Scope and Application of ASTM 1704, Standard Test Method for Capture and Containment Performance of Commercial Kitchen Exhaust Ventilation Systems

The capture and containment exhaust air flow rates for the 10-foot wall canopy exhaust hood were determined under controlled laboratory conditions. 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 hood under test was configured with manufacturer-specified hood features (e.g., hood height and depth and/or volume of hood reservoir, number of duct collars, location and size of duct collars, effluent plume containment features or technologies) and manufacturer-specified installation options (e.g., side panels, back wall, rear seal) over the specified appliances operating under simulated cooking conditions. The common denominator for the different styles and configurations of wall-canopy hoods tested by the PG&E Food Service Technology Center is the 10-foot hood length over a standardized appliance challenge (i.e., a heavy-, medium-, light-, and mixed-duty appliance lines). The specifications of the hood and its installation configuration over each appliance line are detailed within the report.

The laboratory test setup was not intended to replicate a real-world installation of this hood 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 capture and containment performance of an exhaust hood in combination with the specified options 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.

Gaylord Company, Model PG-ND-BDL-54 Wall-Mounted Canopy Exhaust Hood Performance Report

Application of ASTM Standard
Test Method F 1704-05

Food Service Technology Center
(www.fishnick.com)
FSTC Report 5011.07.13

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Contents

Objectives and Scope

This report summarizes the results of performance testing a Gaylord Company, Model PG-ND-BDL-54 Exhaust Hood at the Commercial Kitchen Ventilation Laboratory within the scope of the PG&E Food Service Technology Center program. The objectives were to:

(1) Evaluate the capture and containment performance of this exhaust only, wall-mounted canopy hood when challenged with light-, medium-, heavy-, and mixed-duty appliances under the controlled conditions of the ASTM Standard Test Method F-1704 [Ref 1].
(2) Measure and report the pressure drop across the hood as a function of airflow.
(3) Measure and report the filter velocity profile across the length of the hood.

Equipment

Hood Specifications

The Gaylord PG-ND-BDL-54 canopy hood measured 10 feet wide by 4.5 feet deep by 2 feet high and was mounted to a transparent back wall. A 3-inch standoff behind the back panel was incorporated within the depth of the hood. The hood was equipped with six 19.5-inch by 15.5-inch stainless steel baffle-type grease filters, and exhausted through a 15.0 inch by 15.0 inch exhaust collar. The back panel tapered directly from the bottom of the filter bank, 11-inches above the lower edge of the hood, to the vertical wall, 1.5-inches above the lower edge. The center of the grease cup was located along the back panel 8.5-inches from the left side, 4-inches from the lower edge of the hood. The front lower edge of the hood was located at 78.0 inches above the finished floor. The hood was equipped with a 6-inch internal flange along the entire front edge and a 1-inch flange along each side. The hood setup over a heavy-duty broiler line is shown in Figure 1.

Figure 1. Gaylord PG-ND-BDL-54 Wall-Mounted Canopy Hood Test Setup (Note Transparent Back Wall)

Side Panel Configuration

Partial side panels were used in seven capture and containment evaluations. Three side panel options initially were evaluated to determine an optimum size. The side panels measured 50-inch by 50-inch by 45 degrees, 45-inch by 45-inch by 45 degrees, and 36-inch by 36-inch by 45 degrees. Sensitivity testing with the broiler line showed that the smaller of the three panel options provided the greatest return on hood performance. Subsequently, all side-panel tests in the matrix were conducted using this preferred panel configuration. A photograph with and without the side panels installed on the three-broiler cook line, along with a dimensional drawing, is shown in Figure 2.

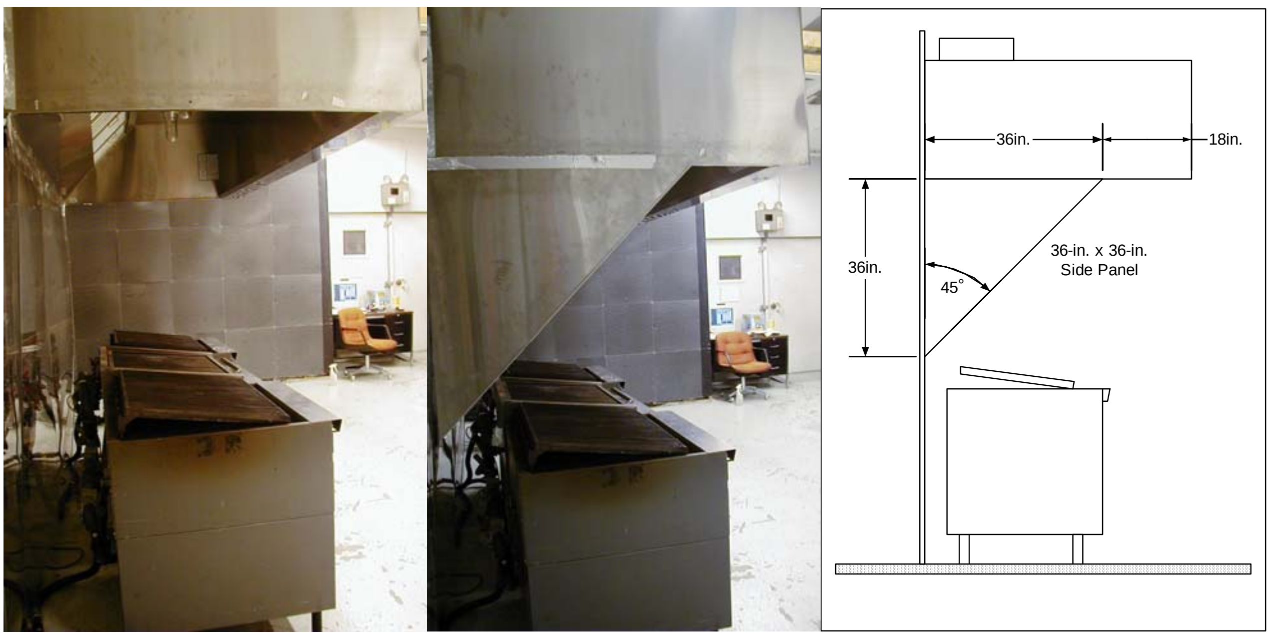

Figure 2. Side View with and without 36-inch x 36-inch Side Panels

Cooking Appliances

The appliances used to challenge this wall-mounted canopy hood were full-size electric ovens (light-duty category), 2-vat high-efficiency gas fryers, a three-foot griddle (medium-duty) and 3-foot underfired gas broilers (heavy-duty). For each setup, the appliances were operated under simulated heavy-load cooking conditions established by a recent ASHRAE research project [Ref 2] based on the heavy load testing per the ASTM Standard Test Methods for appliances [Ref 5,6,7,8]. The cooking appliance specifications are listed in Table 1.

Table 1 Cooking Appliance Specifications

	3-Ft. Gas Charbroiler	Full-Size Electric Convection Oven	2-Vat Gas Fryer	3-Ft. Gas Griddle
Rated Input	96,000 Btu/h	12.1 kW	160,000 Btu/h	90,000 Btu/h
Capacity	719 sq. in.	8.6 cu. ft	Two 50 lb. vats	1026 sq. in.
Height	37.0 in.	57.3 in.	45.3 in.	37.0 in.
Width	34.0 in.	40.0 in.	31.3 in.	36.0 in.
Depth	31 in.	41/38/42 in.	28 in.	37 in.

Hood/Appliance Overhang Relationship

The appliance lines were positioned in a “pushed back” condition with a minimum distance between the backwall and the rear of the appliance (i.e., rear gap), while allowing enough space for utility connections. Figure 3 illustrates the relationship between front overhang and rear gap. Table 2 shows the actual dimensions of front overhang and rear gap in the “pushed back” condition. Ovens remained in the 12.0-inch overhang position for all tests, as this was also the position of maximum “push back” and minimum rear gap.

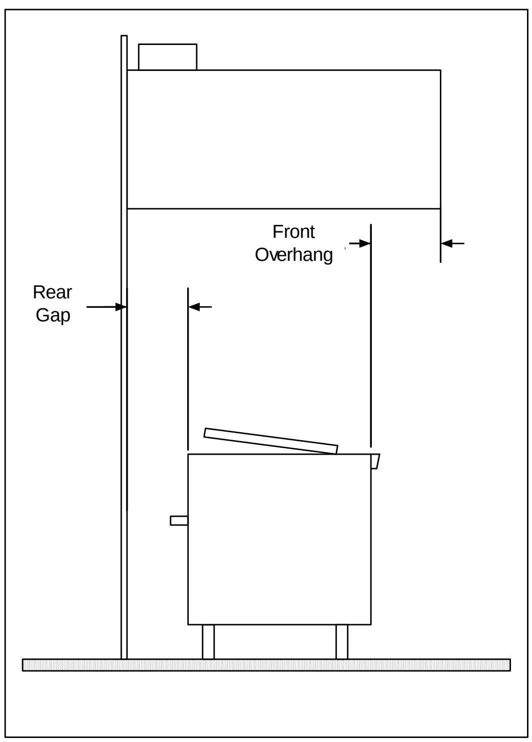

Figure 3. Relationship between Front Overhang and Rear Gap

Table 2 Hood/Appliance Overhang Relationships

	3-Ft. Gas Broiler	Full-Size Electric Convection Oven	2-Vat Gas Fryer	3-Ft Gas Griddle
Front Overhang to Appliance [in.]	18	12	22	12
Rear of Appliance to Backwall [in.]	5	1	4	5

Test Protocol

Capture & Containment Testing

"Hood capture and containment" is defined in ASTM F1704-05, *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 capture and containment (C&C) 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 C&C was achieved. For most cases, single-test determinations were used to establish the reported threshold of C&C. This threshold C&C rate was used for direct comparisons across scenarios. In all evaluations, the replacement air was supplied from low velocity, floor-mounted diffusers along the opposite wall (Figure 4). 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].

A walk-by protocol was introduced to simulate operator movement in the restaurant in the vicinity of the hood during the cooking process. The procedure was used in the lab to emulate the effect of operator disturbance on capture and containment. For this assessment, a researcher walked a line 18 inches in front of the appliances with a 12 inch overhang at a rate of 100 steps per minute. The exhaust rate was then increased to achieve capture and containment of the thermal plume under this dynamic challenge.

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. Since the heat and effluent generated by the cooking process change the air density above the equipment, the sensitive flow visualization systems provide a graphic image of the thermal activity along the perimeter of the hood. The front and left lower edges of the hood were monitored by schlieren systems located at a height that was centered between the typical 36-inch appliance height and the 78-inch hood height. The right lower edge of the hood was monitored using a shadowgraph system, located at the same height as the hood edge. Figure 4 shows a plan view of the laboratory with the relative positions of the hood and flow visualization tools.

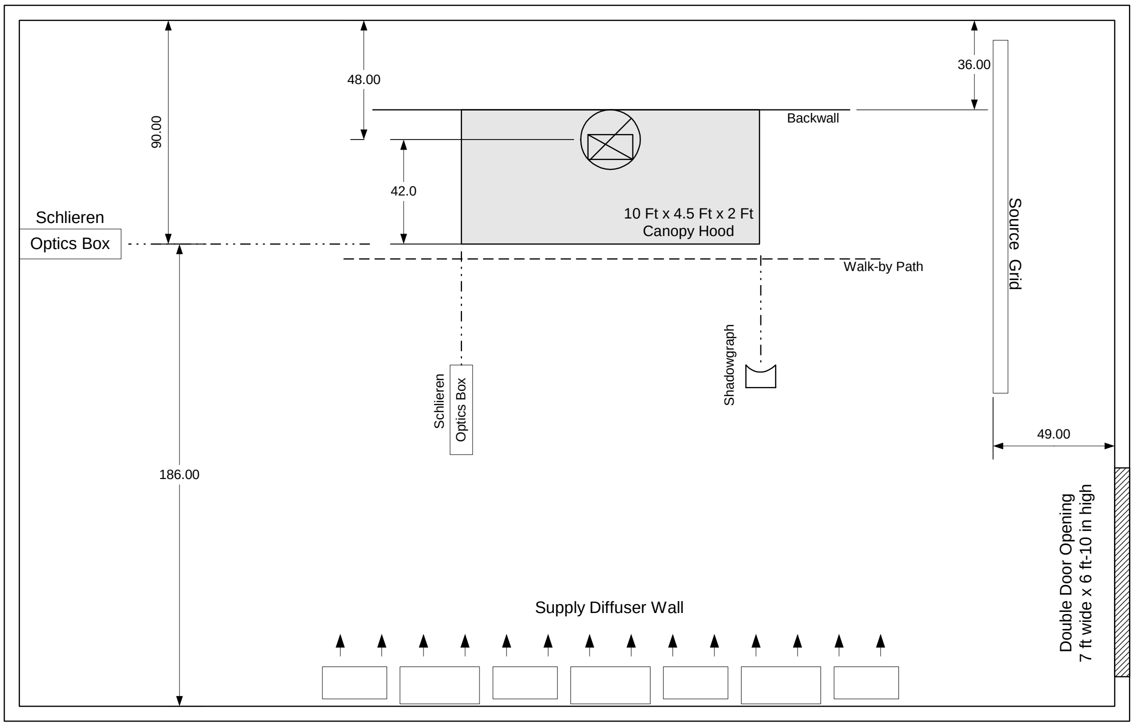

Figure 4. Plan View of Lab During Hood Evaluation

The airflow measurements in the laboratory are in compliance 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%.

Static Pressure Differential

The static pressure difference was measured between the laboratory and the exhaust collar of the hood. The pressure was taken at the exhaust collar with a 4-inch by 2-inch right-angle static pressure probe inserted at the center of the side of the 15-inch by 15-inch by 2.5-inch collar. The static pressure taps were located approximately 4-inches inside the exhaust collar wall and 0.5-inch above the top of the hood. The pressures were taken for five exhaust flow rates (1500, 2000, 2500, 3000, and 3300 cfm).

Filter Face Velocity Profile

The filter face velocity was measured with a 4-inch diameter, rotating vane anemometer (RVA) flush against the filter. One-minute average readings were recorded for each filter traverse. The profiles were taken for two exhaust airflow rates, 2000 and 3000 cfm.

Appliance and Hood Configuration Test Matrix

The performance of the Gaylord PG-ND-BDL-54 hood was evaluated for 12 test conditions. Generally, each appliance line configuration was evaluated in a best practice “pushed back” condition with and without side panels. In addition, one test with the broiler challenge included a seal between the rear of the appliances and the wall. Another additional test was performed on the mixed appliance line to evaluate hood performance under a dynamic walk-by challenge. In this case, the exhaust rate was increased to achieve capture and containment under the disruption caused by operator movement. The following test matrices present the details of the test setups for the respective appliance lines. Each test condition is sequentially numbered for reference to the reported data.

Underfired Gas Broiler (Heavy-Duty) Test Matrix

The heavy-duty challenge was comprised of three 3-foot, gas underfired broilers. The front overhang was 18.0 inches in the pushed back condition and resulted in a rear gap of 5.0 inches. The hood was tested for each appliance location with and without side panels, in a static (no operator movement) condition. With the broilers in this configuration and the side panels installed, an additional evaluation was done with the 5.0-inch rear gap sealed between the broilers and the back wall at the height of the top of the appliance cabinet (Test 3). The test matrix for the heavy-duty broilers is shown in Table 3 and the setup illustrated in Figure 5.

Table 3. Underfired Gas Broiler (Heavy-Duty) Test Matrix

Test #	LH Appliance	LH Appliance Effective Front Overhang[1] [in.]	LH Appliance Effective Rear Gap [in.]	CTR Appliance	CTR Appliance Effective Front Overhang [in.]	CTR Appliance Effective Rear Gap [in.]	RH Appliance	RH Appliance Effective Front Overhang[1] [in.]	RH Appliance Effective Rear Gap [in.]	Side Panels	Side Overhang [in.]
1	Broiler	18	5	Broiler	18	5	Broiler	18	5	Without	6
2	Broiler	18	5	Broiler	18	5	Broiler	18	5	With	6
3	Broiler	18	5	Broiler	18	5	Broiler	18	5	With Side Panels & Rear Seal	6

Figure 5. Heavy-Duty Underfired Gas Broiler Line

Gas Fryer (Medium-Duty) Test Matrix

The medium-duty test matrix consisted of three 2-vat gas fryers (6 vats total). The front overhang was 22.0 inches and resulted in a rear gap of 4.0 inches. The hood was tested with and without side panels, in a static (no operator movement) condition. The test matrix for the medium-duty fryers is shown in Table 4 and the setup illustrated in Figure 6.

Table 4. Fryer (Medium-Duty Appliance) Test Matrix

Test #	LH Appliance	LH Appliance Effective Front Overhang[1] [in.]	LH Appliance Effective Rear Gap [in.]	CTR Appliance	CTR Appliance Effective Front Overhang [in.]	CTR Appliance Effective Rear Gap [in.]	RH Appliance	RH Appliance Effective Front Overhang[1] [in.]	RH Appliance Effective Rear Gap [in.]	Side Panels	Side Overhang [in.]
4	2-Vat Fryer	22	4	2-Vat Fryer	22	4	2-Vat Fryer	22	4	Without	6
5	2-Vat Fryer	22	4	2-Vat Fryer	22	4	2-Vat Fryer	22	4	With	6

Figure 6. Medium-Duty Gas Fryer Line

Full-Size Electric Convection Oven (Light-Duty) Test Matrix

The light-duty test matrix consisted of one full-size electric convection oven and two full size gas convection ovens. As the electric oven idled, the gas ovens maintained the same operating temperature, and then the burners were turned off during the capture and containment evaluation [Ref 2]. The front overhang was 12.0 inches. In this configuration, the left oven had 4.0 inches between the convection motor and the backwall, the center oven had 1.0 inch between the motor and the backwall, and the right oven was flush against the backwall. The rear gap was measured from the rear of the convection fan motor to the back wall, except for the right oven that had its motor shrouded. The hood was tested with and without side panels, in a static (no operator movement) condition. The test matrix for the full-size ovens is shown in Table 5 and the setup illustrated in Figure 7.

Table 5. Full-Size Convection Oven (Light-Duty) Test Matrix

Test #	LH Appliance	LH Appliance Effective Front Overhang[1] [in.]	LH Appliance Effective Rear Gap [in.]	CTR Appliance	CTR Appliance Effective Front Overhang [in.]	CTR Appliance Effective Rear Gap [in.]	RH Appliance	RH Appliance Effective Front Overhang[1] [in.]	RH Appliance Effective Rear Gap [in.]	Side Panels	Side Overhang [in.]
6	Oven	12	4	Oven	12	1	Oven	12	0	Without	0
7	Oven	12	4	Oven	12	1	Oven	12	0	With	0

Figure 7. Light-Duty Full Size Convection Oven Line

2-Vat Fryer/Charbroiler or Griddle/Convection Oven (Combination-Duty) Test Matrix

The combination duty test matrix consisted of the 2-vat gas fryer in the left position, the 3-foot gas underfired broiler in the center position and the full-size electric convection oven in the right position. The performance of the hood was evaluated with and without side panels, in a static (no operator movement) condition, except for Test 10. For this test, hood performance was evaluated using a walk-by protocol. In Test 11 and 12, the broiler was replaced with a gas griddle. The test matrix for the combination-duty appliance line is shown in Table 6 and the setup illustrated in Figure 8.

Table 6. Fryer/Broiler/Convection Oven (Combination Duty) Test Matrix

Test #	LH Appliance	LH Appliance Effective Front Overhang[1] [in.]	LH Appliance Effective Rear Gap [in.]	CTR Appliance	CTR Appliance Effective Front Overhang [in.]	CTR Appliance Effective Rear Gap [in.]	RH Appliance	RH Appliance Effective Front Overhang[1] [in.]	RH Appliance Effective Rear Gap [in.]	Side Panels	Side Overhang [in.]
8	2-Vat Fryer	22	4	Broiler	18	5	Oven	12	1	Without	6
9	2-Vat Fryer	22	4	Broiler	18	5	Oven	12	1	With	6
10[2]	2-Vat Fryer	22	4	Broiler	18	5	Oven	12	1	With	6
11	2-Vat Fryer	22	4	Griddle	12	5	Oven	12	1	Without	6
12	2-Vat Fryer	22	4	Griddle	12	5	Oven	12	1	With	6

[2]Test condition was conducted with “walk-by” protocol.

Figure 8. Fryer/Charbroiler/Convection Oven Appliance Line

Results and Discussion

The capture and containment (C&C) results are presented below for the different appliance-line configurations.

Broiler (Heavy-Duty) Testing

The results of the gas broiler-line capture and containment testing are presented in Table 7. It was found that the exhaust rate required to capture and contain the thermal challenge from three broilers was 3600 cfm. When side panels were added to this condition, the threshold airflow rate for C&C was reduced to 2600 cfm. When the rear gap between the broiler cabinet and backwall was sealed, the C&C exhaust rate was reduced even further to 2000 cfm (200 cfm/ft).

Table 7. Capture and Containment Results for Charbroilers

Test #	LH Appliance	LH Appliance Effective Front Overhang[1] [in.]	CTR Appliance	CTR Appliance Effective Front Overhang [in.]	RH Appliance	RH Appliance Effective Front Overhang[1] [in.]	Side Panels	Side Overhang [in.]	C&C Exhaust Rate [acfm]	C&C Exhaust Rate [acfm/ft]
1	Charbroiler	18	Charbroiler	18	Charbroiler	18	Without	6	3600	360
2	Charbroiler	18	Charbroiler	18	Charbroiler	18	With	6	2600	260
3	Charbroiler	18	Charbroiler	18	Charbroiler	18	With Side Panels & Rear Seal	6	2000	200

Fryer (Medium-Duty) Testing

The results of the gas fryer capture and containment testing are presented in Table 8. It was found that the exhaust rate required to capture and contain the three 2-vat fryers (6-vats total) was 3500 cfm. The hood's ability to capture and contain was challenged by the strong thermal plume from the fryers' flue jetting up along the rear wall, then sideways along the rear of the hood, escaping at the rear corners. If side panels were added to this condition, the exhaust rate dropped to 1700 cfm (170 cfm/ft).

Table 8. Capture and Containment Results for Fryers

Test #	LH Appliance	LH Appliance Effective Front Overhang[1] [in.]	CTR Appliance	CTR Appliance Effective Front Overhang [in.]	RH Appliance	RH Appliance Effective Front Overhang[1] [in.]	Side Panels	Side Overhang [in.]	C&C Exhaust Rate [acfm]	C&C Exhaust Rate [acfm/ft]
4	2-Vat Fryer	22	2-Vat Fryer	22	2-Vat Fryer	22	Without	6	3500	350
5	2-Vat Fryer	22	2-Vat Fryer	22	2-Vat Fryer	22	With	6	1700	170

Full-Size Convection Oven (Light Duty) Testing

The results of the full-size convection oven testing are presented in Table 9. It was found that the exhaust rate required to capture and contain three full-size convection ovens with and without side panels was 700 cfm (70 cfm/ft).

Table 9. Capture and Containment Results Full-Size Convection Ovens

Test #	LH Appliance	LH Appliance Effective Front Overhang[1] [in.]	CTR Appliance	CTR Appliance Effective Front Overhang [in.]	RH Appliance	RH Appliance Effective Front Overhang[1] [in.]	Side Panels	Side Overhang [in.]	C&C Exhaust Rate [acfm]	C&C Exhaust Rate [acfm/ft]
6	Oven	12	Oven	12	Oven	12	Without	0	700	70
7	Oven	12	Oven	12	Oven	12	With	0	700	70

Fryer/Broiler or Griddle/Convection Oven (Combination-Duty) Testing

The results for the 2-vat fryer/3-foot charbroiler/full-size convection oven capture and containment tests are presented in Table 10. All evaluations were conducted at a static condition except for test 10, which incorporated a walk-by protocol. Test 11 and 12 were conducted with a griddle in place of the broiler.

The exhaust rate required to capture and contain a 2-vat fryer/3-foot broiler/full-size convection oven cook line was 3600 cfm. If side panels were added to this pushed back condition, the plume from the fryer flue was brought under control and the C&C exhaust rate dropped to 1800 cfm (180 cfm/ft).

Table 10. Capture and Containment Results for 2-Vat Fryer / Charbroiler / Full-Size Convection Oven Appliance Line

Test #	LH Appliance	LH Appliance Effective Front Overhang[1] [in.]	CTR Appliance	CTR Appliance Effective Front Overhang [in.]	RH Appliance	RH Appliance Effective Front Overhang[1] [in.]	Side Panels	Side Overhang [in.]	C&C Exhaust Rate [acfm]	C&C Exhaust Rate [acfm/ft]
8	2-Vat Fryer	22	Charbroiler	18	Oven	12	Without	6	3600	360
9	2-Vat Fryer	22	Charbroiler	18	Oven	12	With	6	1800	180
10[2]	2-Vat Fryer	22	Charbroiler	18	Oven	12	With	6	2400	240
11	2-Vat Fryer	22	Griddle	12	Oven	12	Without	6	3400	340
12	2-Vat Fryer	22	Griddle	12	Oven	12	With	6	1600	160

[2]Test condition was conducted with “walk-by” protocol.

A walk-by evaluation was conducted for the combination duty line with side panels. The increased exhaust flow rate required to capture and contain the dynamically disturbed thermal plume was 2400 cfm (600 cfm higher than the static condition).

The combination-duty appliance line was also evaluated with a griddle replacing the broiler in the center position. Without side panels installed, the measured C&C exhaust rate was 3400 cfm. With side panels added, the C&C exhaust rate was reduced to 1600 cfm (160 cfm/ft).

Static Pressure Differential Measured at Exhaust Collar

The static pressure drop between the laboratory and the exhaust collar was measured for five exhaust flow rates. The pressure drop across the hood ranged from 0.18 in. of water at 1500 cfm to 1.09 in. of water at 3300 cfm. At 2500 cfm the pressure drop was 0.57 in. of water. The results are presented in Table 11.

Table 11. Hood Static Pressure Readings at Exhaust Collar

Exhaust Flow Rate [acfm]	Hood Static Pressure at Exhaust Collar [inches of water]
1500	0.18
2000	0.36
2500	0.57
3000	0.91
3300	1.09

Figure 9 presents the static pressure versus airflow curve. The data were a very good fit, reflecting a typical pressure versus airflow relationship.

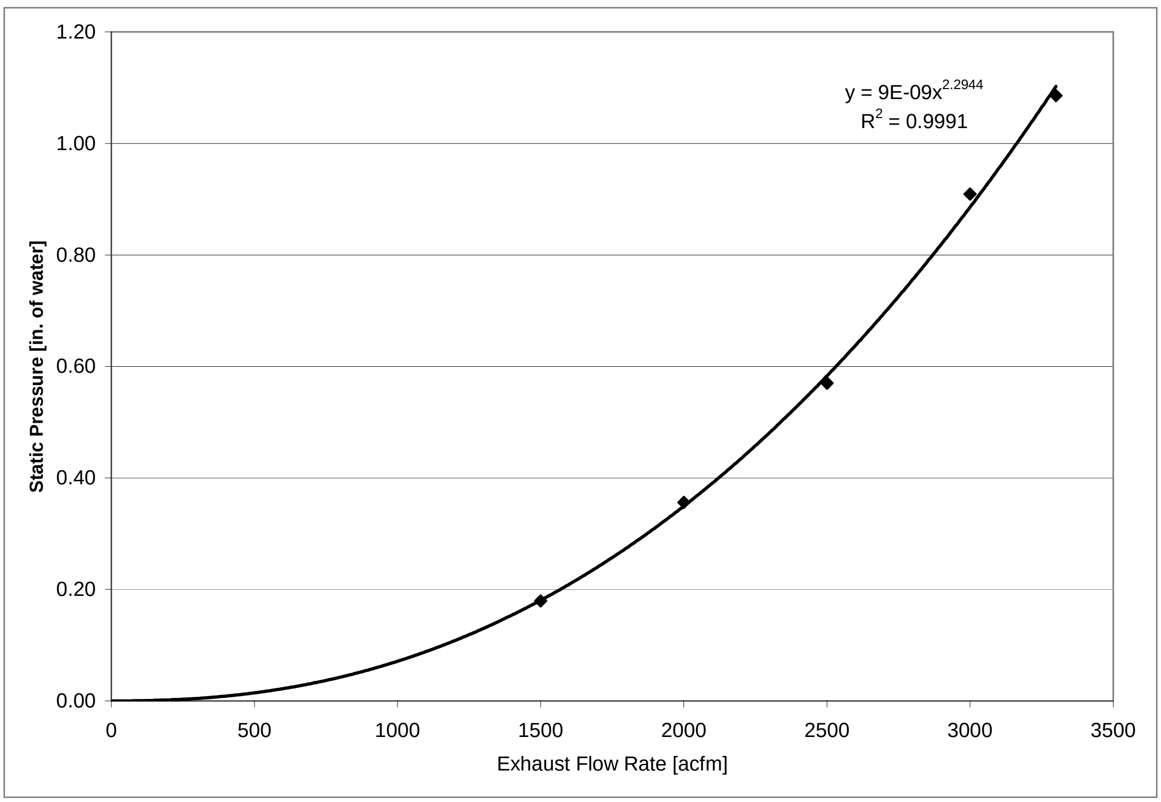

Figure 9. Static Pressure Differential Measured at the Exhaust Collar

Filter Face Velocity Testing

Filter face velocity readings were taken for each of the six filters at two exhaust flow rates. For the 2000 cfm exhaust rate, the filter velocities ranged from 189 to 262. For the 3000 cfm exhaust rate, the filter velocities ranged from 259 to 377 fpm. The data are presented in Table 12 and a velocity profile is shown in Figure 10.

Table 12. Filter Face Velocity Readings

Exhaust Flow Rate [acfm]	Left Filter #1 Velocity [fpm]	Filter #2 Velocity [fpm]	Filter #3 Velocity [fpm]	Filter #4 Velocity [fpm]	Filter #5 Velocity [fpm]	Right Filter #6 Velocity [fpm]	Avg. Filter Velocity [fpm]	Standard Deviation [fpm]	Standard Deviation [%]
2000	191	196	219	262	189	189	208	29	14
3000	259	275	348	377	276	272	301	49	16

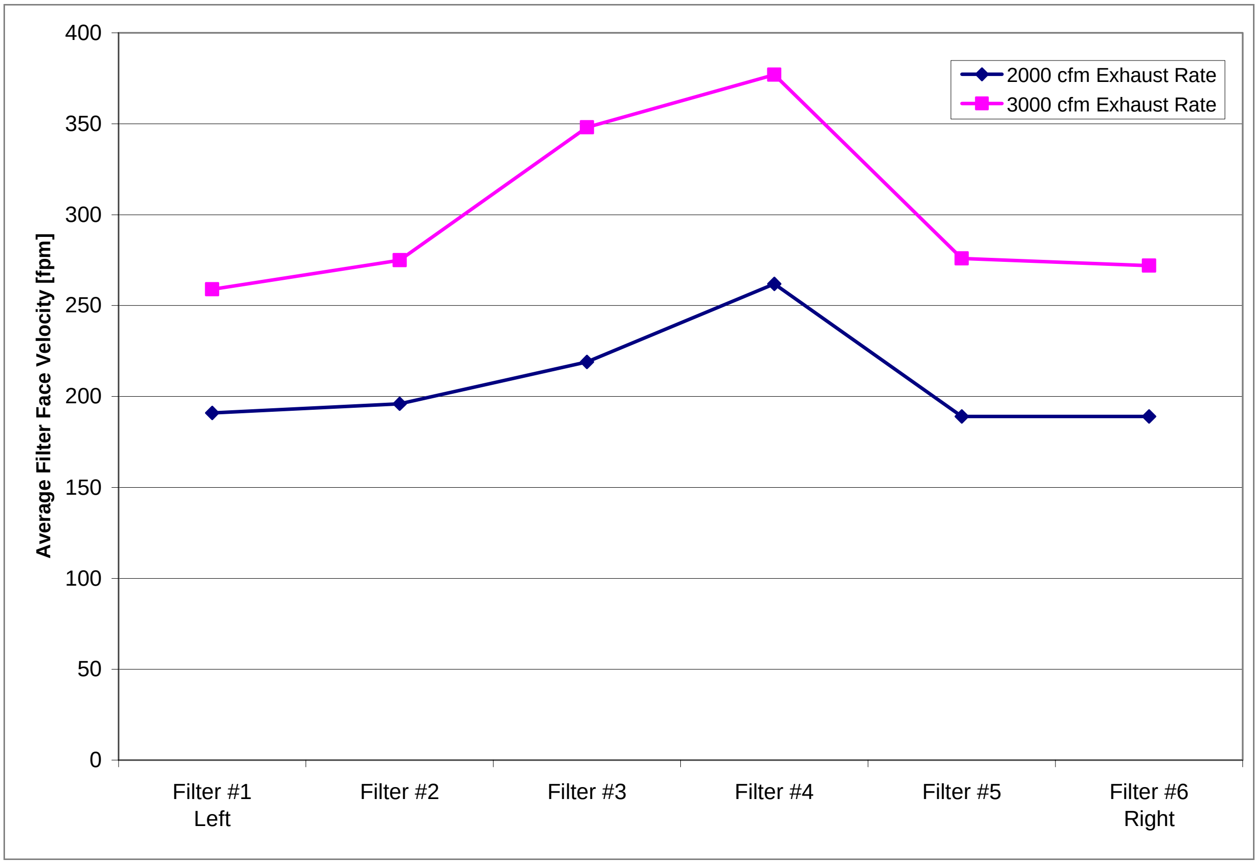

Figure 10. Filter Face Velocity Profiles

For both exhaust rates, the profiles show that the velocity was at a maximum in the center of the hood (slightly higher for the filter located right of center below the exhaust collar) and a minimum towards the ends. For the 2000 cfm exhaust rate, the average filter velocity was 208 fpm. The velocity increased to 262 fpm near the exhaust collar and dropped to 189 fpm at the right end filter. For the 3000 cfm rate, the average filter velocity was 301 fpm, with a center velocity of 377 fpm and an end velocity of 259 fpm.

Summary of Results and Conclusions

Figure 11 and Table 13 summarize the results for the capture and containment testing. The test numbers in Figure 11 refer to the first column of Table 13 and associated test condition. An immediate observation is the range in C&C airflow rates, from a low of 700 cfm (70 cfm/ft) to a high of 3600 cfm (360 cfm/ft). The higher rates, above 2400 cfm (240 cfm/ft), were for the heavy- and medium-duty appliance challenge (broilers and fryers) without side panels. This can be compared to data for a generic 10-foot, wall canopy hood reported by an ASHRAE research project [Ref 2] where the range for these two appliance categories without side panels was from 2400 cfm (240 cfm/ft) to 4400 cfm (440 cfm/ft).

The dramatic benefit of side panels was demonstrated for nearly all appliance combinations tested. The 36-inch x 36-inch x 45-degree panel installed on both ends of the 10-foot, wall mounted Gaylord hood provided the most stable capture and containment flow rates. However, the interaction between the side panel and the 1-inch side flange required a higher capture and containment exhaust rate for the three broilers. With the broilers in the pushed back position, the thermal plume was difficult to capture and contain as it moved horizontally along the tapered panel and out the rear corner. However, the addition of side panels reduced the C&C flow rate to 2600 cfm. When a rear shield was added (between the rear of the appliance and the back wall), the C&C flow rate dropped to 2000 cfm (200 cfm/ft). Based on testing experience of the CKV research team and data from the ASHRAE study [Ref 2], this is considered to be a very low threshold of C&C for a heavy-duty appliance challenge.

The multi-duty line was incorporated with the test matrix to reflect a cooking equipment challenge in a real-world, casual dining kitchen. In this case, the C&C rate ranged from 3400 cfm to 3600 cfm without side panels. When the side panels were installed, the C&C flow rate dropped to 1800 cfm (180 cfm/ft). Under the dynamic walk-by condition, the C&C exhaust rate increased to 2400 cfm (240 cfm/ft). When the griddle was substituted for the broiler under static test conditions, a C&C rate of 1600 cfm (160 cfm/ft) was recorded.

The static pressure differential measured at the exhaust collar, varied from 0.18 to 0.91 in. of water between 1500 to 3000 cfm of exhaust airflow. At 2500 cfm (250 cfm/ft) the measured static pressure difference was 0.57 in. of water.

The measured filter velocities across the length of the exhaust hood showed a 14% standard deviation from the average measured velocity at 2000 cfm and 16% at 3000 cfm, respectively.

Table 13. Summary of Capture and Containment Results

Test #	LH Appliance	LH Appliance Effective Front Overhang[1] [in.]	LH Appliance Effective Rear Gap [in.]	CTR Appliance	CTR Appliance Effective Front Overhang[1] [in.]	CTR Appliance Effective Rear Gap [in.]	RH Appliance	RH Appliance Effective Front Overhang[1] [in.]	RH Appliance Effective Rear Gap [in.]	Side Panels	Side Overhang [in.]	C&C Exhaust Rate [cfm]
1	Charbroiler	18	5	Charbroiler	18	5	Charbroiler	18	5	Without	6	3600
2	Charbroiler	18	5	Charbroiler	18	5	Charbroiler	18	5	With	6	2600
3	Charbroiler	18	5	Charbroiler	18	5	Charbroiler	18	5	With Side Panels & Rear Seal	6	2000
4	2-Vat Fryer	22	4	2-Vat Fryer	22	4	2-Vat Fryer	22	4	Without	6	3500
5	2-Vat Fryer	22	4	2-Vat Fryer	22	4	2-Vat Fryer	22	4	With	6	1700
6	Oven	12	4	Oven	12	1	Oven	12	0	Without	0	700
7	Oven	12	4	Oven	12	1	Oven	12	0	With	0	700
8	2-Vat Fryer	22	4	Charbroiler	18	5	Oven	12	1	Without	6	3600
9	2-Vat Fryer	22	4	Charbroiler	18	5	Oven	12	1	With	6	1800
10[2]	2-Vat Fryer	22	4	Charbroiler	18	5	Oven	12	1	With	6	2400
11	2-Vat Fryer	22	4	Griddle	12	5	Oven	12	1	Without	6	3400
12	2-Vat Fryer	22	4	Griddle	12	5	Oven	12	1	With	6	1600

[1]Front overhang measured from front of hood to front of appliance
[2]Test condition was conducted with "walk-by" protocol.

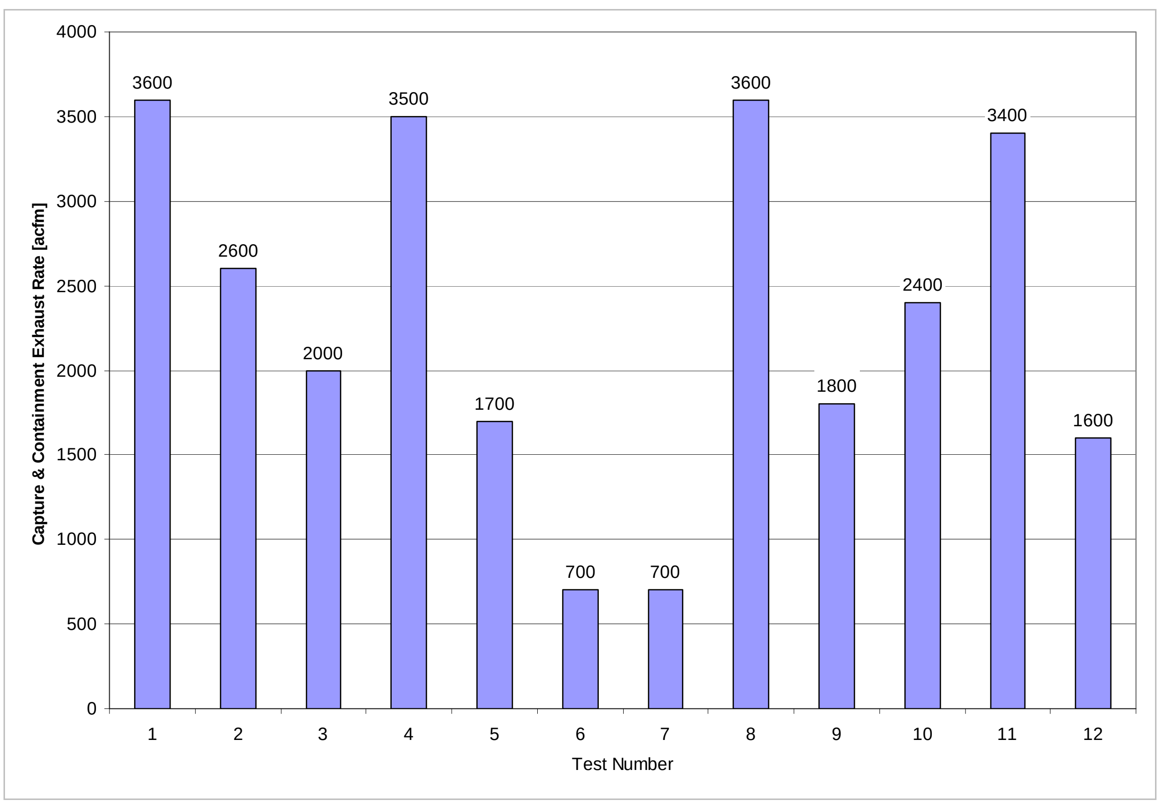

Figure 11. Summary of Capture and Containment Results

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Appendix A: Gaylord Model PG-ND-BDL-54 Hood Drawing