KitchenSox™ Air Diffusers
Performance Report

Application of ASTM Standard
Test Method F1704-09

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The information in this report is based on data generated at the PG&E Food Service Technology Center's Commercial Kitchen Ventilation Laboratory

The diffuser performance based on the capture and containment exhaust air flow rates for the 10-foot wall canopy exhaust hoods were determined under controlled laboratory conditions. The makeup air was supplied from the diffusers under test, the balance of the makeup air was supplied at low velocity (less than 60 ft/min) through floor-mounted, displacement diffusers along the wall opposite the front face of the hood. Appliances were positioned to maximize hood overhang and minimize the gap between the appliance and rear wall. The repeatability/accuracy of the reported values is considered to be ± 5% (e.g., ± 100 cfm at 2000 cfm).

The diffusers were configured with manufacturer-specified features and tested with the specified appliances operating under simulated cooking conditions. The specifications of the diffusers, hood and their installation configurations over each appliance line are detailed within the report.

The laboratory test setup was not intended to replicate a real-world installation of these diffusers and hoods where greater exhaust airflows may be required for the capture and containment of the cooking effluent. The objective of this ASTM 1704 testing was to characterize the performance of the diffusers by determining the capture and containment performance the exhaust hoods within a controlled laboratory environment. The data in this report should not be used as the basis for design exhaust rates and specifications. Design exhaust rates must recognize UL710 safety listings, utilize the knowledge and experience of the designer with respect to the actual cooking operation, and compensate for the dynamics of a real-world kitchen.

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Objectives

This report summarizes the performance benefit of low-velocity fabric diffusers. This was accomplished by comparing the effect of three KitchenSox™ fabric diffusers and one 4-way diffuser on the capture and containment performance of wall-mounted canopy hoods. Makeup air supplied through displacement diffusers was used as the reference case for the minimum capture and containment airflow. Specifically, the objectives were to:


2. Measure and report the velocity profile along the lower edge of the canopy hood over a range of airflows for the four diffusers.

3. Measure and report the pressure drop across four diffusers over a range of airflows for the diffusers.

Equipment

KitchenSox™ 2-Foot by 2-Foot MetalPan D-Fuser™

The KitchenSox™ MetalPan D-Fuser™, manufactured by DuctSox® Corporation, measured 2 feet by 2 feet and was attached to a metal pan with a 10-inch round collar centered in the top. The fabric extended below the metal pan approximately 6 inches, in the shape of a D. The assembly was dropped into the grid of the lab’s suspended ceiling. The center of the diffuser was located 3 feet from the right side and 3 feet in front of the hood. The bottom of the pan, or the top of the fabric, was located 83 inches above the finished floor. The 2-ft. by 2-ft. KitchenSox™ diffuser is shown in Figure 1.
Figure 1. KitchenSox™ 2-Foot by 2-Foot Fabric Diffuser

KitchenSox™ 2-Foot by 4-Foot Fabric Diffuser

The KitchenSox™ MetalPan D-Fuser™ diffuser measured 2 feet by 4 feet and was attached to a metal pan with a 12-inch round collar centered in the top. The fabric extended below the metal pan approximately 6 inches, in the shape of a D. The assembly was dropped into the support grid of the lab’s suspended ceiling. The center of the diffuser was located 4 feet from the right side and 3 feet in front of the hood. The bottom of the pan, or the top of the fabric, was located 83 inches above the finished floor. The 2-ft. by 4-ft. KitchenSox™ diffuser is shown in Figure 2.

Figure 2. KitchenSox™ 2-Foot by 4-Foot Fabric Diffuser
KitchenSox™ 2-Foot by 10-Foot Fabric Diffuser

The KitchenSox™ fabric diffuser measured 2 feet by 10 feet and was hung from the suspended ceiling. The 12-inch round collar was located at the top center of the diffuser. A cloth baffle was inserted in the diffuser, below the collar, to redirect the airflow from the duct connection. The fabric extended below the ceiling approximately 9 inches, in the shape of a D. The diffuser was centered on the front of the hood, 3 feet from the front. The top of the fabric was located 83 inches above the finished floor. The 2-ft. by 10-ft. KitchenSox™ diffuser is shown in Figure 3.

Figure 3. KitchenSox™ 2-Foot by 10-Foot Fabric Diffuser
2-Foot by 2-Foot Metal 4-Way Diffuser

The metal louvered 4-way diffuser measured 2 feet by 2 feet and was attached to a metal pan with a 12 inch round collar centered in the top. The assembly was dropped into the grid of the suspended ceiling and was flush with the ceiling. The center of the diffuser was located 3 feet from the right side and 3 feet in front of the hood. The bottom of the diffuser was located 83 inches above the finished floor. The 2-foot by 2-foot 4-way diffuser is shown in Figure 4.

Figure 4. 2-Foot by 2-Foot Metal 4-Way Diffuser

Hood Specifications

The diffusers were sequentially evaluated in front of two wall mounted rear filter canopy hoods. The first hood was a generic "unlisted" hood and the second was a UL listed hood. The generic hood had no engineered accessories or designs that would aid in the capture and containment performance, such as flanges on the lower edge of the hood, or internal returns. The hood did not have a standoff behind the rear panel. The side panels were clear. The generic hood measured 10.0 feet wide by 4.0 feet deep by 2.0 feet high. It was equipped with six 19.6-inch by 19.6-inch by 1.8 inch baffle-type grease filters, and exhausted through a 36-inch by 14-inch exhaust collar.

The UL listed hood was equipped with a stainless steel back wall and custom front lower edge to enhance capture and containment performance. The hood measured 10.0 feet wide by 4.5 feet deep by 2.5 feet high. The hood was equipped with seven 10.5-inch by 15.5-inch stainless steel removable baffle-type grease filters, and exhausted through an 18-inch by 10-inch exhaust collar. The lower edges of both hoods were installed at a height of 78.0 inches above the finished floor. The typical hood setup for the generic hood over a heavy-duty broiler line is shown in Figure 5.
Figure 5. Test Set Up with Generic Wall-Mounted Canopy Hood and Heavy-Duty Appliance Line with KitchenSox™ 2ft by 4ft Diffuser. (Note Transparent Back Wall)
Side Panel and Corner Blank Configurations

Side panels were used in three of the diffuser evaluations with the generic canopy hood. The side panels measured 36 inches deep by 36 inches high and tapered at a 45° angle. A corner blank was used in two of the diffuser evaluations with the generic canopy hood to shield the lower front corner of the hood from disruptive air velocities from the KitchenSox™ diffuser. The corner blank measured 10 inches by 10 inches on the sides and bottom. A photo of the side panels and corner blank attached to the 2-ft. by 4-ft. KitchenSox™ diffuser is shown in Figure 6.

Cooking Appliances

The appliance line used under the generic hood to evaluate the diffusers was three heavy duty underfired gas broilers. Each 3-foot broiler had a rated input of 96,000 Btu/h and operated at approximately 65,000 Btu/h during simulated full-load cooking conditions. The hood front overhang was 22.0 inches to the cooking surface and 15.5 inches to the cabinet. The side overhang was 6.0 inches. The rear gap between the back of the appliance and the wall was 1 inch.

The appliance line used under the UL listed hood to evaluate the diffusers was a combination line that consisted of 2-vat high-efficiency gas fryers (medium-duty), a three-foot underfired gas broiler (heavy-duty) and a full-size electric oven (light-duty). The appliances were operated under simulated heavy-load cooking conditions. The simulated cooking conditions for both appliance lines were established by an ASHRAE research project [Ref 2] based on the heavy load testing according to the ASTM Standard Test Methods for appliances [Ref 5,6,7]. The hood front overhang was 22.0 inches to the cabinet of the fryer, 18.0 inches to the cabinet of the broiler, and 9.0 inches to the door of the oven. The side overhang was 6.0 inches. The rear gap between the back of the appliance and the hood’s backwall was 0 for the fryers, 1 inch for the broiler and 1 inch for the oven.
Test Protocol

Diffuser Performance Testing

The performance of the diffusers was evaluated by determining the effect on the capture and containment performance of generic and UL listed hoods. The performance of the hoods was evaluated by how well they captured and contained the simulated thermal plume from the heavy-duty and mixed-duty appliance lines.

"Hood capture and containment" is defined in ASTM F1704-09, Capture and containment performance of commercial kitchen exhaust ventilation systems, as "the ability of the hood to capture and contain grease laden cooking vapors, convective heat and other products of cooking processes." Hood capture refers to the products getting into the hood reservoir, while containment refers to these products staying in the hood reservoir and not spilling out into the space. "Minimum capture and containment" is defined as "the conditions of hood operation at which the exhaust flow rate is just sufficient to capture and contain the products generated by the appliance in idle and heavy load cooking conditions, or at any intermediate prescribed load condition."

For each diffuser evaluation, a predetermined amount of makeup air was introduced through the diffuser and the capture and containment (C&C) exhaust rate was determined for the hood. For the capture and containment evaluation, the exhaust rate was reduced until spillage of the plume was observed (using the airflow visualization techniques described below) at any point along the perimeter of the hood. The exhaust rate was then increased in fine increments until capture and containment was achieved. For most cases, single-test determinations were used to establish the reported threshold of capture and containment for the specified test condition. In all evaluations, the replacement air necessary to balance the laboratory was delivered through the low velocity, floor-mounted diffusers along the opposite wall with a maximum discharge velocity of 60 fpm (Figure 7). The introduction of replacement air from such sources has been found to be optimum (i.e., the least disruptive) for the laboratory test setup [Ref 3].

Airflow Visualization

The primary tools used for airflow visualization were schlieren and shadowgraph systems, which visualize the refraction of light due to air density changes. The sensitive flow visualization systems provide an image of the thermal activity along the perimeter of the hood by viewing the change in air density above the equipment caused by the heat and effluent generated by the cooking process. The front edge of the hood was monitored by a schlieren system and the left and right edges of the hood were monitored using shadowgraph systems. All visualization systems were located near the 78-inch hood height. Other flow visualization tools available to seed the thermal plume included smoke sticks and theater fog. Figure 7 shows a plan view of the laboratory with the relative positions of the diffusers, hood and flow visualization systems.
Figure 7. Plan View of Lab during Outlet Evaluations

The airflow measurements in the laboratory comply with the AMCA 210/ASHRAE 51 Standard [Ref 4]. The error on the airflow rate measurement is less than 2%. The repeatability of capture and containment determinations is typically within 5%.

Diffuser Velocities

The diffuser velocities were measured with a 4-inch diameter, rotating vane anemometer (RVA) and hot wire anemometer positioned to measure the velocity vertically downward and flush against the front panel of the hood and one inch above the lower edge of the hood. Average readings were recorded at the center of each one foot distance along the front face of the hood. The velocity profiles were taken for five makeup air rates, 500, 1000, 1500, 2000 and 2500 cfm.

Diffuser Static Pressure Differential

The static pressure difference was measured between the laboratory and the diffuser under test. A side wall tap was typically located in the upper corner of the pan above the 4-way, 2-ft. by 2-ft. and 2-ft. by 4-ft. diffusers. For the 2-ft. by 10-ft. diffuser, the location was inside near the end of the diffuser. The pressures were measured using makeup air flow rates between 250 and 2000 cfm.
Diffuser Configuration Test Matrix

The KitchenSox™ fabric diffusers and 4-way diffuser were evaluated in 23 test conditions. Generally, the two appliance line configurations were positioned in a best practice “pushed back” condition. Diffuser performance was evaluated for two types of hoods at various makeup air flow rates, with or without accessories. The baseline case was determined with 100% of the makeup air being supplied through the floor mounted displacement system. When makeup air was introduced through the ceiling diffusers, the balance of the replacement air was delivered through the floor mounted displacement system.

The following test matrices in Table 1 and Table 2 present the details of the test setups for the respective hoods and appliance lines.

Table 1. Diffuser Test Matrix for Generic Hood and Heavy-Duty Appliance Line

<table>
<thead>
<tr>
<th>Diffuser</th>
<th>Diffuser Airflow [cfm]</th>
<th>Accessory</th>
</tr>
</thead>
<tbody>
<tr>
<td>Displacement/Baseline</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Displacement/Baseline</td>
<td>0</td>
<td>Side Panel</td>
</tr>
<tr>
<td>Metal, 4-Way, Single 2-ft. x 2-ft.</td>
<td>500</td>
<td></td>
</tr>
<tr>
<td>Metal, 4-Way, Single 2-ft. x 2-ft.</td>
<td>1000</td>
<td></td>
</tr>
<tr>
<td>KitchenSox™, Single 2-ft. x 2-ft.</td>
<td>500</td>
<td></td>
</tr>
<tr>
<td>KitchenSox™, Single 2-ft. x 2-ft.</td>
<td>1000†</td>
<td></td>
</tr>
<tr>
<td>KitchenSox™, Single 2-ft. x 4-ft.</td>
<td>500</td>
<td>Side Panel</td>
</tr>
<tr>
<td>KitchenSox™, Single 2-ft. x 4-ft.</td>
<td>1000</td>
<td></td>
</tr>
<tr>
<td>KitchenSox™, Single 2-ft. x 4-ft.</td>
<td>1000</td>
<td>Side Panel</td>
</tr>
<tr>
<td>KitchenSox™, Single 2-ft. x 4-ft.</td>
<td>1500†</td>
<td>Corner Blank</td>
</tr>
<tr>
<td>KitchenSox™, Single 2-ft. x 4-ft.</td>
<td>1500†</td>
<td>Corner Blank</td>
</tr>
<tr>
<td>KitchenSox™, D-Shape, 2-ft. x 10-ft.</td>
<td>500</td>
<td></td>
</tr>
<tr>
<td>KitchenSox™, D-Shape, 2-ft. x 10-ft.</td>
<td>1000</td>
<td></td>
</tr>
<tr>
<td>KitchenSox™, D-Shape, 2-ft. x 10-ft.</td>
<td>1500</td>
<td></td>
</tr>
<tr>
<td>KitchenSox™, D-Shape, 2-ft. x 10-ft.</td>
<td>2000†</td>
<td></td>
</tr>
</tbody>
</table>

*airflow rate above manufacturer’s recommended rate for outlet

Table 2. Diffuser Test Matrix for UL listed Hood and Mixed-Duty Appliance Line

<table>
<thead>
<tr>
<th>Diffuser</th>
<th>Diffuser Airflow [cfm]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Displacement/Baseline</td>
<td>0</td>
</tr>
<tr>
<td>Metal, 4-Way, Single 2-ft. x 2-ft.</td>
<td>500</td>
</tr>
<tr>
<td>Metal, 4-Way, Single 2-ft. x 2-ft.</td>
<td>1000</td>
</tr>
<tr>
<td>KitchenSox™, Single 2-ft. x 2-ft.</td>
<td>500</td>
</tr>
<tr>
<td>KitchenSox™, Single 2-ft. x 2-ft.</td>
<td>1000²</td>
</tr>
<tr>
<td>KitchenSox™, Single 2-ft. x 2-ft.</td>
<td>1500²</td>
</tr>
</tbody>
</table>

²airflow rate above manufacturer’s recommended rate for outlet
Results and Discussion

Diffuser Performance Testing

The results of the diffuser evaluations based on the effects on hood capture and containment rates are presented for the UL listed hood and 2-vat fryer/broiler/oven (mixed-duty) line in Figure 8, and the generic hood and broiler (heavy-duty) line configuration in Figure 9.

In general, it was found that the diffuser effect on capture and containment was less for the UL Listed hood than for the generic hood. This follows from the performance advantage achieved by using engineered hood designs. Though the appliance lines were different, with 500 cfm makeup air introduced through the 4-way diffuser, the capture and containment exhaust rate increased by 100 cfm for the UL listed hood and by 1000 cfm for the generic hood, over their respective baseline rates using the displacement ventilation system. When 500 cfm of makeup air was introduced through the 2-ft. by 2-ft. KitchenSox™ diffuser, the exhaust rate increased by 100 cfm over the baseline rates for the UL listed hood and the generic hood.

Overall, for both the generic and UL hoods, 1000 cfm through the 4-way diffuser disrupted the performance of the hood to such a degree that it was beyond the capacity of the lab’s exhaust system to capture and contain the thermal plume from the appliances (i.e., 3000 and 3600 cfm, respectively).

![Figure 8. Capture and Containment Rates for Various Makeup Air Devices and Air Flow Rates with a UL Listed Hood and 2-Vat Fryer/Broiler/Oven (Line](image-url)
For the baseline case, the capture and containment exhaust rate for the UL listed hood and mixed-duty line was 1700 cfm. The baseline case was determined by introducing 100% of the makeup air from the floor mounted displacement diffusers. When 500 cfm of makeup air was introduced through the 4-way diffuser, the exhaust rate increased to 1800 cfm. When the airflow rate through the 4-way diffuser was increased to 1000 cfm, an exhaust rate of 3000 cfm was insufficient to capture and contain the thermal plume from the appliances; 3000 cfm was the exhaust capacity of the lab for the UL listed hood design.

When 500 cfm was introduced through the 2-ft. by 2-ft. KitchenSox™ diffuser, there was no detrimental effect on hood performance and the capture and containment of 1700 cfm was the same as the baseline case.

For the makeup air flow rate of 1000 cfm through the 2-ft. by 2-ft. KitchenSox™ diffuser, the capture and containment rate was 1800 cfm.

For the makeup air flow rate of 1500 cfm through the 2-ft. by 2-ft. KitchenSox™ diffuser, the capture and containment exhaust rate for the UL listed hood was 1900 cfm, 200 cfm above the baseline rate of 1700 cfm.

Figure 9. Capture and Containment Rates for Various Makeup Air Devices and Air Flow Rates with a Generic Hood and Broiler (Heavy-Duty) Line
The baseline capture and containment exhaust rate for the generic hood and the heavy-duty broiler line was 2300 cfm. When 36-in. by 36-in. side panels were installed on the hood, the rate decreased to 2200 cfm. For a makeup air flow rate of 500 cfm introduced through the 4-way diffuser, the capture and containment rate increased to 3300 cfm. For the same makeup air flow rate of 500 cfm through the 2-ft. by 2-ft. KitchenSox™ diffuser, the capture and containment rate was 2400 cfm. For the makeup air flow rate of 500 cfm through the 2-ft. by 4-ft. KitchenSox™ diffuser, the capture and containment rate was the same as the baseline rate of 2300 cfm. It was the same exhaust rate of 2300 cfm for 500 cfm through the 2-ft. by 4-ft. KitchenSox™ diffuser and the generic hood with side panels, and the same exhaust rate of 2300 cfm for 500 cfm through the 2-ft. by 10-ft. KitchenSox™ diffuser.

For a makeup air flow rate of 1000 cfm introduced through a 4-way diffuser, the capture and containment rate was greater than 3600 cfm. When 1000 cfm was introduced through a 2-ft. by 2-ft. KitchenSox™ diffuser, the capture and containment rate was 3000 cfm. When 1000 cfm was introduced through the 2-ft. by 4-ft. KitchenSox™ diffuser, the exhaust rate was 2800 cfm. When side panels were added to the hood, the exhaust rate dropped to 2700 cfm. When a corner blank was added to the 2-ft. by 4-ft. KitchenSox™ diffuser the rate was 2700 cfm also. For a makeup air flow rate of 1000 cfm introduced through the 2-ft. by 10-ft. KitchenSox™ diffuser, the exhaust rate was 2600 cfm. The capture and containment exhaust rate is 300 cfm higher than the baseline case of 2300 cfm. For the 2-ft. by 10-ft. KitchenSox™ diffuser, the specific airflow rates are used to calculate a makeup air to exhaust air ratio of 38%.

For a makeup airflow rate of 1500 cfm introduced through a 2-ft. by 4-ft. KitchenSox™ diffuser, the capture and containment exhaust rate was 3500 cfm. When a corner blank was added to the diffuser, the exhaust rate decreased to 3200 cfm. For a makeup airflow rate of 1500 cfm through a 2-ft. by 10-ft. KitchenSox™ diffuser, the exhaust rate was 3100 cfm. The specific airflow rates are used to calculate a makeup air to exhaust air ratio of 48%.

For a makeup airflow rate of 2000 cfm introduced through a 2-ft. by 10-ft. KitchenSox™ diffuser, the exhaust rate was 3300 cfm. That is, 1000 cfm higher than the baseline case for a makeup air to exhaust air ratio of 61%.
Diffuser Velocity Testing
Discharge velocities from four diffusers at five makeup air flow rates were taken along the front lower edge of the hood and presented in Figure 10. Prior research quantified the detrimental effects of high velocity makeup air near the hood [Ref 3]. The lower edge velocities for the makeup air configurations tested ranged from 0 fpm for 500 cfm through the 2-ft. by 4-ft. KitchenSox™ diffuser to 706 fpm for 1000 cfm through the 4-way diffuser. Overall, the lower edge velocity effect on hood capture and containment performance ranged from no increase over the baseline exhaust rate of 2300 cfm to more than 3600 cfm, which is 1300 cfm higher than the baseline rate.

![Figure 10. Diffuser Velocities for Various Makeup Airflows at the Lower Edge of the Generic Hood](image)

For the makeup air flow rate of 500 cfm introduced through the 4-way diffuser, the peak velocity of 313 fpm contributed to increasing the capture and containment exhaust rate from a baseline of 2300 cfm to 3300 cfm. There was no lower edge velocity measured when 500 cfm was introduced through the 2-ft. by 4-ft. KitchenSox™ diffuser, the capture and containment rate was the same as the baseline of 2300 cfm.

For the makeup air flow rate of 1500 cfm introduced through the 2-ft. by 4-ft. KitchenSox™ diffuser, the peak lower edge velocity was 174 fpm. This velocity at the
lower edge of the hood contributed to increasing the capture and containment exhaust rate to 3500 cfm.

For the makeup air flow rate of 2000 cfm introduced through the 2-ft. by 10-ft. KitchenSox™ diffuser, the peak velocity of 60 fpm contributed to increasing the capture and containment rate to 3300 cfm.

The highest diffuser velocity measured at the lower edge of the hood was 706 fpm for a makeup air flow rate of 1000 cfm introduced through the 4-way diffuser. The effect on hood performance was very detrimental. The hood failed to capture and contain the thermal plume at an exhaust rate of 3600 cfm, which was the capacity of the lab’s exhaust system for the generic hood design.

For a small group of diffusers and makeup air flow rates, peak diffuser velocities ranged between 29 and 47 fpm. For the 2-ft. by 10-ft KitchenSox™ diffuser and a makeup air flow rate of 1000 cfm, the peak velocity was 29 fpm and the capture and containment rate was 2600 cfm. For the 2-ft. by 2-ft. KitchenSox™ diffuser and a makeup air flow rate of 500 cfm, the peak velocity was 33 fpm and the capture and containment rate was 3300 cfm. For the 2-ft. by 10-ft. KitchenSox™ diffuser and a makeup air flow rate of 1500 cfm, the peak velocity was 45 fpm and the capture and containment rate was 3100 cfm. For the 2-ft. by 2-ft. KitchenSox™ diffuser and a makeup air flow rate of 1000 cfm, the peak velocity was 46 fpm and the capture and containment rate was 3000 cfm. For the 2-ft. by 4-ft. KitchenSox™ diffuser and a makeup air rate of 1000 cfm, the peak velocity was 47 fpm and the capture and containment rate was 2800 cfm.
Static Pressure Differential of Diffusers

The static pressure versus airflow curves of the 4-way diffuser, 2-ft. by 2-ft. KitchenSox™ diffuser, 2-ft. by 4-ft. KitchenSox™ diffuser, and 2-ft. by 10-ft. KitchenSox™ diffuser are shown in Figure 11.

![Figure 11. Static Pressure Differential of Diffusers](image)

The diffuser most sensitive to a change in pressure with respect to airflow is the 2-ft. by 2-ft. KitchenSox™ diffuser. The diffuser least sensitive to airflow is the 2-ft. by 10-ft. KitchenSox™ diffuser. Of the diffusers tested, the pressure curves of the 4-way diffuser and 2-ft. by 4-ft. KitchenSox™ diffuser were most similar.
Conclusions

The KitchenSox™ low-velocity fabric diffusers distributed the discharge velocities uniformly over the area of the fabric, minimizing the negative effect of diffuser-supplied makeup air on the capture and containment performance of the hood. The fabric diffusers demonstrated a distinct advantage over 4-way diffusers for commercial kitchen HVAC applications. For the majority of the cases tested, the exhaust capture and containment airflow rate for the hoods tested with the KitchenSox™ diffusers approached the baseline exhaust rate that was established using the displacement ventilation system to supply replacement (makeup) air.

A KitchenSox™ diffuser can be used to deliver a significant proportion of the makeup air required for a kitchen hood. Capture and containment testing found that as much as 60% of the exhaust air requirement (3300 cfm) of a kitchen hood could be introduced through a 2-ft. by 10-ft. KitchenSox™ diffuser without an appreciable increase in the exhaust rate over the baseline rate.

The 2-ft. by 4-ft. KitchenSox™ diffuser could be considered a direct replacement for the 4-way diffuser. A comparison of the static pressure versus airflow curves of the two diffusers found them similar and therefore the HVAC system pressure would essentially remain the same. The enhanced performance of the 2-ft. by 4-ft. KitchenSox™ diffuser over the 4-way could be used to mitigate field problems arising from poor capture and containment due to high velocities from a 4-way diffuser.

The contributing factor to higher capture and containment exhaust rates is the high discharge velocities from diffusers. The highest velocity measured at the lower edge of the hood was through the 4-way diffuser, and the lowest velocity measured was through the 2-ft. by 4-ft. KitchenSox™ diffuser. For two of the test conditions with the 4-way diffuser, the high velocity created by the 4-way diffuser disrupted the performance of the hood to such a degree that it was beyond the capacity of the lab’s exhaust system to capture and contain the thermal plume from the appliances.

Previous research [Ref 2] [Ref 8] indicates that engineered hoods perform better by design. The capture and containment rates are lower for engineered hoods than for generic hoods because engineered hoods more efficiently handle the thermal plume from appliances and local disturbances, such as from diffusers. The testing showed the negative effect of the higher velocities from diffusers on capture and containment was less for the engineered UL listed hood than for the generic hood.
References


