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Subject: A Comparative Analysis of the AspenAir Whole-House High-Efficiency Air Filter and the Aprilaire 5000 (AA 5000)

Attached is the report resulting from our analysis of data and information available from the Aprilaire (website, installation and owners guides, and sales literature) as well as from lab results from independent labs.

**The AspenAir filter out performs the Aprilaire 5000 (AA 5000) in each of the following categories: Operational power consumption, Filter replacement / maintenance, Capture rates, Initial static pressure, Dust loading, Energy Costs and Bacterial kill rate.**

**When compared to the Aprilaire 5000, the AspenAir Whole-House High-Efficiency Air Filter delivers more conditioned air resulting in increased comfort while driving down consumer's heating and cooling utility costs.**



# A Comparative Analysis of the AspenAir Whole-House High-Efficiency Air Filter and the Aprilaire 5000

The intent of this report is to highlight and explain a few of the major performance characteristics common to both the AspenAir whole-house high-efficiency air filter and the Aprilaire 5000 so that the reader better understands the differences in performance between the IAQ products of these two air filtration manufacturers.

## **Operational Power Consumption:**

The AA 5000 is wired into 120v and consumes up to 60 watts of power to charge and capture particles. The Air Cleaner Control mounted on the filter can be wired into the central hvac system to control the fan/blower operation (requiring 24v power) otherwise (using battery power only) it's only function is to monitor the filter's run time in hours.

To control the blower requires the running of new wiring from the furnace control board to the filter's LED base which consumes 2 amps or 48 watts of power as per the Installation Instructions found on [www.aprilairecontractor.com](http://www.aprilairecontractor.com).

At PG&E electrical rates, the cost to continuously operate the AA 5000 and the control equates to approximately \$207 per year.

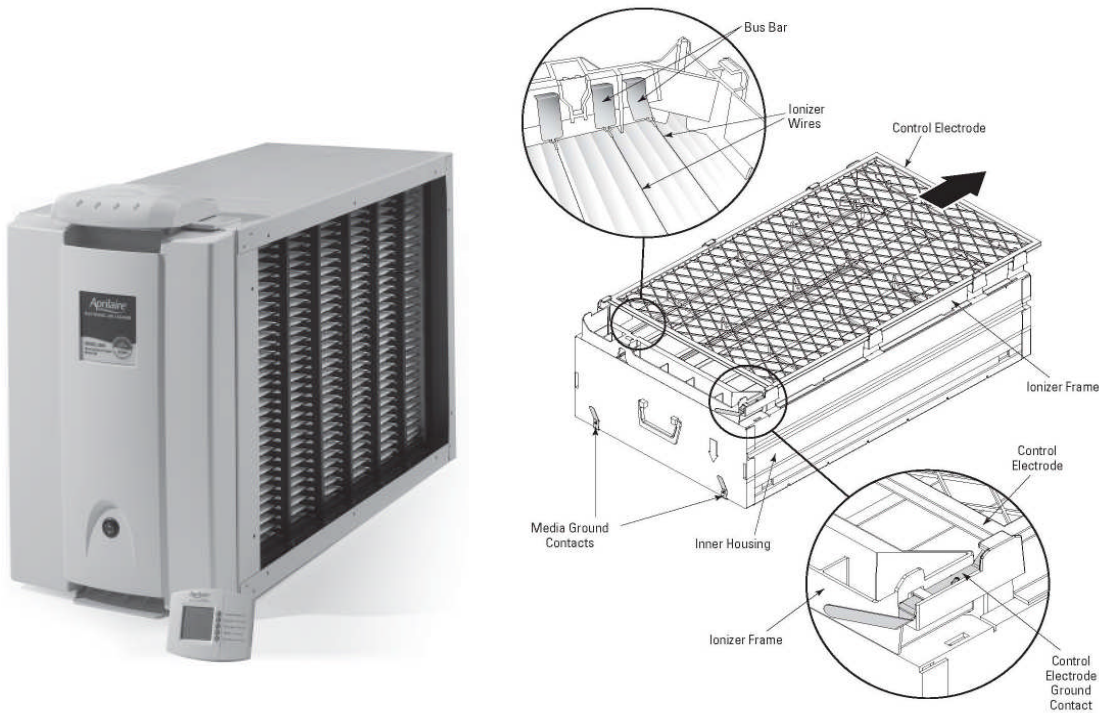
**The AspenAir system, in comparison, only consumes 2 watts and continuous operation would cost the homeowner approximately \$4 per year.**

## **Filter Replacement and Maintenance:**

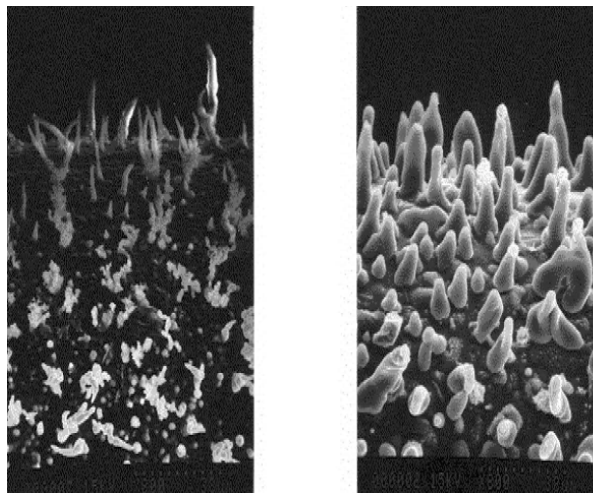
Aprilaire's Homeowner's Manual states the media filter can last up to 1 year yet the control can be programmed to alert the consumer to change the filter only in 3, 6, 9, or 12 month intervals. Since the Air Cleaner Control monitors filter life based on fan run time as opposed to static pressure, the potential of the consumer changing the filter infrequently in a dirty environment is always present. Clearly, the hvac equipment's energy consumption from higher static is not an area of concern in the operation nor is it mentioned in any of the manuals.

To properly maintain the AA 5000 the homeowner must cover three areas: replace the media, clean the Control Electrode screen and clean the Ionizer Wires. To allow access to all three components, the filter's Inner Assembly, as seen below, must be removed from the filter cabinet and disassembled. **Step 1.** Unplug the filter cord from its 120v power source for safety.

**Step 2.** The Control Electrode transfers the electrical charge to the Ionizer Wires below it and must be cleaned of dirt otherwise the potential of arching and/or snapping noise will occur.

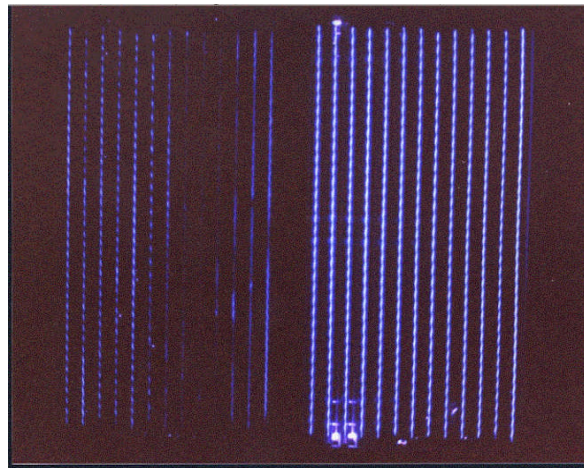


The recommended procedure to clean the Control Electrode is to remove it and either wipe it down with a clean cloth or vacuum it with a brush attachment. **Step 3.** Cleaning the Ionizing Wires requires the use of either 200 grit sandpaper or an abrasive dish scrubber. It's strongly recommend not to use steel wool or introduce moisture to these components as the risk of an electrical shortage could occur once the unit is reassembled and powered back on. Each of the nine individual Ionizer Wires must be scraped to reduce the build-up of Silicon Dioxide, as seen in the picture below. Otherwise the intensity of the Ionizer Wires will become increasingly

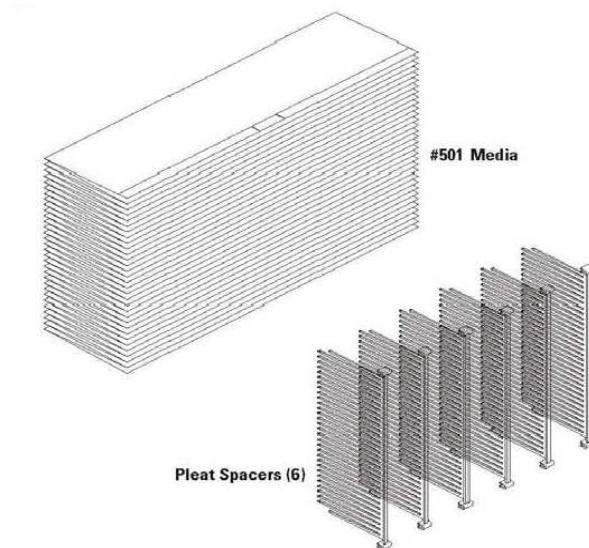


AspenAir vs. the Aprilaire 5000 - Filter Comparison

weak and the charge to the particles in the air stream becomes less as the build-up of Silicon Dioxide insulates the wires. Care must be given so as not to break the wires during this procedure or a gap in the ionizing field will occur, further reducing efficiency. Below is an example of a set of ionizing wires and their electrical coronas. These wires are not from an Aprilaire unit, and are shown simply to demonstrate the problems that silicon dioxide create in systems that use ionizing wires. The set on the right is a new and clean while the set on the left has been operating for only a month. Should the homeowner allow this silicon dioxide to accumulate for a full year before cleaning the result would almost assuredly be increasingly poor air filtration performance at the most crucial contaminant levels. Those levels to include viruses, bacteria, mold and pollen spores.



**Step 4.** Replacing the media is a bit tricky but the homeowner can master the skill after a number of replacement cycles. Care must be given in unsnapping the plastic tabs holding the media assemble in place or the risk of breaking occurs. The media is a deep pleated accordion style and is separated by six Pleat Spacers. The media must be spread evenly to allow each



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comb on the Pleat Spacer to correctly separate the multiple media pleats. Once the first spacer is installed the other five would follow in similar fashion. After all the Pleat Spacers have been re-installed and the cleaning maintenance has been completed, the homeowner can now re-assemble the Inner Housing. The homeowner must be careful to properly assemble the key electrical components of the AA 5000. The Media Ground strips, Bus Bars, Control Electrode frame and the Control Electrode Ground Contact must be correctly installed and un-damaged to align all power contacts and thus ensure proper operation. **Step 4** - Slide the AA 5000's Inner Assembly into the filter housing. **Step 5** - Plug in the filter cord to its 120v source.

Though the media itself may only need replaced 1 to 4 times annually, it is clear the electrical components would need a more comprehensive maintenance schedule to maintain optimum efficiencies. Otherwise the homeowner could be paying additional utility costs while not enjoying the benefits of their electronic filter.

Maintenance on an AspenAir whole-house, high efficiency air filter is far less labor intensive to the homeowner. In a Filter Grill application one only need to turn off the thermostat to disrupt the 24v power source, open the louver door, open the front grid with a gentle pull on the handle, replace the single-piece of non-pleated woven media, close the grid door, wipe down the grid and louver door, if necessary, and close the louver door. No removal or disassembly of the filter is required. Nor are there any metal wires or contacts requiring maintenance greatly simplifying the time of maintenance.



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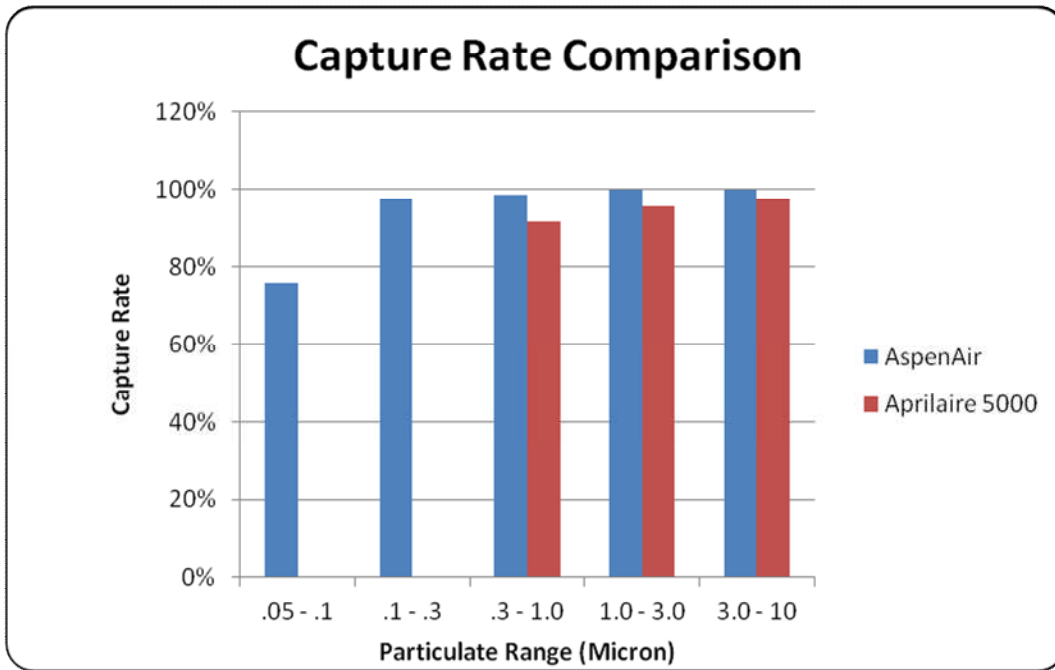
In a Furnace Mount application the homeowner would be required to follow the above steps with the only additional steps being the removal of the filter from the housing by removing the filter door panel, unplugging the power jack and sliding the filter out of the housing, as seen in the pictures below.



**To summarize, maintenance of AspenAir's whole-house high efficiency filters is far safer, simpler and less labor intensive than the AA 5000.**

### **Particle Capture Rates:**

In determining filter comparison data it is critical to acknowledge the differentiating airflow rates between the various tests. AspenAir's filter was lab certified at an airflow rate of 500 fpm or 2000 cfm while Aprilaire's 5000 filter was certified at 347 fpm or 1388 cfm.

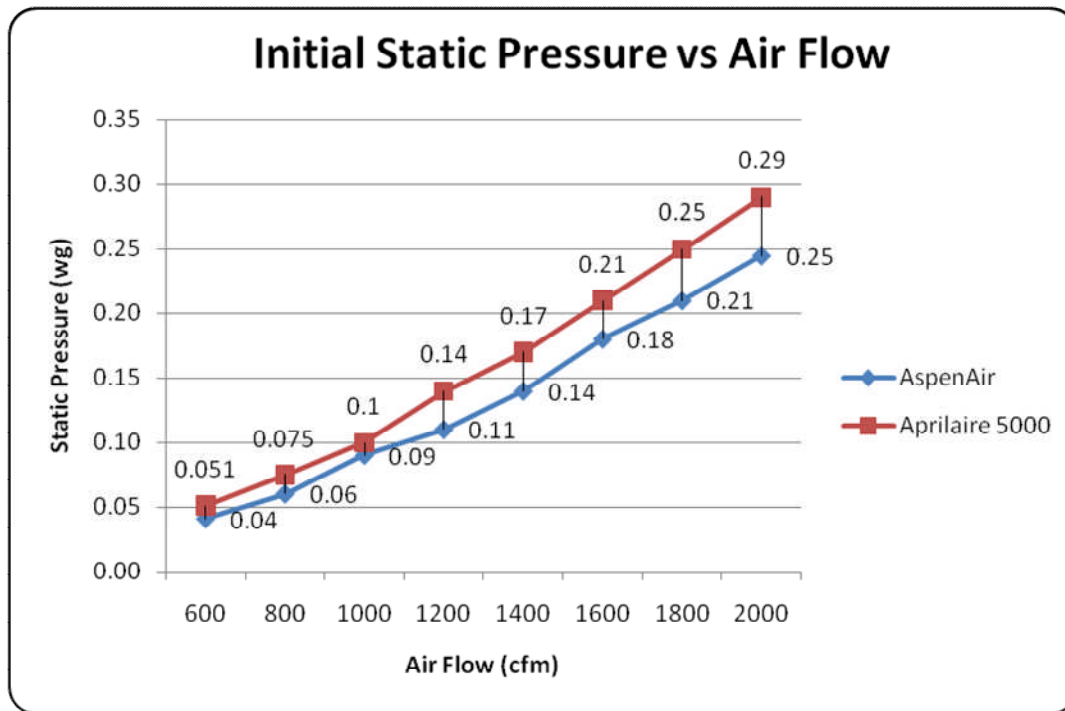


As shown in the above graph, AspenAir’s high-efficient filter drawing on 24,000 volts of power clearly captures a far greater amount of dirt, pollens and microbial material than the AA 5000 electronic media filter. Note that virus and bacteria are generally < 1 micron in size. Though AspenAir uses 24 volts to generate 24,000 volts of cleaning power, it only does so by consuming 2 watts which equates to roughly \$4 of annual energy costs to the consumer when the fan is operating continuously. In comparison, the Aprilaire 5000 will cost the homeowner \$207 annually to operate. While these numbers may not seem large, over a ten year period, the cost to operate the AspenAir filter is only \$40 while the cost to operate the Aprilaire 5000 is \$2,070. AspenAir offers homeowners a 98% savings when compared to Aprilaire 5000 when the fan/blower is set to constant fan mode.

**To summarize, the AspenAir whole-house high-efficiency air filter captures more dirt even at the smallest particle sizes and costs significantly less to operate than the Aprilaire 5000.**

**Initial Static Pressure:**

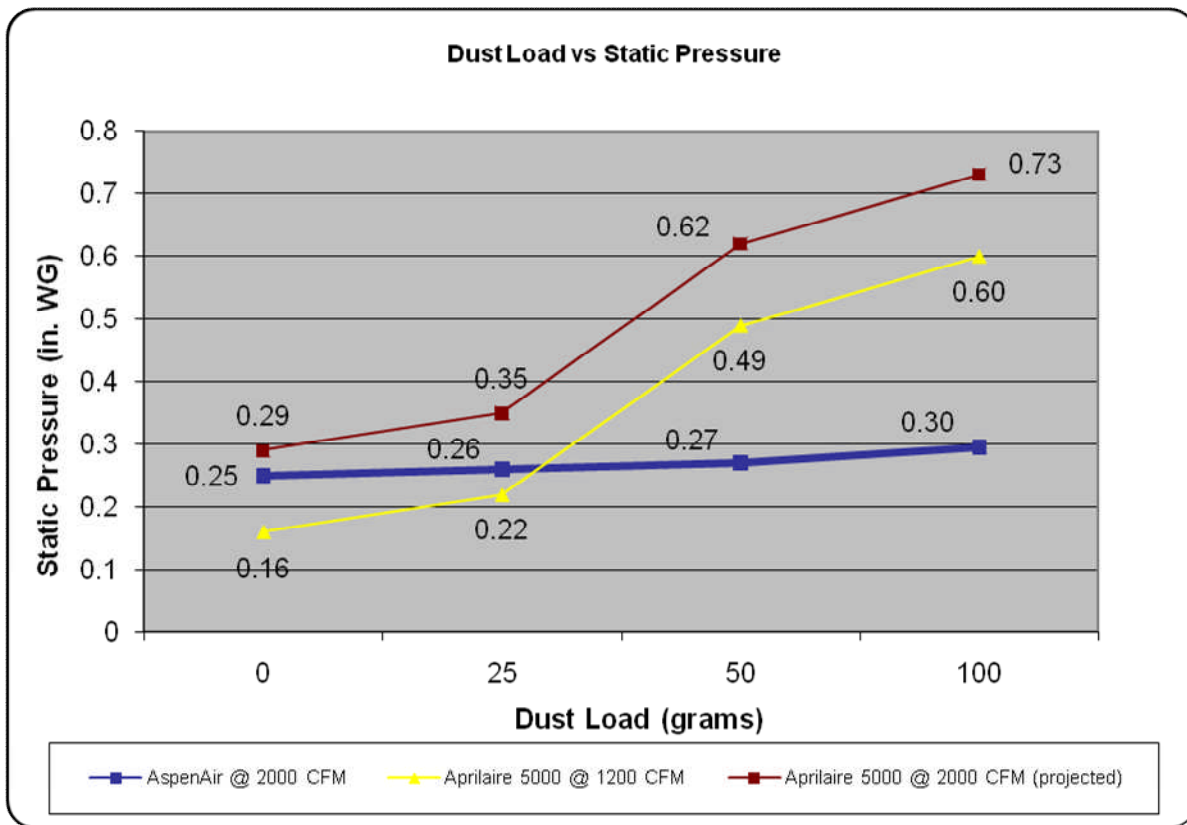
A major factor which increases the utility energy cost to the consumer is the resistance to airflow by the filter. The greater the resistance the more money is consumed as fewer BTU’s (British Thermal Units) are delivered into the home resulting in extended heating and cooling run times. The first factor in this regard would be the initial static pressure across a clean filter (see graph below). As shown in the chart the AA 5000 shows an average increase of 20% in static pressure as compared to AspenAir at the same airflow, which further means that AspenAir delivers approximately 17% more airflow than the AA 5000 at any given level of static pressure.



**To summarize, the AspenAir whole-house high efficiency air filter consistently operates at lower static pressure and delivers better airflow than the Aprilaire 5000.**

**Dust Loading vs. Static Pressure:**

The next factor to consider would be the rise in static pressure as the filters load with dust. The graph below shows the AA 5000 published loading curve at 1200 CFM, along with the AspenAir loading curve at 2000 CFM. Had both been tested at the greater velocity it is reasonable to assume that Aprilaire’s static numbers would have increased significantly, as the increase in cfm from 1200 cfm to 2000 cfm is a 67% increase. With that in mind, on the graph shown below, we may conservatively approximate what those static pressure numbers may have been at 2000 CFM for the AA 5000 simply by adding 0.13” to each point (the difference between the AA 5000 at 2000 CFM and their tested result at 1200 CFM). While conservative, this result would still be significant, even if we added only 0.05” to each value.



Clearly the static pressure increases on Aprilaire’s filter faster due to increased velocity and as their media begins the process of “face loading” which has the effect of clogging the media. Their media is roughly 1/8” thick and quickly becomes loaded and restricted with material. You’ll notice all three of the dust loading lines end at 100 grams as that is the point when Aprilaire recommends that their media be replaced.

On the other hand AspenAir’s media is over 2” thick and is capable of holding up to 1200 grams of dirt without the problem associated with face/surface loading. Since there is no monitor or gauge to inform the homeowner when the AA 5000’s media has reached its saturation point of 100 grams of dirt, and since we know that most homeowners do not replace their filter media as often as recommended by filter manufacturers, it is highly likely that this would inadvertently cause a homeowner’s utility bill to rise substantially due to the abnormally high static pressure across their fully loaded media. In comparison, AspenAir’s even depth loading media significantly reduces the risk of dramatic increases in utility bills by minimizing the static pressure resulting from the face/surface loading properties which are common to the AA 5000.

**To summarize, AspenAir’s whole-house high efficiency air filter maintains lower static pressure while capturing and holding significantly more dirt than the AA 5000.**

**Energy Costs:**

AspenAir vs. the Aprilaire 5000 - Filter Comparison

In addition to energy saved by low operating power as outlined earlier, the differences in static pressure as both filters load drives significant differences in energy costs. Changes in energy use and cost occur initially as additional fan watts are required to keep the airflow constant (if using an ECM (Electronically Commutated Motor), and then through reduced BTUs of heating and cooling energy as the ECM motor becomes limited in its ability to overcome the higher static. In the case of a PSC (Permanent Split Capacitor) motor the total fan energy will increase over time due to decreases in delivered BTUs. The reduction of delivered BTUs, as with the AA 5000, results in longer operational run times and significant increases in energy costs. In other studies comparing AspenAir against filters with much less static pressure levels, AspenAir allowed significant energy savings on both operation energy consumption as well as energy efficient delivery of heating and cooling. (See Beaman Assoc. Report 8 2009)

**To summarize, the AspenAir whole-house air filter consumes less energy and costs homeowners less money to operate than the AA 5000.**

### **Bacterial Kill Rate:**

Aprilaire makes no claim toward microbial effect while AspenAir has recently been lab certified showing results of a 98.7% bacterial kill rate within 1 hour. One of our competitors has also claimed multiple bacterial and viral kill rates, though their system charges particles at 11,000 volts and captures particles in a media immersed in only a 6,000 volt field. At 24,000 volts, AspenAir's electrical field is 4 times more powerful, resulting in a significantly greater particulate capture rate, and one might reasonably assume, an equal or greater microbial kill rate than this competitor's system.

**To summarize, the AspenAir whole-house air filter kills 99% of captured bacterial within one hour, while the AA 5000 make no specific bacterial kill rate claim.**

### **Conclusion:**

If one keeps the consumer's best interests in mind, then the following criteria must be carefully evaluated:

- **Operational Power Consumption**
- **Filter Replacement & Maintenance**
- **Particle Capture Rate**
- **Initial Static Pressure**
- **Dust Loading vs. Static Pressure**
- **Energy Costs**
- **Bacterial Kill Rate**

With its safe and simple maintenance procedures, the AspenAir whole-house high-efficiency air filter delivers cleaner, healthier air by capturing and holding more dirt while significantly increasing air flow and significantly reducing homeowner's ownership and operational costs.

**The performance from AspenAir's Nex-Gen technology is clearly superior to that of the Aprilaire 5000 in every category that we evaluated.**

Appendix:

- Aprilaire Specification Sheet Model 5000 Form No. 2295 07.05
- Aprilaire Installation Instructions Model 5000 Form No. 10007971 5.08
- Aprilaire Owner's Manual Model 5000 Form No. 10007970 5.08