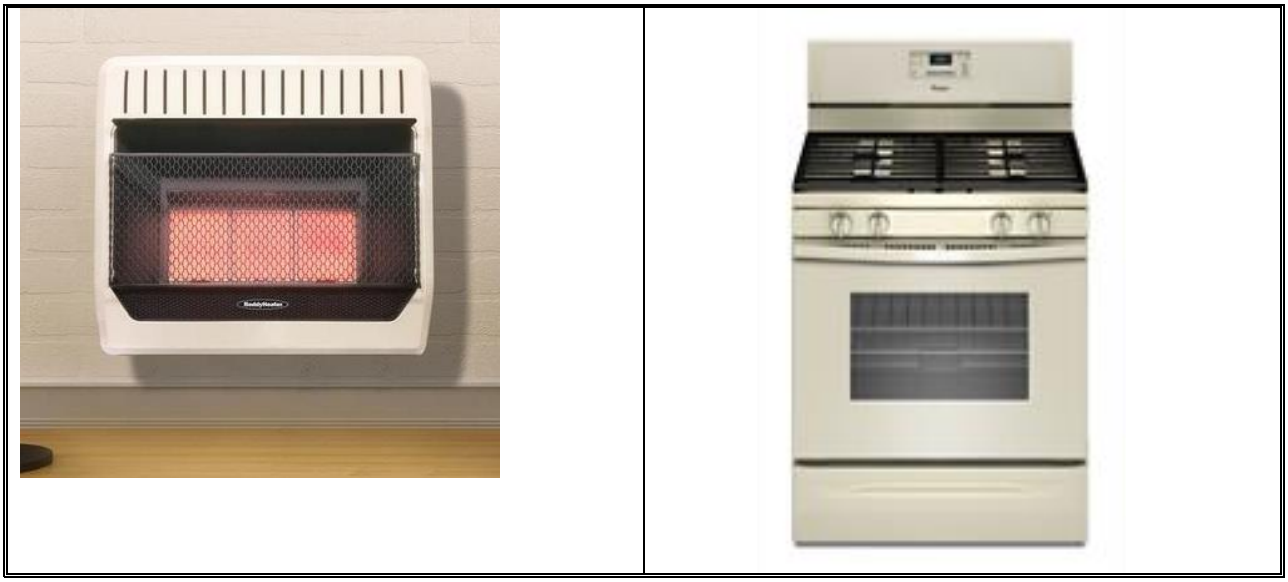


Figure 3: Listed Unvented Room Heater and Domestic Gas Range

(4)Electric

This is probably self-explanatory. Electric appliances do not have a requirement to exhaust the products of combustion, because there aren't any, so there is no naturel draft venting system that would get impaired by excessive exhaust.

Follow up Question #1

In the Exception to NCMC 505.2, There is an "s" on the fans in the phrase "...shall be provided where exhaust fans are capable of exhausting more than 600 cfm...". Does this mean the sum-total of all exhaust fans in the building, or is it merely referring to the kitchen exhaust fans?

Answer #1:
It was not intended for all the exhaust fans in the building. It only applies to kitchen exhaust fans in the same dwelling to be added up in determining the exhaust cfm and subsequent makeup air. There is another code section that applies to other exhaust fans that ***could*** apply, NCFGC Section 304.4[v]. In said code section, the phrase "…exhaust fans..." clearly applies to any and all fans in the building. It is a performance section, and the responsibility to make sure it is met predominantly falls upon the installing contractors and/or design professionals.

If we us as an example a 2-story house with the following exhaust systems: kitchen hood (400 CFM), a downstairs powder room exhaust fan (50 CFM), an upstairs Hall-bath exhaust fan (50CFM) and a Master Bath exhaust fan (80CFM) with a Master Water closet exhaust fan (50CFM). For this example, there is NOT a natural-draft appliance in the dwelling.

If the Exception meant to add all the kitchen and other exhaust in determining the exhaust requirements we would have: 400+50+50+80+50 = 630 and 630 CFM is greater than the 600 CFM threshold and makeup air would be required. However, this is not the way this section is intended to be applied. The Exception to 505.2 is applying only to kitchen exhaust systems. There could be multiple kitchen exhaust systems, and if they total up to more than the 600 cfm threshold, then the makeup air would be required prescriptively by Section 505.2.

Follow up Question #2
If there is an appliance that is not exempted by the Exception, i.e. it **IS** a natural draft appliance, but it is located outside the thermal envelope (and air barrier system), is it considered "in the house?".

Answer #2:
It is inside the house if it is under the roof, however, for purposes of this section and this section only, if an appliance that requires natural draft venting is:

> (1) located outside the thermal envelope (and air-barrier system), **and**
> (2)obtains all its combustion air from outdoors, such as a ventilated attic or ventilated crawl space, or an attached mechanical room with dedicated makeup air from all outdoors (in compliance with NC FGC 304.6), **and**
> (3) there are no combustion air openings from inside the thermal envelope to the attic, crawl, or mechanical space;

then if **all three** of these conditions are met that appliance can be considered outside the house and not count as one of the appliances that may affect the 400 or 600 cfm threshold. The logic being it should be unaffected by negative draft from the house. If the appliance is located in a space that is outside the thermal envelope but is in an attached space such as an attached garage **without dedicated openings** complying with NCFGC 304.6, then that appliance **DOES** count towards the determination of whether it is or is not affecting the 400 or 600 cfm threshold. See

Figure 4 for illustrations of these cases. Please note the illustration is only trying to demonstrate this topic and is not meant to illustrate all applicable code sections or all conceivable installations.

Follow up Question #3
How are site-built masonry fireplaces treated--as an appliance or are they exempt from consideration?

Answer #3:
They would be treated as an appliance that requires natural draft. As such, they are not able to meet one of the four conditions under the Exception to 505.2. If there is a site-built masonry fireplace in the dwelling, then the makeup air threshold is the 400cfm value.

The code language prior to the amendments did not differentiate between appliances and fireplaces; any kitchen exhaust over 400 cfm required makeup air. With the amendment, the use of the word ***appliance*** is introduced, and of course gas logs, manufactured fireplaces, fireplace inserts, etc, are all appliances, so they are already addressed. However, site-built fireplaces are site-built fireplaces, so they do not fall under the term appliance, but they are something in the dwelling that clearly is dependent upon natural draft.

Follow-up Question #4
What are some examples of kitchen exhaust volumes and the code-minimum makeup air required?

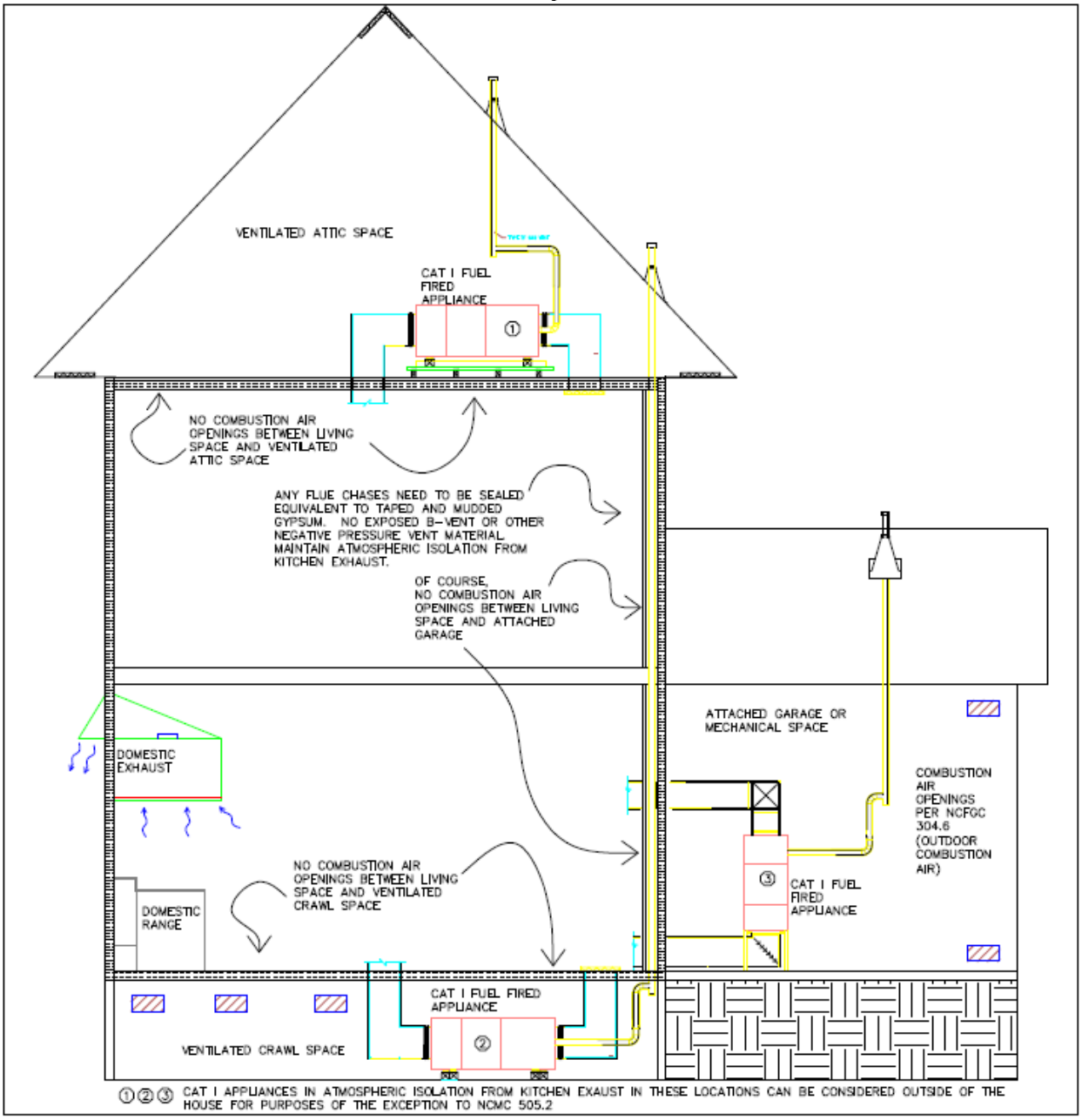
Answer:
Please refer to Table 2 for some examples.

Table 2: Examples of Kitchen Exhaust and Minimum Makeup Air Requirements

Scenario Kitchen Hood CFM	Do all appliances* meet one or more conditions of the Exception to 502.2?**	Code-Minimum Makeup air required by 505.2	Makeup air required by NCFGC 304.4
Hood 1: 400 cfm (or less)	Yes	0 cfm (400 – 600 =less than zero)	Amount, if any, determined by contractor(s)
Hood 1: 400 cfm (or less)	No	0 cfm (400 – 400 =0)	"
Hood 1: 401 cfm	Yes	0 cfm (401 – 600 =less than zero)	"
Hood 1: 401 cfm	No	1 cfm*** (401 – 400 =1)	"
Hood 1: 600 cfm	Yes	0 cfm (600 – 600 =0)	"
Hood 1: 600 cfm	No	200 cfm (600 – 400 =200)	"
Hood 1: 601 cfm	Yes	1 cfm*** (601 – 600 =1)	"
Hood 1: 601 cfm	No	201 cfm (601 – 400 =201)	"
Hood 1: 800 cfm	Yes	200 cfm (800 – 600 =200)	"
Hood 1: 800 cfm	No	400 cfm (800 – 400 =400)	"
Hood 1: 1200 cfm	Yes	600 cfm (1200 – 600 = 600)	"
Hood 1: 1200 cfm	No	800 cfm (1200 – 400 = 800)	"
Hood 1: 400 cfm Hood 2: 400 cfm	Yes	200 cfm (400+400-600=200)	"
Hood 1: 400 cfm Hood 2: 400 cfm	No	400 cfm (400+400-400=400)	"

*Includes site-built fireplaces (factory-built fireplaces are already covered as an *appliance*)
**The four conditions would be (1) direct-vent (2) power vent (3) unvented) or (4) electric.
*** In reality, this represents either 401 or 601 cfm that is "leaving the building" via the exhaust fan. In practice, the installation of a functioning makeup air means would more than likely provide significantly more than the 1 cfm required by minimum code. Obviously, it would be difficult to design, install, and measure a makeup air device that provides 1 cfm of makeup air. However, this is the mathematical value required by minimum code, and remember, it represents either 401 or 601 cfm leaving the building via the kitchen exhaust fan(s).

Figure 4: Examples of Appliances in a house that, if installed so atmospherically decoupled from house, can be considered "outside of house" for NCMC 505.2 Exception



[i] Direct vent is a defined term in the NCFGC and NC Mechanical code. The definition is reprinted here for convenience:
DIRECT-VENT APPLIANCES. Appliances that are constructed and installed so that all air for *combustion* is derived from the outdoor atmosphere and all flue gases are discharged to the outdoor atmosphere.

[ii] From 1971 and 1980 NC Mechanical Code

[iii] Power-vent is a defined term in the NCFGC and NC Mechanical Code. The definition is reprinted here for convenience.
MECHANICAL DRAFT SYSTEM. A venting system designed to remove flue or vent gases by mechanical means, which consists of an induced-draft portion under nonpositive static pressure or a forced-draft portion under positive static pressure.
Forced-draft venting system. A portion of a venting system using a fan or other mechanical means to cause the removal of flue or vent gases under positive static pressure.
Induced-draft venting system. A portion of a venting system using a fan or other mechanical means to cause the removal of flue or vent gases under nonpositive static vent pressure.
Power venting system. A portion of a venting system using a fan or other mechanical means to cause the removal of flue or vent gases under positive static vent pressure.

[iv] **501.8 Appliances not required to be vented.** The following appliances shall not be required to be vented.
1. Ranges.
2. Built-in domestic cooking units *listed* and marked for optional venting.
3. Hot plates and laundry stoves.
4. Type 1 clothes dryers (Type 1 clothes dryers shall be exhausted in accordance with the requirements of Section 614).
5. Item 5 not shown for brevity
6. Refrigerators.
7. Counter appliances.
8. Room heaters *listed* for unvented use.
9. Direct-fired makeup air heaters.
10. Other appliances *listed* for unvented use and not provided with flue collars.
11. Specialized appliances of limited input such as laboratory burners and gas lights.

[v] **304.4 Makeup air provisions.** Where exhaust fans, clothes dryers and kitchen ventilation systems interfere with the operation of appliances and fireplaces, makeup air shall be provided.

Keywords: