



FLEXLAB®

MEASURING AIRFLOW AND CAPTURE EFFICIENCY OF OVER-THE-RANGE MICROWAVE EXHAUST FANS

This research verified that over-the-range microwaves can meet the kitchen ventilation airflow requirements of California's building code.

THE CHALLENGE

Determine if over-the-range microwave exhaust fans commonly meet the code required airflow performance for kitchen ventilation in California homes

The California residential building code requires kitchen exhaust ventilation for indoor air quality protection. The code has requirements for minimum airflow and maximum sound level to be certified with standardized test methods. For years, over-the-range microwaves (OTRs) have been installed in new California homes despite limited certification data and uncertainty about their performance.

THE SOLUTION

In a project funded by the California Energy Commission, Berkeley Lab researchers used the U.S. Department of Energy's FLEXLAB® facility to measure the performance of several OTR models observed in a study of recently built California homes, and compared them to conventional range hoods that met minimum code requirements at similar cost. The study measured airflow and capture efficiency (CE), the fraction of cooktop-generated air pollutants captured and removed by exhaust devices. The study in FLEXLAB also evaluated the accuracy of the method used to measure OTRs in homes in the California study.

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Tests of range hoods and over-the-range microwaves in FLEXLAB® have offered unique insights in the assessment of airflows and capture efficiency for kitchen ventilation, a critical element in high-performance homes.
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Nicholas Hurst, Indoor airPLUS Program, U.S. Environmental Protection Agency



THE BOTTOM LINE

OTRs performed similarly to comparably priced range hoods and confirmed that they could meet the code requirement for airflow.

THE EXPERIMENT

- A simulated kitchen was set up at FLEXLAB to evaluate the common configuration of a range hood or OTR installed on a wall between cabinets.
- Airflows were measured using variations of a balanced-pressure flow method, including the protocol used in the Healthy Efficient New Gas Homes (HENGH) field study, to quantify any bias associated with the field data.
- Measurements of airflow and capture efficiency were made for six OTRs, including three that had certified tests conducted after the project began. Measurements also were made on two standard range hoods with airflow and cost comparable to the OTRs, when accounting for the microwave functionality.
- The study measured CE using the carbon dioxide (CO_2) emitted from burners as they heated pots of water, and calculated the ratio of added CO_2 in the exhaust flow over the total CO_2 generated from burning fuel.
- Each OTR and range hood was tested for airflow at each available setting.
- Sound levels (in decibels) also were measured.

THE RESULTS

- OTRs generally met California code requirements for airflow, which were the same as those in ASHRAE's residential ventilation standard.
- The HENGH field protocol was biased low by 14% on average. Correction factors were developed and applied to data for 20 OTRs from HENGH.
- Airflows of OTRs were similar to range hoods of similar cost.
- Airflows of OTRs without certified test results were similar to those that were listed and met the airflow requirements of ASHRAE 62.2.
- The CE performance of the tested OTRs was consistent with those tested in prior studies, showing CE increasing with airflow and being higher for emissions occurring at the back cooktop burner(s) compared to those from the front burner(s).
- The relationship of CE to airflow for OTRs was within the range of those found for standard range hoods, but OTRs appear to have more consistent CE performance for front-burner emissions.

