

Air Cleaning / Filtering Devices

Introduction

When installing the *Unico System* it should be designed to provide total comfort. To assure that good air quality is delivered to the conditioned space, the inclusion of an air cleaning/filtering device may be desired. This Tech Note describes the variety of such devices that are available and the necessary design criteria to assure continued effective performance.

Before proceeding with the selection and design of the air cleaning / filtering device, be sure to read *Tech Note 106, Return Duct System Design Requirements*. As specified in this Tech Note the one important requirement for the air cleaning/ filtering device is that it should not impose a pressure drop any greater than 0.10 inches of water column (IWC) (25 Pa) based on a total allowable pressure drop for the return duct system of 0.15 IWC (37 Pa), with the return duct being 0.05 IWC (13 Pa). And most important the pressure drop of the filtering device must not increase excessively with time as the filter media loads up with the particulate matter removed from the return air stream.

While the *Unico System* typically includes one central attic return with a flexible return duct and filter grille, there are many situations where fabricated ductwork and/or multiple returns are desired or required. This Tech Note will address those situations as well.

Note: In preparation of this Tech Note, Unico has solicited the recommendations from the major manufacturers of residential sized air cleaning devices that would be compatible with the Unico System. The pressure drop limitations and airflow capacities necessary for the various Unico air handlers were defined. The packaged return system that varies with the size of the air handler was as specified in Table 1.

The listing of air cleaning devices in this Tech Note may not include all devices available. Some that impose excessively high-pressure drop have necessarily been excluded.

Models	Return Duct ID inches (mm)	Standard Filter Size Inches (mm)	Maximum Airflow CFM (l/s)
1218	12 (305)	14 x 20 (356 x 508)	400 (189)
2430	14 (356)	14 x 25 (356 x 635)	600 (283)
3642	18 (457)	14 x 30 (356 x 762)	1000 (472)
4860	20 (508)	20 x 30 (508 x 762)	1250 (590)
		24 x 30 (610 x 762)	

Table 1. Return Duct, Filter Size and Airflow Specifications

Filter Types

The variety of filter media and choices of basic filtering method provide an array of different pressure drops (see Figure 1.)

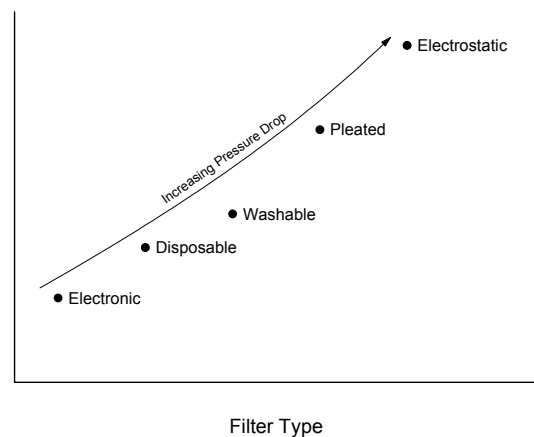


Fig. 1. Typical Filter Pressure Drop

The Unico packaged return air system is shipped with a disposable filter that is on the low end of the pressure drop curve. Care must be taken when considering any of the higher efficiency type of filters as shown in Figure 1, especially the electrostatic type. In order to use several of the higher efficiency types the filter may have to be oversized as will be discussed later.

Manufacturer's Data

Most manufacturers of air cleaning devices provide performance data based on *ASHRAE Standard 52, Gravimetric and Dust Spot Procedure for Testing Air-Cleaning Devices Used in General Ventilation for Removing Particulate Matter*. Typical data might include the resistance, arrestance and efficiency. Of particular interest for considering a device for the *Unico System* is the resistance which is the initial (clean filter) pressure drop based on an air velocity of 300 ft/min (1.52 m/s). Some manufacturers may show this pressure drop for specific filter models for various flow rates. The important thing to keep in mind is that the pressure drop data is the initial reading for a clean filter. As the filter loads up with dirt the pressure drop will increase. The rate of this increase will vary with the size of the filter, the velocity of the air passing through the filter, and the amount of time the filter is used before cleaning or disposal. The challenge in selecting a

compatible filter is to relate the initial resistance rating to the design limit of pressure drop for the *Unico System* of 0.10 IWC (27 Pa) for initial resistance as measured during the ASHRAE Std. 52 testing at 300 ft/min (1.52 m/s) to allow for the build-up of dirt during operation. This is only a guideline for typical residential applications; if the system were exposed to more extreme environments where there is a likelihood of more adverse dirt exposure or there is less frequent maintenance than recommended by the filter manufacturer, then a lower initial resistance would be dictated. In all cases the filter manufacturer's recommendations should take precedence.

Filter Selection

To facilitate filter selection for the standard *Unico System* return air filter grille see Table 2. This table provides the acceptable resistance for five (5) different sizes of filter that fit into the Unico return air filter grille at various design airflows. Since these operate at velocities different from the test value of 300 ft/min (1.52 m/s) the acceptable resistance can be higher for the lower velocities as shown in Table 2. If a selected filter exceeds the acceptable resistance either it should not be used or in some cases a larger filter can be used. This can be done in several ways as follows:

1. Use the next larger filter grille such as the UPC-01-2430 for the UPC-01-1218 or the UPC-01-3642 for the UPC-01-2430. For the UPC-01-4860 there is no larger size to go to.
2. Secure a larger stock filter grille and adapt it to the standard return air ducts or use fabricated return air duct system using ductboard or acoustically lined sheet metal.
3. Use a duct-mounted filter and fabricate a return duct system using ductboard or acoustically lined sheet metal.

Air Handler Model Filter Size inches (mm)	Design Airflow CFM (l/s)	Velocity for Std. Filter Size fpm (m/s)	Acceptable Resistance IWC (Pa)
M1218 14 x 20 (356 x 508)	200 (94.4)	102 (0.518)	.236 (59)
	300 (142)	154 (0.782)	.156 (39)
	400 (189)	206 (1.05)	.117 (29)
	500 (236)	257 (1.31)	.093 (23)
M2430 14 x 25 (356 x 635)	400 (189)	165 (0.838)	.145 (36)
	500 (236)	206 (1.05)	.117 (29)
	600 (283)	247 (1.25)	.097 (24)
	700 (330)	288 (1.46)	.083 (21)
M3642 14 x 30 (356 x 762)	700 (330)	240 (1.22)	.100 (25)
	800 (378)	274 (1.39)	.088 (22)
	900 (425)	309 (1.57)	.077 (19)
	1000 (472)	343 (1.74)	.070 (18)
M4860 20 x 30 (508 x 762)	1000 (472)	240 (1.22)	.100 (25)
	1100 (519)	264 (1.34)	.091 (23)
	1200 (566)	288 (1.42)	.083 (21)
	1300 (613)	312 (1.58)	.077 (19)
M4860 24 x 30 (610 x 762)	1000 (472)	200 (1.02)	.120 (30)
	1100 (519)	220 (1.12)	.109 (27)
	1200 (566)	240 (1.22)	.100 (25)
	1300 (613)	360 (1.32)	.092 (23)

Table 2. Acceptable Resistance for Unico Air Handlers Using Unico Air Filter Grille

Table 3 provides the necessary filter area (square inches or square cm) for various filter initial resistance ratings. After you have selected your filter, use the initial resistance of the filter to find the required filter area for the airflow of your system in Table 3. The shaded figures are those exceeding the standard filter grille sizes.

Electronic Air Cleaners

These are available as ceiling filter grille type or duct mounted type. Where the central single return is being used the Unico filter grille can be replaced with ceiling mounted type Electronic Air Cleaners (e.g. Honeywell F52C and Trion TM2 2000). A return air filter box with connections for the standard flexible return duct must be fabricated to mount the filter grille into. For a multiple

Air Handler Model Filter Size inches (mm)	Design Airflow CFM (l/s)	Filter Resistance Rating per ASHRAE Std. 52, IWC (Pa) @300 ft/min (1.52 m/s)						
		0.05 (12)	0.07 (17)	0.08 (20)	0.1 (25)	0.12 (30)	0.15 (37)	0.2 (50)
		Required Filter Area, square inches (square cms) for Resistance						
M1218 14 x 20 (356 x 508)	200 (94.4)	76 (490)	90 (581)	96 (619)	108 (697)	118 (761)	132 (852)	152 (981)
	300 (142)	114 (735)	135 (871)	144 (929)	161 (1039)	176 (1135)	197 (1271)	227 (1465)
	400 (189)	152 (981)	179 (1155)	192 (1239)	215 (1387)	235 (1516)	263 (1697)	303 (1955)
	500 (236)	190 (1226)	224 (1445)	240 (1548)	269 (1735)	294 (1897)	329 (2123)	379 (2445)
M2430 14 x 25 (356 x 635)	400 (189)	152 (981)	179 (1155)	192 (1239)	215 (1387)	235 (1516)	263 (1697)	303 (1955)
	500 (236)	190 (1226)	224 (1445)	240 (1548)	269 (1735)	294 (1897)	329 (2123)	379 (2445)
	600 (283)	228 (1471)	269 (1735)	288 (1858)	322 (2077)	353 (2277)	395 (2548)	455 (2935)
	700 (330)	266 (1716)	314 (2026)	336 (2168)	376 (2426)	411 (2652)	460 (2968)	531 (3426)
M3642 14 x 30 (356 x 762)	700 (330)	266 (1716)	314 (2026)	336 (2168)	376 (2426)	411 (2652)	460 (2968)	531 (3426)
	800 (378)	304 (1961)	359 (2316)	384 (2477)	430 (2774)	470 (3032)	526 (3394)	606 (3910)
	900 (425)	342 (2206)	404 (2606)	432 (2787)	484 (3123)	529 (3413)	592 (3819)	682 (4400)
	1000 (472)	380 (2452)	449 (2897)	480 (3097)	537 (3465)	588 (3794)	658 (4245)	758 (4890)
M4860 20 x 30 (508 x 762) 24 x 30 (610 x 762)	1000 (472)	380 (2452)	449 (2897)	480 (3097)	537 (3465)	588 (3794)	658 (4245)	758 (4890)
	1100 (519)	418 (2697)	494 (3185)	528 (3406)	591 (3813)	647 (4171)	724 (4668)	834 (5378)
	1200 (566)	456 (2942)	538 (3474)	576 (3716)	645 (4159)	705 (4550)	789 (5092)	909 (5867)
	1300 (613)	494 (3187)	583 (3764)	624 (4026)	698 (4505)	764 (4930)	855 (5517)	985 (6356)

Table 3. Filter Area for Various Filter Initial Resistance Ratings per ASHRAE Standard 52

return system use one duct mounted Electronic Air Cleaner (EAC) near the air handler if possible.

See Table 5 for listing of Electronic Air Cleaners and the pressure drop ratings. Be sure to include the pre-filter and any after filter's (such as carbon media for odor removal) pressure drop. When selecting an EAC for an application, be sure to note the minimum CFM rating that the manufacturer has given for each model. **DO NOT SELECT** a larger size that has a minimum CFM rating that is greater than the design CFM of the *Unico System*. The manufacturers have cautioned that operating an EAC at this lower CFM can lead to ozone problems and in some cases the airflow switch (where applicable) will not be activated because of insufficient airflow.

Disposable Filters

These are the standard filters supplied with Unico filter grilles. These are less efficient filters and the homeowner should replace them frequently depending on system usage. They are more frequently referred to as disposable panel filters. Media typically is fiberglass that can vary in density and thickness (e.g. ½-inch, 1-inch or 2-inch). The thicker and denser filters provide higher arrestance and are more efficient but impose greater pressure drop. The currently available standard panel filters are likely to range from 20-50% arrestance with resistance of .04 to .07 IWC (10 to 18 Pa) and should have acceptable pressure drop for all air handlers at any airflow (see Table 2).

Higher efficiency disposable panel filters are available from many manufacturers. When considering these filters, be sure to check Table 2 to see that the resistance is at or below the acceptable level. When resistance values are higher than acceptable, use Table 3 to determine the increase in size that would create an acceptable resistance

Manufacturer	Disposable	Washable	Pleated Extended Surface
AAF International P.O.Box 35690 Louisville, KY 40232 (888)223-2003	X		X
Air Kontrol, Inc. P.O.Box 597 Batesville, MS 38606 (800)647-6192	X	X	X
Air Guard Industries P.O.Box 32578 Louisville, KY 40232 (502)969-2304	X	X	X
Glasfloss Industries P.O.Box 150469 Dallas, TX 75315	X		X
Precisionaire, Inc 2399-26th Ave. North St.Petersburg, FL 33713 (800)347-2220	X	X	X
Purolator Products Air Filtration Co. PO Box 1637 Henderson, NC 27536 (800)356-2397	X	X	X
Research Products Corp PO Box 1467 Madison, WI (800)334-6011		X	

Table 4. Manufacturers of Panel Filters by Types

rating (based on *ASHRAE Standard 52*). To illustrate the use of Tables 2 and 3 look at the data for higher efficiency disposable panel filters from AAF International in Table 6.

Washable Filters

Typically these filters have aluminum mesh or steel media and are marginally acceptable. The resistance may vary from .04 to over .10 IWC (10 to over 25 Pa) with arrestance in the range of 54-75%. Use Table 2 to screen for acceptable models based on resistance and use Table 3 to determine larger filter area necessary when applicable. One major concern in using these filters is getting the homeowner to wash them frequently enough.

Pleated Higher Efficiency Filters

These filters have an extended surface area through a series of pleats. As the number of pleats increases for each foot of face area the efficiency will increase but so will the pressure drop. These are available from several manufacturers and as with the previous filter categories they should be screened using Table 2 to find ones that have acceptable resistance for the 1-inch thick panel type models to fit into the standard filter grille. Then use Table 3 to determine what larger area is needed when resistance is greater than the acceptable limit.

However, the pleated design is also available in thicker (e.g. 4-inch) models that are typically duct mounted, although two manufacturers (Research Products and Trion) have Grill Mount models. See Table 6. All the manufacturers show a minimum airflow rating of 600 CFM for these filters. While they do not indicate the filters will not operate below this CFM, because of the larger size of the filters lower airflow would not give effective filtration and would not be cost effective.

Electrostatic Filters

These filters are made with varying layers of media. The higher the efficiency the greater the pressure drop. Very few are available that will permit using the standard size filter grille. See Table 7 for a listing of the models having lower resistance. This table shows some models that have higher resistance than is acceptable per Table 2 that would necessitate larger filters (see Table 3).

Other Air Purifying Devices

In addition to the air filtering devices discussed in the prior sections, there are available in the marketplace other air Purifying devices that are integrated into the air distribution system, typically in the return air ducts. See Table 8.

It is recommended that if you are interested in these products that you contact the manufacturer for more complete specifications, limitations and installation detail.

Manufacturer	Model Type	Model No.	Duct Opening inches (mm)	Pressure Drop IWC (Pa)	Airflow CFM (l/s)	Matches to Unico Models	Min. Airflow CFM (l/s)		
Honeywell 1985 Douglas Dr. N Golden Valley, MN 55422 (800)328-5111	Return Grill F52F	20 x 12.5-1 cell	26(660) x 12.88(327)	0.08 (20)	400 (189)	M1218, M2430	400 (189)		
				0.125 (31)	600 (283)				
	Duct Mounted F50F	20 x 25-2 cell	29.06(738) x 22(559)	14.44(367) x 18.25(457)	0.08 (20)	800 (378)	M3642	800 (378)	
					0.10 (25)	1000 (472)			
		16 x 20-2 cell	14.44(367) x 23.25(591)	18.44(468) x 10.88(276)	0.07 (17)	600 (283)	M2430	500 (236)	
					0.04 (10)	600 (283)	M2430, M3642	500 (236)	
		20 x 20.5-1 cell	18.44(468) x 10.88(276)	18.44(468) x 18.25(457)	18.44(468) x 23.25(591)	0.04 (10)	400 (189)	M1218, M2430	400 (189)
						0.08 (20)	600 (283)		
	20 x 20-2 cell	18.44(468) x 18.25(457)	18.44(468) x 18.25(457)	18.44(468) x 23.25(591)	0.04 (10)	600 (283)	M2430, M3642	500 (236)	
					0.08 (20)	1000 (472)			
20 x 25-2 cell	18.44(468) x 23.25(591)	18.44(468) x 23.25(591)	18.44(468) x 23.25(591)	0.06 (15)	1000 (472)	M3642	800 (378)		
				All Models have built-in airflow switch					
Trion, Inc PO Box 760 101 McNeill Rd Sanford, NC 27331 (800)227-3917	Grille Mount	TGM2-1000-1 cell	11.13(282) x 20(508)	0.026 (6)	400 (189)	M1218, M2430, M3642	400 (189)		
				0.05 (12)	600 (283)				
				0.13 (32)	1000 (472) **				
		TGM2-2000-2 cell	27(686) x 20(508)	22.5(572) x 14(356)	22.5(572) x 13.88(352)	0.03 (7)	1000 (472)	M3642, M4860	1000 (472) *
	0.11 (27)					2000 (944) **			
	0.02 (5)					600 (283)			
	Duct Mount	SE/HE 1400-2 cell	22.5(572) x 14(356)	22.5(572) x 13.88(352)	0.06 (15)	1000 (472)	M2430, M3642, M4860	600 (283)	
					0.11 (27)	1400 (661) **			
					0.02 (5)	600 (283)			
		IAQ 1400, 16 x 25 2 cell	22.5(572) x 13.88(352)	19(483) x 17.88(454)	22.5(572) x 13.88(352)	0.07 (17)	1000 (472)	M2430, M3642, M4860	600 (283)
						0.10 (25)	1400 (661) **		
						0.016 (4)	600 (283)		
		IAQ 1400, 20 x 20 2 cell	19(483) x 17.88(454)	22.5(572) x 13.88(352)	22.5(572) x 13.88(352)	0.034 (8)	1000 (472)	M2430, M3642, M4860	600 (283)
						0.07 (17)	1400 (661) **		
0.022 (5)	600 (283)								
Trim TX-2 cell	22.5(572) x 13.88(352)	22.5(572) x 13.88(352)	22.5(572) x 13.88(352)	0.05 (12)	1000 (472)	M1218, M3642, M4860	400 (189)		
				0.07 (17)	1200 (566) **				
				Note: Only the SE Models have built-in Airflow Sensor, optional for all others					
Electro-Air Div. White Rodgers 9797 Reavis Rd. St. Louis, MO 63123 (314)577- 1300	All Mod- els Duct Mount & 2 cell	SST 10	13.56(344) x 18.88(473)	0.03 (7)	600 (283)	M2430, M3642, M4860	600 (283)		
				0.07 (17)	1000 (472)				
				0.08 (20)	1200 (566) **				
		SST 14	13.56(344) x 23.63(600)	17.75(451) x 18.63(473)	17.75(451) x 18.63(473)	0.04 (10)	1000 (472)	M3642, M4860	1000 (472) *
						0.08 (20)	1600 (755) **		
		SST 16	17.75(451) x 18.63(473)	17.75(451) x 18.63(473)	17.75(451) x 18.63(473)	0.03 (7)	1000 (472)	M3642, M4860	1000 (472) *
						0.12 (30)	2000 (944) **		
		UST 20 x 20	17.75(451) x 18.63(473)	17.75(451) x 18.63(473)	17.75(451) x 18.63(473)	0.04 (10)	1000 (472)	M3642, M4860	1000 (472) *
0.12 (30)	2000 (944) **								
Note: SST Models have built-in Airflow Monitor, for UST Models it is an accessory									
LakeAir Int'l, Inc PO Box 4150 Rapids Dr. Racine, WI 54404 (800)558-9436	All Mod- els Duct Mount & 1 cell	LAD-1814	16.5(419) x 20.5(521)	0.03 (7)	600 (283)	M1218, M2430, M3642	400 (189)		
				0.07 (17)	1000 (472)				
		LAD-2214	16.5(419) x 24.5(622)	16.5(419) x 24.5(622)	16.5(419) x 24.5(622)	0.07 (17)	1000 (472)	M3642, M4860	800 (378)
						0.10 (25)	1400 (661)		
Note: Models with suffix are airflow switch equipped									

* Operate only at this airflow or higher

** Manufacturer's Rating Data which is given for max airflow rating, other pressure drop data is projected from it

Table 5. Electronic Air Cleaners (EAC) to match to the Unico System

Manufacturer	Model Type	Model No.	Duct Opening inches (mm)	Pressure Drop IWC (Pa)	Airflow CFM (l/s)
Lake Air Int'l PO Box 4150 1509 Rapids Dr. Racine, WI 54404 (800)558-9436	Duct Mount	1-1814	16(406) x 20 (508)	0.02 (5)	600 (283)
				0.10 (25)	1000 (472)
		1-2214	16(406) x 25(635)	0.02 (5)	600 (283)
				0.08 (20)	1000 (472)
Research Products PO Box 1467 1015 E. Washington Ave Madison, WI 53701 (800)334-6011	Duct Mount	Space Guard 2200	19.88(505) x 21.88(556)	0.05 (12)	600 (283)
				0.09 (22)	1000 (472)
		Space Guard 2400	15.75(400) x 26.44(672)	0.06 (15)	600 (283)
				0.10 (25)	1000 (472)
	Grille Mount	2250	Rough-in Box Size 21.25(540) x 26.25(667)	0.05 (12)	600 (283)
				0.10 (25)	1000 (472)
Skuttle Mfg. Co. 101 Margaret St. Marietta, OH 45750 (740)373-9169	Duct Mount	DB-25-16	15(381) x 22(559)	0.06 (15)	600 (283)
				0.11 (27)	800 (378)
		DB-25-20	18(457) x 22(559)	0.16 (40)	1000 (472)
				0.075 (19)	800 (378)
Trion Inc PO Box 760 101 McNeill Rd Sanford, NC 27331 (800)227-3917	Duct Mount	1200TM	22.63(575) x 13.69(348)	0.05 (12)	600 (283)
				0.10 (25)	800 (378)
				0.14 (35)	1000 (472)
		2000	22.63(575) x 17.69(449)	0.02 (5)	600 (283)
				0.06 (15)	800 (378)
				0.10 (25)	1000 (472)
		20 x 20	19.13(486) x 17.69(449)	0.02 (5)	600 (283)
				0.05 (12)	800 (378)
				0.08 (20)	1000 (472)
		25 x 20	22.63(575) x 17.69(449)	0.02 (5)	600 (283)
				0.06 (15)	800 (378)
				0.10 (25)	1000 (472)
	Grille Mount	Air Bear 1200	25.38(645) x 16.38(416)	0.05 (12)	600 (283)
				0.10 (25)	800 (378)
		Air Bear 2000	25.38(645) x 20.38(518)	0.14 (35)	1000 (472)
				0.02 (5)	600 (283)
		0.06 (15)	800 (378)		
		0.10 (25)	1000 (472)		

Table 6. Pleated Higher Efficiency Filters Thicker Designs

Manufacturer	Model Designation	Resistance IWC (Pa)	Arrestance
Air Sponge Filter Co. 11905 N.W. 35th St. Coral Springs, FL 33065 (800)757-1836	Health Smart Filter w/Bio Sponge Media Anti- microbial treated	.09 (23)	93%
	Note: Adding carbon pad(actasorb) for removing odors adds .05 inches water (13 Pa) Resistance		
Dust Free, Inc. PO Box 519 Royse City, TX 75089 (800)441-1107	Max. Aire Gold	.08 (20)	81%
	Dust Fighter 84	.10 (25)	84%
	Dust Star	.12 (30)	85%
	Allergy Gold	.12 (30)	90%
All have Anti-microbial foam			
Newtron Products PO Box 27175 3874 Virginia Ave. Cincinnati, OH 45227 (800)543-9149	Watchdog 84 *	.08 (20)	84%
	Contractors Choice	.08 (20)	84%
	Remind-Air **	.08 (20)	NA
Anti-bacterial additive included			
Precisionaire, Inc PO Box 7568 St.Petersburg, FL 07432 (201)444-0600	Natural Air Anti-microbial	.23 (58) #	90%
Glasfloss Ind., Inc. PO Box 150469 Dallas, TX 75315 (214)741-7056	Z-Line MR-8	.21 (53) #	NA

* Sounds alarm when CO is detected.
 ** Signals (whistle) when filter needs cleaning
 # Filters exceed Resistance ratings all air handlers except M1218 @ 200 CFM (94.4 l/s); larger filters required per Table 3.

Table 7. Electrostatic Air Cleaners with Lower Resistance

Manufacturer	Model Type	Model
Kleen-Air Co. 269 W.Carmel Dr. Carmel, IN 46032 (317)848-2759	Ozone Generating Devices	Oxy-Gen Model D-200
Alpine air of New York 16 High Ridge Rd. Plainview, NY 11803 (516)692-5058	Ozone Generating Devices	Living Air Model XL-15 (up to 2500 sq.ft.) (232 sq. m)
		Living Air Model 880 (up to 1000 sq.ft.) (93 sq. m)
Elite Environmental Products 5216 Chesbro Rd Agoura Hills, CA 91301 (818)991-0757	Second Wind Air Purifier	Model 1000 KCS (up to 4000 sq.ft) (372 sq.m)

Table 8. Air Purifying Devices