HOOD AND FAN SELECTION AND APPLICATION GUIDELINES

NOTE: These guidelines are for general information only, and are not to be used in lieu of reference to governing local codes. Additional information which may also be relevant is contained in national standards such as the International Mechanical Code published by the International Code Council, and NFPA 96 Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations published by the National Fire Protection Association.

HOOD TYPES

Kitchen hoods can be categorized into two basic types: overhead canopies and backshelf or proximity hoods, and further subdivided within types based on details of design, operation and installation.

CANOPY HOODS

Canopy hoods can be classified by installation characteristics (i.e. installation against a wall (wall hood), installation as an island over a single line of cooking equipment (single island hood), or installation as an island over a double line of equipment placed back to back (double island hood).
Within each classification there are several types of hoods available, each type exhibiting a different characteristic as to how make-up air to the kitchen space is handled.

Energy Saving (Short Cycle) Hoods

Energy saving hoods are used for grease exhaust applications and are designed to introduce filtered untempered outside air directly into the hood capture area. This concept reduces the amount of air removed from the kitchen, thus saving energy during the heating and/or cooling seasons. The amount of air which can be “short cycled” without affecting the capture of contaminants varies depending on the required exhaust air volume (often determined by local codes) and the amount of grease, heat and smoke generated by the cooking equipment. Since the requirement for tempered room air is reduced, smaller capacity heating and/or cooling equipment is required, reducing the overall system initial and operating costs.
Note that the use of energy saving type hood is not recommended over open flame cooking equipment such as charbroilers, charcoal or wood fire cooking surfaces, etc. These types of hoods are KEES models KS-100 (wall hood) and KSI-100 (island hood).

Tempered Air (Compensating) Hoods

Tempered air hoods are used for grease exhaust applications and are constructed to introduce tempered or non-tempered air directly into the kitchen through registers mounted in the face and/or bottom front of the hood. Generally, this make-up air is supplied by a unit dedicated to the kitchen hood system. These types of hoods are KEES models KS-200T, KS-300T and KS-400T (wall hoods) and KSI-200T, KSI-300T and KSI-400T (island hoods).

Exhaust Only Hoods

Exhaust only hoods are utilized for exhausting grease from cooking operations as well as moisture or “heat only” from non-grease producing equipment. Exhaust only hoods have no provision for introducing tempered or untempered air into the hood or kitchen. Make-up air is provided independent from the kitchen hood system. These types of hoods for grease exhaust are KEES models KA (wall hood) and KB (island hood), and for heat or moisture exhaust models are KF or KG.

BACKSHELF OR PROXIMITY HOODS

Backshelf hoods are used for grease exhaust applications and are available as exhaust only hoods. Backshelf hoods may be selected for use in applications where overhead canopies are impractical (such as a low ceiling height), or in other situations where an overhead canopy is not desirable. Use of backshelf hoods is not recommended for open flame equipment such as charbroilers. These types of hoods are KEES models KC and KD.

HOOD SIZING

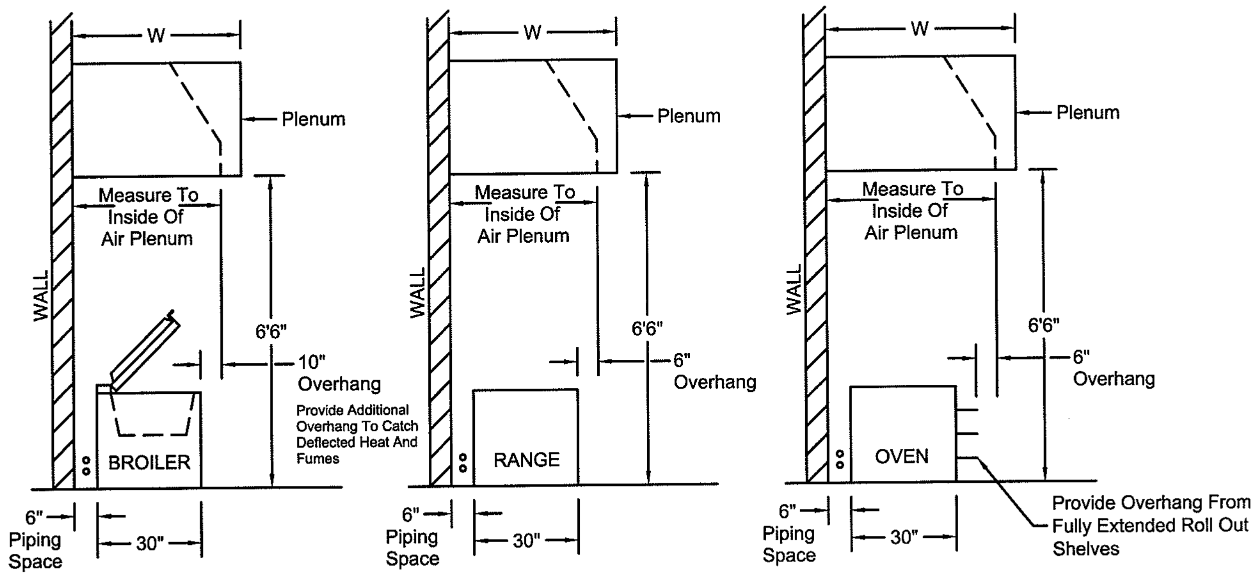
CANOPY HOODS FOR GREASE EXHAUST

Canopy hoods should be sized to provide adequate overhang of the cooking equipment.

The length of the hood should allow a minimum overhang of 6” from the edge of the equipment to the inside of the hood. Additional overhang to 12” can be helpful in improving capture effectiveness, as can the use of side curtains. Side curtains or additional overhang are strongly recommended with the use of high heat equipment or open flame equipment such as charbroilers.

The width of the hood should also provide a minimum of 6” of overhang from the front of the cooking equipment to the inside edge for a wall hood. To determine the minimum hood width, three dimensions must be considered:

1. The furthermost distance from the wall to where the back of the equipment is located. This area is typically used for utility access for wiring, gas piping, etc., and may be as much as 6” to 8”.
2. The depth of the cooking equipment. If roll out shelves are used, the distance should include the shelf fully extended. If equipment doors or lids deflect heat or grease toward the kitchen when opened, additional depth will need to be allowed for. Where a row of cooking equipment includes items of varying depth, the hood depth should be selected based on the furthest projecting equipment (or multiple hoods of varying depth may be used).
3. Minimum overhang from the front of the equipment (#2 above) to the inside edge of the hood; a minimum of 6” is recommended. Additional overhang should be used if equipment doors or lids deflect heat or grease toward the kitchen when opened. Note that energy saving (short cycle) and tempered air (compensating) hoods have plenums of 5” to 12” respectively. The overhang must be measured from the inside of these plenums.



The height of the hood should be a minimum of 24" and should not exceed 36". Higher hood height improves capture efficiency. For low ceiling installations, hoods can be pitched from a height of less than 24" in the front (the minimum height varies depending on the type of hood) to a rear dimension of from 24" to 36". It is recommended to maximum capture efficiency that pitched hoods maintain an average height of 24".

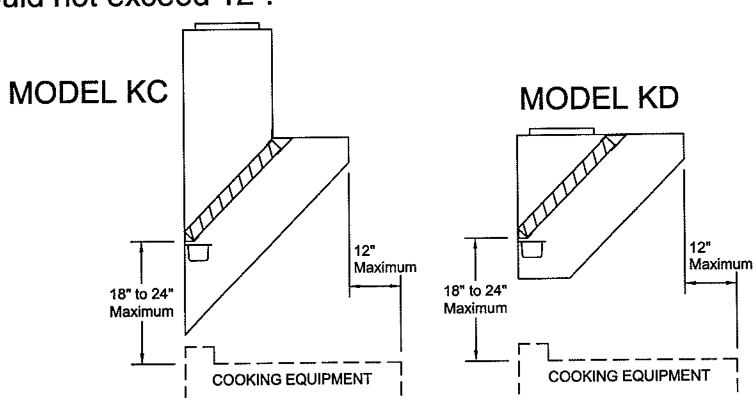
Hoods are normally installed at a minimum of 6'6" and a maximum of 7'0" above the floor level in accordance with code requirements and to allow sufficient headroom for personnel. Tall equipment may require additional consideration when determining hood installation height.

CANOPY HOODS FOR MOISTURE OR "HEAT ONLY" EXHAUST

Hoods should overhang equipment a minimum of 6", and a minimum height of 18" to 24" is recommended.

BACKSHELF OR PROXIMITY HOODS

The length of a backshelf should be a minimum of the length of the cooking equipment. Overhang is not required, but can improve capture efficiency, as can the use of side skirts. Backshelf hoods should be located to provide a minimum of 18" and a maximum of 24" from the cooking surface to the filters, and the distance from the front of the hood to the front of the cooking surface should not exceed 12".



EXHAUST AIRFLOW REQUIREMENTS & FAN SELECTION CRITERIA

CANOPY HOODS

The amount of air which needs to be removed by a canopy kitchen hood is a function of the size of the hood selected, plus the size, temperature, heat and grease production of the cooking equipment under the hood.

Calculate the base amount of exhaust air for the hood as:

Base Exhaust Airflow = 50 x Hood Length(feet) x Hood Width(feet)

To calculate the amount of additional air required for each piece of equipment, use the following:

Equipment Type	Additional Exhaust Air Requirements Per Sq. Ft. of Cooking Surface, CFM / Sq. Ft.
LOW TEMPERATURE (400 Degrees F) Ovens, Roasters, Steam Kettles, Ranges, Non-grease Producing Equipment	0
MEDIUM TO HIGH TEMPERATURE (600 Degrees F) Fryers, Grilles, Griddles, Deep Fat Fryers	37
MAXIMUM TEMPERATURE (700 Degrees F) Solid Fuel Appliances, Charbroilers	95

The Total Exhaust Airflow is the sum of the Base Exhaust Airflow and each of the Appliance Exhaust Airflows.

Exhaust air ducts should be sized for a duct velocity of no less than 1,500 FPM and not more than 2,300 FPM. 1,750 FPM is the recommended velocity to use in selecting exhaust collar sizes. Using this guideline, the exhaust pressure drop of the hood only (includes filter and duct collar losses; does not include ductwork losses) will be approximately .55 I.W.G.

To calculate the duct area required for a desired CFM and duct velocity:

$$\text{DUCT AREA, SQ.FT.} = \frac{\text{AIR FLOW, CFM}}{\text{DUCT VELOCITY, FPM}}$$

To calculate the duct velocity for a duct size and CFM:

$$\text{DUCT VELOCITY, FPM} = \frac{\text{AIR FLOW, CFM}}{\text{DUCT AREA, SQ.FT.}}$$

Shown below is the exhaust CFM Per Collar Using 1,750 FPM duct velocity:

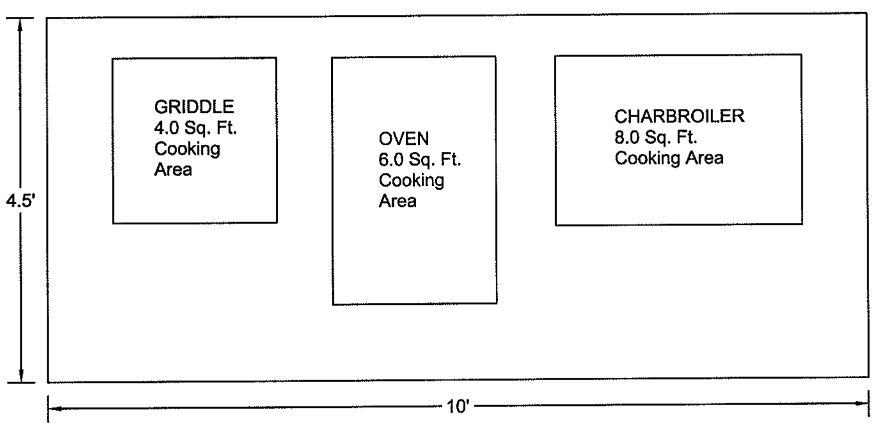
CFM PER EXHAUST COLLAR AT 1,750 FPM															
	8"	10"	12"	14"	16"	18"	20"	22"	24"	26"	28"	30"	32"	34"	36"
8"	778	972	1167	1361	1556	1750	1944	2139	2333	2528	2722	2917	3111	3306	3500
10"		1215	1458	1701	1944	2188	2431	2674	2917	3160	3403	3646	3889	4132	4375
12"			1750	2042	2333	2625	2917	3208	3500	3792	4083	4375	4667	4958	5250
14"				2382	2722	3063	3403	3743	4083	4424	4764	5140	5444	5785	6125
16"					3111	3500	3889	4278	4667	5056	5444	5833	6222	6611	7000

The pressure drop in the hood for the exhaust air flow is comprised of two losses: the pressure drop through the filters and the entrance losses associated with the entry of the exhaust air into the exhaust ductwork.

Filter Face Velocity F.P.M.	Filter Pressure Loss I.W.G.		Exhaust Collar Velocity F.P.M.	Exhaust Collar Pressure Loss, I.W.G.
150	0.18		1,500	0.06
200	0.33		1,750	0.09
250	0.50		2,000	0.11
300	0.73		2,200	0.16

EXAMPLE:

Calculate the required exhaust airflow for a wall exhaust hood with a cooking line comprised of griddle, an oven and a charbroiler as shown below:



The Base Exhaust Air Flow is:

Base Exhaust Air Flow = 50 x Hood Length(feet) x Hood Width(feet)
Base Exhaust Air Flow = 50 x 10.0 x 4.5 = 2,250 CFM

The Additional Appliance Grease Exhaust Airflow is calculated as shown:

Appliance Airflow = Cooking Surface Area x Add'l Air Amounts Tabulated above:

Griddle	4 x 37 = 148 CFM
Oven	6 x 0 = 0 CFM
Charbroiler	8 x 95 = 760 CFM
Total Appliance Airflow	= 908 CFM

The total exhaust airflow is:

Total Exhaust Airflow = Base + Appliance Airflow

Total Exhaust Airflow = 2,250 + 908 = 3,158 CFM

Calculate the filter pressure drop based on the filter face velocity, and the pressure drop table above:

Filter Vel. = Exh. Airflow(CFM) / (Length of Filter Bank(feet) x Height of Filters(feet))

For the prior example (filters are 16" (1.33 feet) high):

Filter Face Velocity = 3,158 / (10.0 x 1.33) = 237 FPM

From the table above, the filter pressure drop is:

Filter Pressure Drop = 0.46 IWG.

The exhaust collar pressure drop is based on the exhaust duct velocity also shown in the table above. Exhaust duct should be sized for approximately 1,750 FPM.

From the table above, the exhaust collar pressure loss at 1,750 CFM is 0.09 IWG.

The total pressure drop of the hood is:

Hood Pressure Drop = Filter Pressure Drop + Exhaust Collar Loss
Hood Pressure Drop = 0.46 + 0.09 = 0.55 IWG

The fan for this application would be selected for 3,158 CFM at a static pressure of the total of the duct losses from the hood to the fan plus the hood pressure drop calculated above, 0.55 IWG.

Island hoods, hoods with side skirts, etc. are handled in the same manner as the wall hood example above. Base the exhaust airflow calculation on the appropriate hood size for the application.

CANOPY MOISTURE OR "HEAT ONLY" HOODS

The amount of air which needs to be removed by a canopy moisture or "heat only" exhaust hood is a function of the size of the hood selected, plus the size and heat or moisture production of the equipment under the hood.

Appliances are categorized by the amount "loading" produced by the equipment:

LOW LOAD
Non-grease producing equipment such as ovens or rotisseries.

HIGH LOAD
Dishwashers

Tabulated below is exhaust air data for moisture and "heat only" exhaust hoods:

LOW LOAD	50 CFM per square foot of hood opening (L x W)
HIGH LOAD	80 CFM per square foot of hood opening (L x W)

The exhaust air flow pressure drop for a typical hood (duct collar loss) is approximately 0.2 IWG.

BACKSHELF HOODS

The guidelines for exhaust air quantities for backshelf or proximity hoods is tabulated below. Note that state and local codes may require higher exhaust air flows and would in all cases supercede these guidelines.

LIGHT DUTY (steam equipment, kettles)	200 CFM per foot of hood length
MEDIUM DUTY (ranges, ovens, griddles, grilles)	300 CFM per foot of hood length
HEAVY DUTY (fryers)	350 CFM per foot of hood length

Use of backshelf hoods is not recommended for open flame equipment such as charbroilers.

Pressure drop calculations and fan selection criteria would be similar to the canopy hood.

SUPPLY OF MAKE-UP AIRFLOW REQUIREMENTS & FAN SELECTION CRITERIA

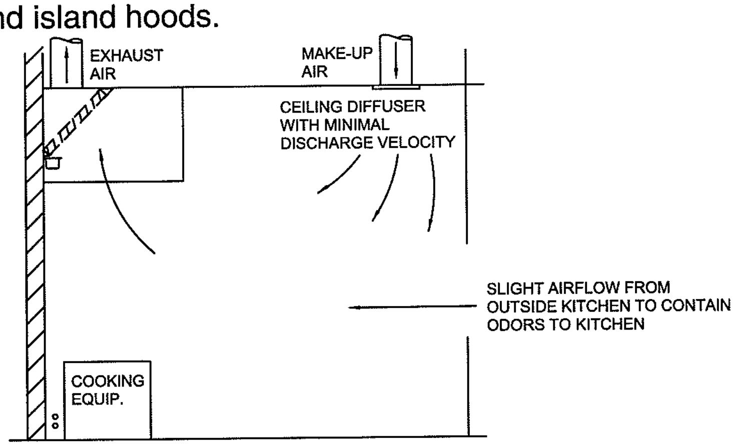
Kitchen hood exhaust requirements result in the need for introduction of make-up air into the kitchen. Insufficient make-up air will result in excessive negative pressure within the building and can cause various problems such as difficult to open entrance doors, increased outside air infiltration, reduced exhaust fan performance, grease and smoke spillage from the hood into the kitchen, etc.

A properly designed make-up air system will provide to the kitchen space slightly less than the amount of air being exhausted (to assure that cooking odors stay in the kitchen) in a manner which precludes excessive drafts. In most climates, to maintain a comfortable working temperature in the kitchen, it will be necessary to heat and/or cool (temper) outside air discharged into the kitchen. There are several concepts which can be used to meet the make-up air requirements of a kitchen:

MAKE-UP AIR PROVIDED THROUGH DIFFUSERS

Make-up air can be delivered to the kitchen through ceiling diffusers. In using this concept, care should be taken to assure that discharge velocities are kept to a minimum to eliminate excessive drafts what could disrupt the airflow into the kitchen hood. In most climates, to maintain a comfortable working temperature in the kitchen, it will be necessary to heat and/or cool (temper) outside air discharged from ceiling diffusers into the kitchen. This arrangement is applicable to both wall and island hoods.

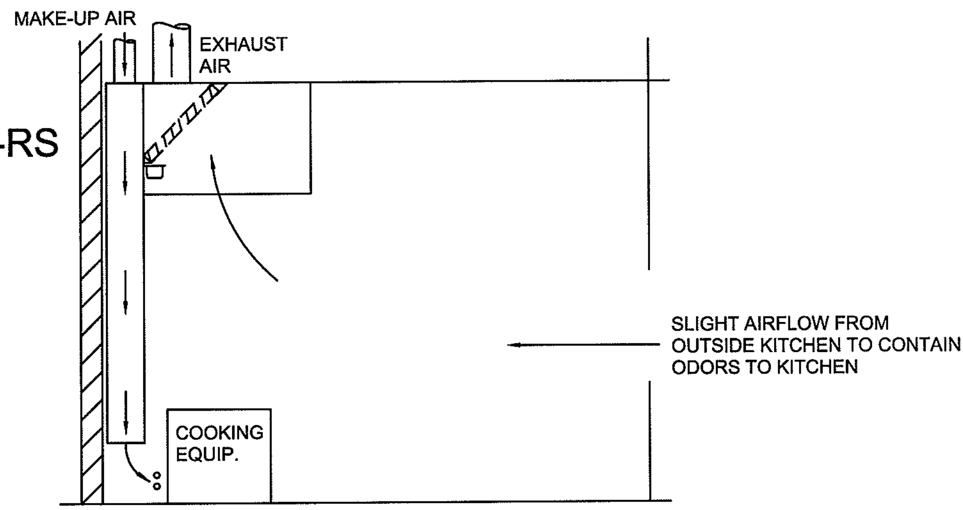
MODEL KA



MAKE-UP AIR PROVIDED THROUGH A PLENUM BEHIND THE KITCHEN HOOD

Make up air can be provided to the kitchen from a plenum mounted behind a kitchen wall hood, sometimes referred to as a "back return plenum". In most climates, to maintain a comfortable working temperature in the kitchen, it will be necessary to heat and/or cool (temper) outside air discharged from a back return plenum into the kitchen. For tempered air applications to achieve optimal comfort and air distribution, make-up air supply through diffusers or through the front of a plenum integral with the kitchen is recommended.

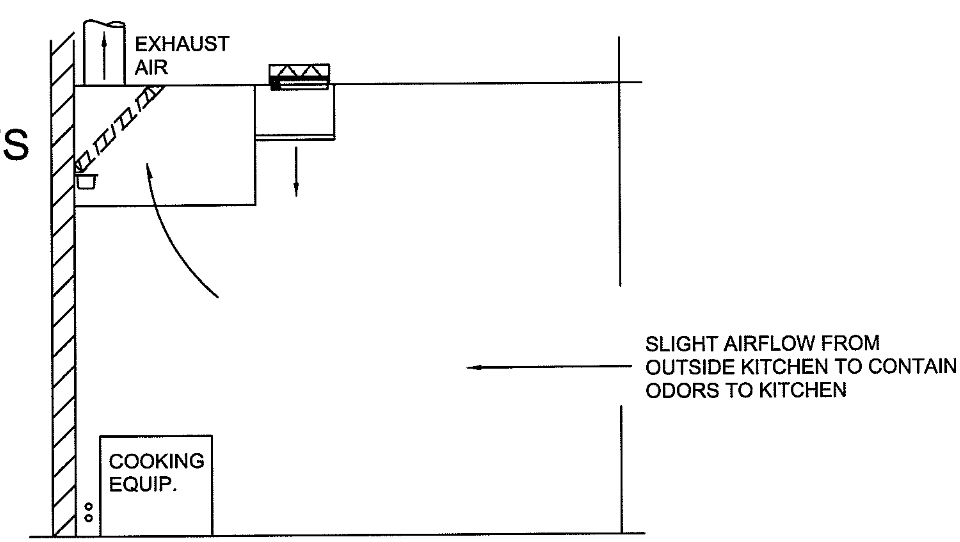
MODEL KA-RS



MAKE-UP AIR PROVIDED THROUGH A PLENUM IN FRONT OF THE KITCHEN HOOD

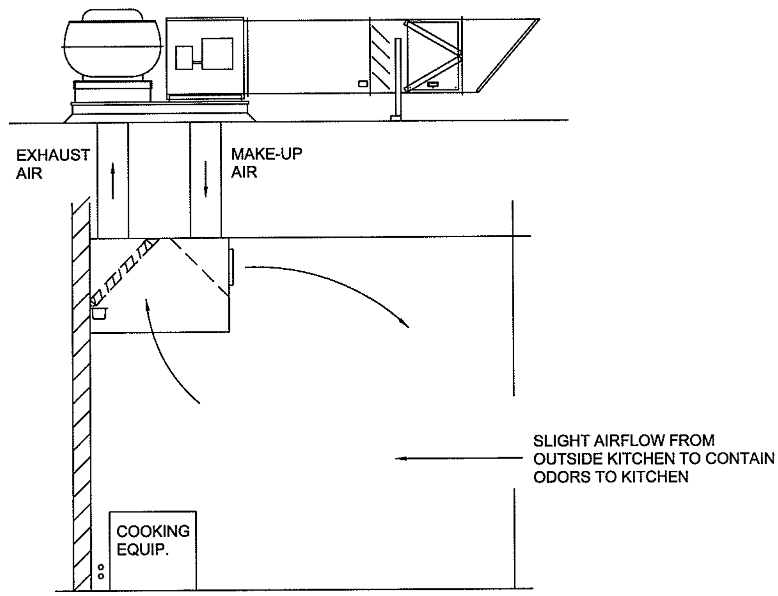
Make-up air can be provided to the kitchen from a plenum mounted in front of the kitchen hood. This arrangement is applicable to either wall or island style hoods. In most climates, to maintain a comfortable working temperature in the kitchen, it will be necessary to heat and/or cool (temper) outside air discharged from the front plenum into the kitchen. For tempered air applications to achieve optimal comfort and air distribution, make-up air supply through diffusers or through the front of a plenum integral with the kitchen is recommended.

MODEL KA-FS



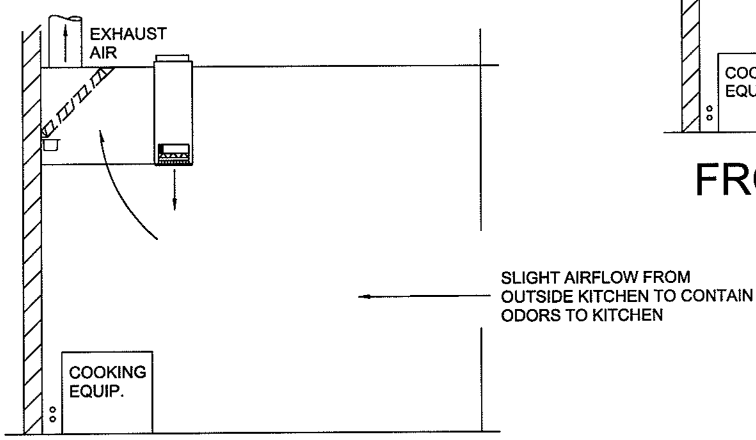
MAKE-UP AIR PROVIDED THROUGH A PLENUM INTEGRAL WITH THE KITCHEN HOOD

This concept utilizes a tempered air (compensating) hood described earlier and is applicable to both wall and island style hoods. Three discharge arrangements are available: front discharge, bottom discharge, or front and bottom discharge. In most climates, to maintain a comfortable working temperature in the kitchen, it will be necessary to heat and/or cool (temper) outside air discharged into the kitchen. For optimal comfort and air distribution, make-up air supply utilizing front discharge is recommended.



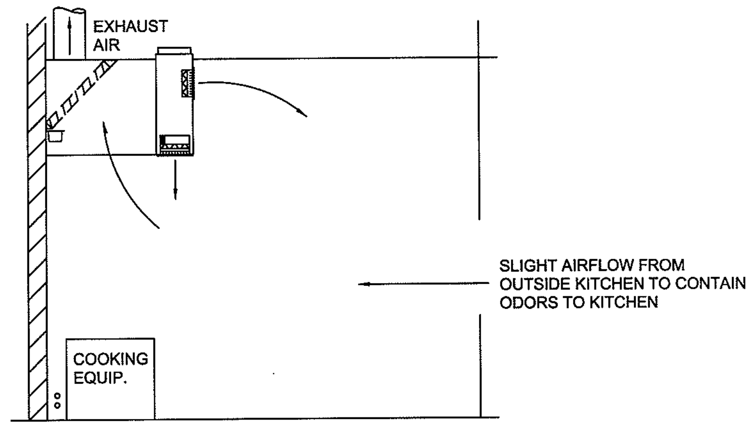
FRONT DISCHARGE

MODEL KS-300T



BOTTOM DISCHARGE

MODEL KS-200T



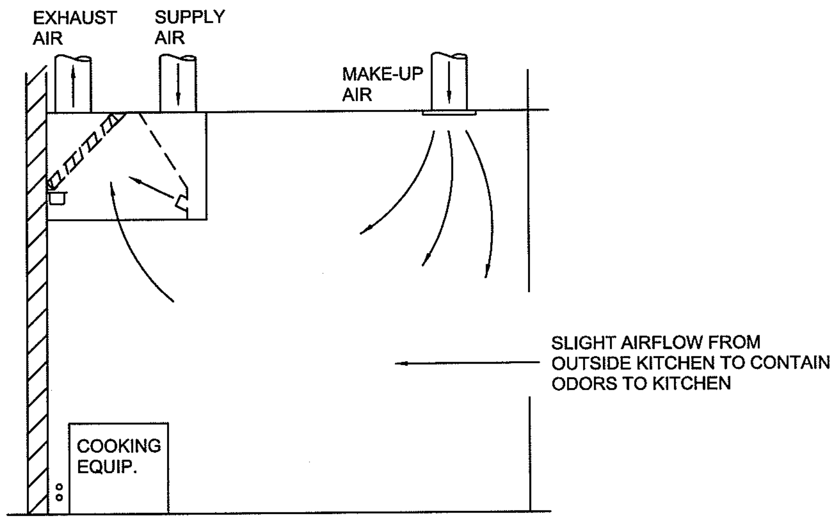
FRONT & BOTTOM DISCHARGE

MODEL KS-400T

MAKE-UP AIR REQUIREMENTS REDUCED BY PROVIDING UNTEMPERED SUPPLY AIR DIRECTLY INTO THE KITCHEN HOOD

This concept utilizes the energy saving (short cycle) type of hood to introduce supply air directly into the kitchen hood to reduce the amount of tempered air required to be supplied to the kitchen. Note that this concept is applicable to situations where code requirements result in exhaust airflow volume in excess of that required to remove the smoke, heat and grease generated by the cooking equipment. The amount of air removed from the kitchen must be at least the total required exhaust airflow as calculated based on the cooking equipment under the hood and the size of the hood selected; any excess required exhaust can be introduced directly into the hood using the "short cycle" concept . The energy saving concept can be used with either wall or island hoods.

MODEL KS-100



Supply air collars & ducts should normally be sized at a velocity of 1,000 FPM to not more than 1,500 FPM to avoid excessive pressure loss. Using this guideline, the supply air pressure drop for a hood with an integral plenum (does not include ductwork losses) will be approximately .25 I.W.G.

Shown below is the supply CFM Per Collar Using 1,250 FPM duct velocity:

CFM PER SUPPLY COLLAR AT 1,250 FPM															
	8"	10"	12"	14"	16"	18"	20"	22"	24"	26"	28"	30"	32"	34"	36"
8"	556	694	833	972	1111	1250	1389	1528	1667	1806	1944	2083	2222	2361	2500
10"		868	1042	1215	1389	1563	1736	1910	2083	2257	2431	2604	2778	2951	3125
12"			1250	1458	1667	1875	2083	2292	2500	2708	2917	3125	3333	3542	3750
14"				1701	1944	2188	2431	2674	2917	3160	3403	3646	3889	4132	4375
16"					2222	2500	2778	3056	3333	3611	3889	4167	4444	4722	5000

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