Technical Bulletin

How to Use Microwaves to Meet Kitchen Exhaust Requirements

Best Practices for Designers, Contractors, and Raters

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This technical bulletin provides best practices related to the design, specification, installation, and testing of microwaves, to meet kitchen exhaust requirements of the ENERGY STAR Single-Family New Homes and Multifamily New Construction programs.

Figure 1: Example of a microwave installed over a cooktop.

Removing local pollutants from occupants' cooking areas is critically important for indoor air quality. The ENERGY STAR program requires kitchen ventilation that (a) meets minimum airflow at an intermittent rate of 100 cubic feet per minute (CFM) or a continuous rate of 5 air changes per hour (ACH), and (b) exhausts directly to the outdoors. Note that compliance will be assessed through a third-party measurement of the installed airflow or by verifying that prescriptive duct sizing limits have been met.

Homes and apartments are often designed with microwaves over cooktops to meet the two criteria above, and to comply with local code requirements. To effectively select and install microwave equipment, HVAC Designers, Ductwork and Fan Installers, and Raters should consider the following guidance.

Recommended Best Practices for the HVAC Designer:

The designer should follow these practices to develop a design likely to meet the program requirements:

- Select the microwaves based on the following criteria:
  a) **Choose a microwave that can be connected to ductwork**. Do not use recirculating systems; these do not comply with the program's local exhaust requirements.
  b) **Confirm the microwave is third-party certified for a reliable estimate of rated airflow.** Two examples follow. Use "Product Subcategory" dropdowns to filter for microwaves.
     - Home Ventilation Institute (HVI) Certified Products Directory
     - Association of Home Appliance Manufacturers (AHAM) Certified Products Directory

- Do not rely on manufacturer cut sheets that estimate airflow from motor power. These types of measurements are unconfirmed and are often higher than tested values.
- **Select a microwave with a rated airflow higher than the minimum requirement, assessed at a static pressure ≥ 0.10 in. w.g.** The airflow of a fan is dependent on the static pressure of the duct system attached to it. Rated airflows are often higher than installed airflows because the installed duct system has a higher static pressure (i.e., more resistance). Selecting a model with a higher rated airflow, assessed at a higher static pressure, will increase the likelihood that the installed system delivers the required airflow.

  For example, in **Table 1**, four different microwaves are shown, with varying rated airflows assessed at different static pressures. Fan C and Fan D are more likely to meet the 100 CFM requirement when tested than Fan A or Fan B.

Table 1: Specifications of Different Kitchen Microwave Exhaust Fans.

	Rated Static Pressure (in w.g.)	Rated Airflow (CFM)	Recommended?
Fan A	0.025	120	✗ No
Fan B	0.10	100	✗ No
Fan C	0.10	250	✓ Yes
Fan D	0.25	200	✓ Yes

- Design the microwave's exhaust ductwork to deliver the minimum 100 CFM (or, if selected, 5 ACH) kitchen exhaust rate.

  a) **Refer to ENERGY STAR Kitchen Exhaust Guidance for prescriptive sizing guidance**. While not mandatory for fans with Rater-measured airflow, following this guidance will help ensure the rated airflow is achieved. As this guide shows, minimizing duct length and the number of elbows will result in higher airflow.

  b) **Ensure that the design accounts for the static pressure impacts of all duct components**. Fan grilles, internal and external dampers, pest screens, and other components of the exhaust fan installation will affect static pressure and, therefore, the airflow.

Recommended Best Practices for the Ductwork and Fan Installer:

The installer and general contractor should follow these practices so that the design performs as planned:

1. **Follow the mechanical design**. Any deviations, such as in duct size, length, layout, and fittings, should be reviewed and approved by the HVAC Designer. **See Figure 2 (found on p. 3).**

2. **Confirm all dampers and other operative fittings function properly for each exhaust run.** Screw placement, misaligned pieces, and even paint can prevent damper movement. **See Figure 3**.
3. **Implement a quality assurance review plan for all installed ductwork.**

Figure 2: Ductwork installed with additional length, bends, transitions, or other fittings will increase static pressure, reducing the final flowrate. This extra 180-degree bend was not in the original design. The ductwork installer should not have installed it without consulting the design engineer.

Figure 3: This installer used UL-181 tape to connect the backdraft damper to the exhaust ductwork above the microwave, preventing the damper from fully opening, reducing the tested airflow.

4. **Test fans for airflow**. While compliance will ultimately be assessed by a third-party verifier, preliminary testing of airflow can be completed to catch any installation issues. This may require the combined efforts of the general contractor, electrician, and mechanical contractor to provide the necessary power and access for testing. Tips for testing include:
    - Perform this at the earliest construction stage possible.
    - Ensure all ductwork, grilles, dampers, and other fittings are installed to simulate normal operating conditions.
    - When selecting airflow measuring equipment, note that commercial flow hoods are typically used when measuring higher airflow rates and anemometers are only accurate for velocity (not flow rate). Neither tool is accurate for measuring dwelling unit kitchen exhaust.

Recommended Best Practices for the Rater:

The Rater should follow these practices to increase the odds that the exhaust rate meets program requirements:

1. **During the design stage, explain the exhaust requirements to the project team and assess their strategy during the design review.**
2. **Inspect the installation during mid-construction walkthroughs**. Verify that the microwave model, duct length, duct diameter size, and number of elbows or fittings adheres to the design. Confirm any microwave manufacturer installation instructions were followed, for example by checking dampers and duct attachment.
3. **Verify the airflow as early as possible to ensure flowrates are meeting requirements**. Select an airflow measurement test method that accounts for the unique variations and space restrictions of the installation. Consider the following:
    - Taping off airflow inlets not aligned with the flow hood. **See Figure 4.**
    - Confirming available equipment fits within the confined testing space, such as between a cooktop and the microwave above.
    - Using customized hood attachments to cover the grilles or airflow inlets more accurately. **See Figures 5 & 6.**
4. Consider alternate testing configurations, such as evaluating the exhaust air from the exterior of the building (where accessible and appropriate).

Figure 4: An example of a neoprene cover used to block a secondary intake on the top of a microwave exhaust and direct all intake air to the underside of the microwave. (Duct mastic tape is also commonly used.) This practice provides the rater with the maximum possible flow tested through a single location.

Figure 5: The bottom of this microwave has two airflow intakes. Some common airflow measuring devices may not be large enough to cover both ports, or the bottom surface of the microwave may not be flat, making accurate testing difficult.

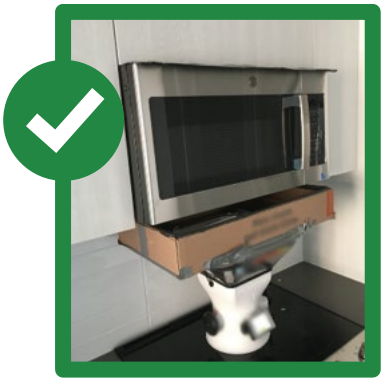

Figure 6: An example of an energy rater's flow hood extension attachment. The box covered all fan intake ports and created a gasketed seal, allowing the rater to more accurately test the full flowrate of the microwave exhaust fan.