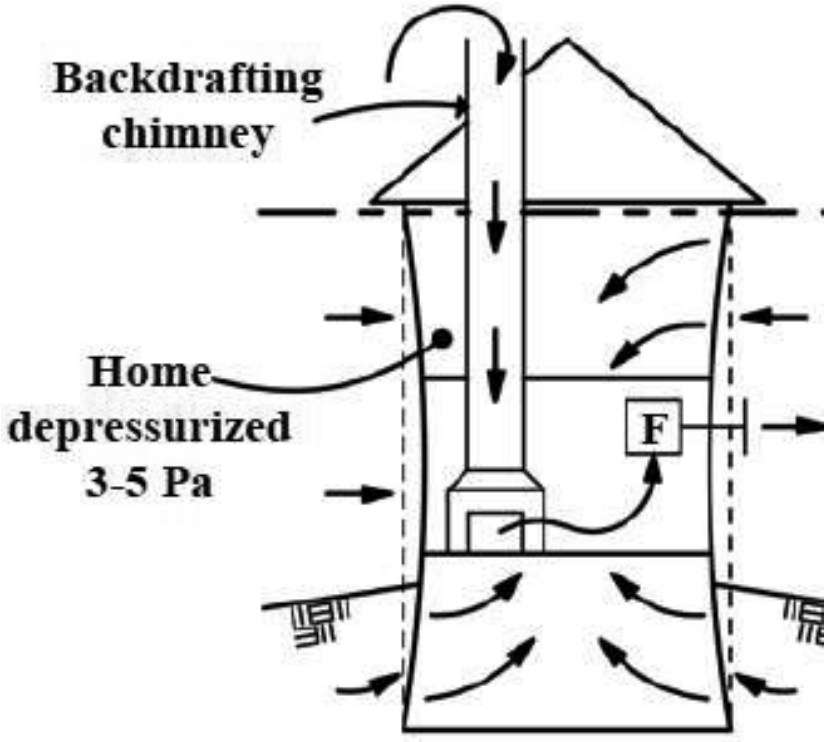
SUPPLEMENT:

Caveats and Cautions

January 2018

PREVENT EXCESS DEPRESSURIZATION

Hoods with higher maximum airflow rates (over 300-400 cfm) can often cause imbalances in airflows in and out of the home. Professional style gas stoves with large burners and downdraft exhaust systems typically require high airflow rates. When insufficient air is brought into the home to balance exhaust flows from exhaust fans and other appliances, depressurization (negative air pressure, or suction) of the home occurs. This can cause combustion equipment to backdraft carbon monoxide and other combustion pollutants into the home. It can also pull unwanted pollutants from adjoining spaces and the outdoors. If naturally vented combustions appliances are present, a combustion appliance safety test is recommended in such situations and is required in most home weatherization programs (BPI 2012; US EPA 2014).



Exhaust air flows can create excessive vacuum pressure (suction) in a home, unless the exhaust flow is balanced by make-up air. Certain airflow rates of exhaust fans (F) can combine with house airtightness to depressurize a house enough to backdraft chimneys and flues from combustion appliances and to pull in soil gases. This can lead to indoor pollution hazards and moisture condensation problems. Image: Jellen et al. 2012 (a or b?). Kitchen Ventilation Systems: Part 1.

Make-up air devices are available to prevent depressurization problems; some can be integrated with central air or ventilation systems. The International Mechanical Code used in some regions requires make-up air if the fan has a rating of 400 cubic feet per minute (cfm) or more and natural draft appliances are present (International Mechanical Code 2018). Minnesota requires make-up air for hood flows of 300 cfm or more in alterations of some types of older homes' exhaust flow calculations for multiple appliances, and a backdraft and spillage test in newer homes. However, both natural draft and induced draft appliances can easily backdraft, so the more efficient direct-vent (sealed combustion) appliances are recommended (Minnesota 2015; Bohac & Cheple 2002).

Downdraft stovetop exhaust systems are an example of fans with very high flow rates. They often produce flows of over 500 cfm in order to effectively overcome the hot, buoyant plume generated by cooking. Commercial style stoves and ovens also require very high flow rates, in order to remove the large amount of heat produced. High flow hood systems that are used frequently can also substantially increase building energy use for meeting cooling, heating, or dehumidification needs.

For airtight homes and homes with high flow exhaust hoods, test the pressure difference between indoors and outdoors when the range hood is on. The graph below (Exhibit 1) illustrates how much house depressurization could be anticipated from various sizes of kitchen exhaust fans at different levels of home airtightness. The hood airflow rate of 400 cfm is also highlighted (the International Residential Code requires make-up air above that airflow rate). A tight home is defined there as one with a blower test rating of 1,500 cfm at 50 Pascals pressure (cfm50).

For example, the fireplace diagonal line in Exhibit 1 indicates that a fireplace in a tight home would potentially backdraft at a hood flow rate of 250 cfm or less, whereas a gas-fired appliance (natural draft) would potentially backdraft at a hood flow rate of 350 cfm or less. Local weather conditions can also affect house pressures. Note that many homes have blower door ratings of less than 1,000 cfm50 and would backdraft at even lower airflow rates for the hood.

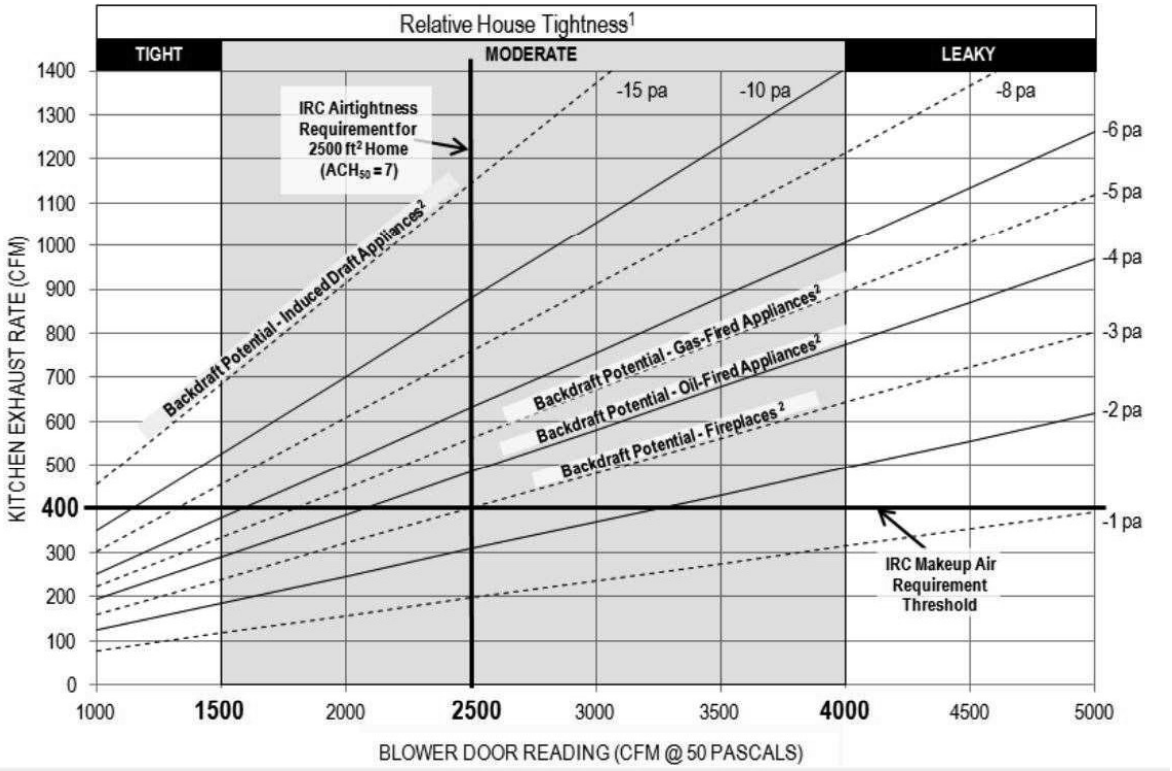


Figure 1: ACH = air changes per hour. cfm= cubic feet per minute. ft2 = square feet. IRC = International Residential Code. pa = pascals. (Jellen, A.C., Wolfgang, B.M, and Turns, M.A., 2012a. Kitchen Ventilation Systems: Part 1. Evaluating the 2009 IRC Requirement for Makeup Air. The Pennsylvania Housing Research Center, Builder Brief)

Consult building officials and building performance experts to determine what local depressurization limits are and how to best meet them. These range from -2 to -50 Pascals, depending on the type of combustion appliance, airtightness, and regional climate(BPI 2012; Nelson 2010; Jellen et al. 2012).

Make-up air systems can also cause thermal comfort problems (cold drafts) and humidity problems. In order to avoid cold drafts from make-up air, some designers recommend supplying 70% of the make-up under the stove and 30% to a common area, in order to create negative pressure near the stove and minimize draft problems (Lstiburek 2014).A designer of very airtight homes (near Passive House criteria) in California has successfully used ducted range hoods with make-up air with little impact on energy use or comfort (Barry 2017). European researchers have recently recommended that low energy, airtight homes use either 1) a motorless range hood, with a high quality grease filter, that can be connected to a common exhaust system using a balanced ventilation system for the house, or 2) a ducted exhaust vent used with a supply ventilation system at specific design pressures (Jacobs & Borsboom 2017). This is an evolving area of healthy building design, so proceed with caution.

In order to provide reliable operation, gravimetric or barometric dampers are not recommended for use in make-up air systems, according to ASHRAE 62.2-2016. Rather, an automatic (interlocked) motorized damper and fan-powered system is

recommended (Karg 2016). In addition, make-up air systems should have an air filter to help keep outdoor air pollution, allergens, and dust from entering the home.

PREVENT CARBON MONOXIDE (CO) POISONING

- Never heat the house with a gas stove or oven. This can be fatal or cause permanent damage to your health. It can also increase the risk of pneumonia in young children (Coker et al. 2015).

- Have a technician check the gas pressure and burner adjustments, especially in propane stoves or if the flame is mostly yellow, erratic, or causing sooting on pots and pans (Appliance411 FAQ 2018). Gas stoves and ovens often produce excessive amounts of CO, but regular testing and maintenance can greatly reduce this hazard (Birkby 2008).

- Do not cover the bottom of natural gas or propane ovens with aluminum foil. Doing so blocks the combustion airflow through the appliance and can produce CO.

- If you are cooking on several burners or over extended periods and do not have a working range hood, open some windows to create a cross draft to remove the indoor pollutants, or use a kitchen exhaust fan.

- Install a CO alarm if you have a gas stove or oven. This is required in many jurisdictions.