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# Quiet Bathroom Fans

A new generation of bath fans effectively clear the air  
with noise levels of 1.5 sones or less



by Andrew Shapiro

On a recent visit to a house to solve a heating problem, I had a chance to look at the bathroom. Moisture was causing the paint to peel, and decay had set in on the window sash and trim, and probably in the structure behind the drywall. This house was not air-tight by any stretch of the imagination, but the bathroom had no fan — and the lack of ventilation was causing a major maintenance problem.

I recommended installing a fan and specified one that ran quietly. I've learned that most people find it annoying to be in a small room while a loud fan is running; if the fan is quiet, it's more likely to be used. That translates into fewer moisture-related problems and lower maintenance costs over the life of the house. Also, if the owners later decide they want an automatic ventilation system for the whole house, an appropriate fan will already be in place (see "Simple Whole-House Ventilation," 9/95).

In recent years, several manufacturers have come out with very quiet bath fans. In this article, I'll describe the types of fans available, take a look at the pros and cons of each, and look at some of the installation practices that will help you and your clients get the most out of the fan you put in.

## Defining "Quiet"

The Home Ventilating Institute (HVI, 30 W. University Dr., Arlington Heights, IL 60004; 708/394-0150) pub-



**Figure 1.** In-line fans are mounted in the attic (shown) or basement, between a grille in the bathroom and the outside wall jack. The insulated duct helps reduce sound transmission and prevents condensation.

lishes independent laboratory sound test results for most of the fans on the market. The sound levels are listed in “sones,” units of measurement that involve a certain loudness at a certain average pitch at a certain distance from the sound source. But I prefer to think of one sone as about equal to the loudness of a typical refrigerator. (Two sones are twice as loud as 1 sone, unlike



**Figure 2.** Some in-line fan manufacturers supply special registers and fittings for various sizes of round duct.

decibels — another measure of sound — where 2 decibels are 10 times as loud as 1 decibel.) By comparison, a typical range hood is 5 or 6 sones, and many common bath fans — the ones that rattle your teeth — are as loud as 4 sones.

In this article, I will be talking about fans with ratings of up to 1.5 sones, because there are a number of these on the market that are labeled “quiet” or

“ultra-quiet.” However, if you are looking for the best quality, I recommend a fan rated at 1 sone or less. For about the same price, the result will be more satisfying.

One caution about sone ratings. The noise level of fans is measured at the relatively low duct pressure of 0.1 inch water pressure. This is about what you’d expect from a 50-cfm fan with 6 feet of 4-inch-diameter rigid duct with one 90-degree bend — a shorter and straighter duct run than is typical. If your ducts increase pressure above this level, the noise from the fan will increase also.

**What’s available?** Manufacturers have used three basic designs to lower the noise level of bath fans:

1. Room-mounted fans, with improved design to lower noise
2. In-line fans, which locate the fan outside the bathroom but still inside the house — usually with the duct run in the attic or basement
3. Exterior-mounted fans, which move the fan entirely outside the house as part of the hood or duct termination

Let’s look at the advantages and disadvantages of each.

### Room-Mounted Bath Fans

Fans mounted in the bathroom ceiling (or sometimes in the wall) are commonplace — a fact that is perhaps their greatest advantage. Everyone on the job, including the electrician, knows how they work, so there are no surprises. Room-mounted fans are typically ducted a short distance through the ceiling framing to the outdoors. Attic ducting is also common, although the duct run may be longer because the exhaust port is usually mounted on a gable end.

Another advantage of room-mounted units is that it’s easy to find and get access to the fan for maintenance. The big disadvantage is that the fan and motor are right in the space with the occupants, who are going to hear any noise that the fan makes. For a room-mounted fan, the quieter the better (see Table A).

### In-Line Fan Systems

An in-line bathroom ventilation system consists of a register in the wall or ceiling and ductwork leading to the outside, with the fan mounted somewhere between (Figure 1). Currently, there is no standard for testing sound levels of

## Ductwork Do’s and Don’ts

### Do:

- Use the same size or larger duct as the fan outlet.
- Seal all duct joints with foil-backed tape, silicone caulk, or duct mastic.
- Use a plastic wire-tie or other mechanical connection at joints between flexible and rigid ducts, then seal the joint. (Foil-backed tape is great for air-sealing, but *not* for mechanical connection.)
- Use rigid duct where possible or be sure the fan is rated for the required flow at higher pressures inside flex duct.
- Use short lengths of flex duct at the connection to the fan to reduce noise.
- Insulate all ducts and fans in unheated attics or unheated crawlspaces to a minimum of R-5.
- Undercut the bathroom door 1 inch above finished floor level.
- Support ducts at frequent intervals to keep them straight; pitch ducts down slightly ( $\frac{1}{4}$  inch over 4 feet) toward the outside.
- Provide ventilation to every bathroom that has a shower or a tub. Windows are great for light, but often are not opened when ventilation is most needed.

### Don’t:

- Reduce the duct size below the fan outlet size.
- Seal ducts with cloth duct tape — it doesn’t hold up over time.
- Use long lengths of 4-inch flex duct, unless you’re using a fan rated to pull enough air at higher duct pressures.
- Terminate the ductwork in the attic. Always take it to daylight.

## Table A. Room-Mounted Fans

Manufacturer/series Model	Air Flow Capacity cfm @ .1"	cfm @ .25"	Sound Rating (sones)	Power Draw (watts)	Contractor Price
<b>Fan America/Solo<sup>1</sup></b>					
SMV80	80	80	0.8	35	\$102
SMV100	100	83	1.2	37	\$105
SMV140	120	110	1.5	40	\$109
<b>American Aldes/Solo<sup>1</sup></b>					
CMV80	80	80	0.8	35	\$102
CMV100	100	83	1.2	37	\$105
CMV140	120	110	1.5	40	\$109
<b>Panasonic/Super Quiet</b>					
FV-05VQ	50	31	0.5	13	\$99
FV-08VQ	90	70	1.0	17	\$104
FV-12VQ	110	60	1.0	21	\$114
FV-20VQ	190	130	1.5	33	\$165
<b>Nutone/Ultra Quiet Test</b>					
LS-50	50	23	0.3	21	\$111
LS-80	80	55	0.8	24	\$116
LS-100	100	80	1.5	38	\$128
<b>Nutone/Quiet Test</b>					
QT-80	80	62	1.5	60	\$103
QT-100L	100	80	1.5	78	\$127
QT-130	130	100	1.0	120	\$114
<b>Broan/Solitaire Ultra Silent</b>					
S50U	50	20	0.3	57	\$92
S80U	80	64	0.6	88	\$104
S80UE	80	77	0.6	24	\$119
S110U	110	97	1.5	59	\$116
S110UE	110	112	1.5	37	\$134
<b>Broan/Sensaire</b>					
MS90	90	80	1.5	50	\$165 <sup>2</sup>
<b>Fasco/SuperQ &amp; Aware</b>					
7100.00	100	n/a	1.5	64	\$94
7100H	100	n/a	1.5	84	\$139 <sup>3</sup>

1. Fan America and American Aldes market the same fan.
2. Includes occupancy sensor; available with humidity sensor.
3. Includes humidity sensor.



**Figure 3.** Multiport fans, such as this one from Broan, are simple to install when ducting exhaust from more than one bathroom.

remote fans (HVI is working on one), but since the fan is not in the room, less noise will reach occupants. (Informal testing by some in-line fan manufacturers indicates that the noise level in the bathroom is 1 sone or lower.)

The in-line fan is usually located in the basement or attic. An in-line system may be unfamiliar to carpenters and electricians, but a basement-mounted fan is easy to get to for installation and maintenance; the opposite is true, however, of a fan in the attic.

One drawback of a basement location is the need for a slightly longer duct run. If ducts are sized improperly, the result may be a louder fan and reduced air flow. (Don't worry about the ability of the fan to pull air down into the basement: In-line fans are plenty strong enough to overcome this small resistance.) Another drawback is that ceilings and walls with finish dry-wall amplify sound like the head of a drum. If you do end up hanging the fan from the floor joists in the basement, use rubber straps to hang it. Alternatively, mount the fan directly to the foundation, where vibration will be absorbed by the concrete rather than transmitted through the framing.

Duct runs for attic-mounted fans are often shorter but require insulation in almost all climates to avoid condensation inside the fan. Kraft-faced R-11 fiberglass batts can easily be wrapped around the fan and tied with cord. (One advantage of basement mounting is that the duct can go out through the band joist, with no need for duct insulation.)

At the bathroom end of the duct, you can use standard grilles and boots, or you can use the nifty fittings made by some fan manufacturers that fit right in the end of a 4-, 5-, or 6-inch round duct (Figure 2).

Another advantage of the in-line system is that a single fan can serve more than one bathroom (the switch in either bathroom turns on the fan). This dual use helps you get the most out of the higher price you will pay for a quiet in-line fan. All of the in-line fan manufacturers and the suppliers listed in Table B sell kits that include the fan, flow-adjustable grilles, the wye

fitting, and some other parts that simplify a split duct.

One minor disadvantage of a single fan serving two bathrooms is that some unnecessary ventilation takes place, because air is drawn from both rooms even when only one room is being used. Also, duct runs of different lengths can result in uneven airflow. To balance the airflow when the lengths of the duct runs to the two bathrooms are unequal, you can put a damper in the shorter duct or use a damping grille.

You can also avoid overventilation by using a speed control to slow the



## Table B. In-Line & Exterior-Mounted Fans

	Manufacturer/series Model	Air Flow cfm @ .1"	Capacity cfm @ .25"	Sound Rating <sup>1</sup>	Draw (watts) <sup>2</sup>	Power Contractor Price
REMOTE IN-LINE	<b>Fantech/FR &amp; CVS</b>					
	FR-100	108	94	n/a	43	\$112
	FR-125	130	110	n/a	48	\$118
	FR-150	240	222	n/a	93	\$120
	CVS-275	280	256	n/a	197	
	<b>Broan</b>					
	SP-100	115	107	n/a		\$127
	MP-140	140		n/a		\$163
	<b>Continental Fan</b>					
	AXC-100A	115	85	n/a	35	\$107
	AXC-125A	159	80	n/a	40	\$112
	<b>American Aldes<sup>3</sup></b>					
EXT.-MOUNTED	VMPS	n/a	85 – 120	n/a	n/a	\$310
	SPV-200	n/a	50 – 250	n/a	90	\$206
	<b>Fantech/RVF</b>					
	RVF-4	122	105	n/a	48	\$136
	RVF-4-XL	178	158	n/a	90	\$142
	RVF-6	235	211	n/a	90	\$168
	<b>Tamarack/Pre-Ventilator</b>					
	Pre-Ventilator-D	110	75	n/a	44	\$165
	Pre-Ventilator-S	75	n/a <sup>4</sup>	n/a	22	\$140

1. Sound rating is not yet available for in-line fans.
2. At 0.1" pressure.
3. Designed to operate at high pressure (above 0.25").
4. Designed for through-wall installation.

fan down and further decrease noise levels. But the owners may slow down the fan too much and not get enough airflow.

**Multiport fans.** One variation on in-

line fans, called a multiport, has built-in collars for attaching more than one duct (Figure 3). Several manufacturers make these, including American Aldes, Broan, and Fantech.

### Exterior-Mounted Bath Fans

The third strategy used to reduce fan noise is to locate the fan entirely outside the house, with ductwork running from one or more bathrooms. Fantech has some models with large enough capacities to serve several baths (see Table B). Tamarack's Pre-Ventilator is designed in two models to serve a single bath: a high airflow model for ducting and a through-the-wall model with no ducting. The Pre-Ventilator also has a unique optional feature — a motorized insulated door that closes tightly to prevent backdrafts when the fan is not running (Figure 4).

As with in-line systems, exterior-mounted fans have the same minor disadvantage of being a nonstandard

installation. And if the fan is mounted outside a second-floor bathroom, maintenance requires working from an extension ladder. Also, unless these fans are located under an eaves or gable overhang, they will need to be flashed on the outside to keep out water. Tamarack's fans include an integral flange that is easier to make watertight than Fantech's plain housing, but neither company provides all of the flashing material you will need. (Both companies are reportedly working to improve watertight installation details.)

### Control Options

Most bathroom fans run off of a separate switch, but they are sometimes coupled with the bathroom overhead light. It is a mistake, however, to assume that ventilation is only needed when the light is on. It often takes longer to clear moisture or odors out of the bathroom than the time that the room is occupied. And in bathrooms with more than one light, the fan may not get turned on at all.

**Timers.** One solution is a 60-minute crank timer, which I have found works well once people become accustomed to using it. Humidity controls are another option, but they have a big disadvantage: Proper operation requires seasonal adjustments that homeowners probably won't make. For example, in cold-climate winters when the air is dry, the humidistat should be set to turn on the fan at a relatively low humidity level; but in the higher humidity of summer, the fan would run constantly at that same setting.

Another option is Tamarack's Aire-Track, a push-button control that runs the fan for 20 minutes at full speed whenever the button is pressed (Figure 5). This control can also be set to run the fan at a lower speed for some portion of each hour. (This works well when the fan is part of an automatic whole-house ventilation system.) The Aire-Track costs about \$80.

**Occupancy sensors.** A third control option is an occupancy sensor, which automatically turns on the fan whenever someone comes into the bathroom, and can be used in place of a wall switch. An adjustable time delay can be set so that the fan will run for a specified amount of time (usually from 5 minutes to an hour) after a person



**Figure 4.** An optional feature of Tamarack's Pre-Ventilator is a motorized insulated door that opens automatically when the fan comes on, then closes tightly to prevent backdrafts when the fan is not running.



TAMARACK

SENSORSWITCH

**Figure 5.** Tamarack's Aire-Track (left) combines a single switch with a timer — the fan runs for 20 minutes at full speed whenever the button is pressed. SensorSwitch's Passive Dual Technology occupancy sensor (right) turns the fan on whenever it "sees" or "hears" someone enter the room.

leaves the room. This is a good control strategy for rental or commercial bathrooms as well as residences. Occupancy sensors are available from SensorSwitch (10 Capital Dr., Wallingford, CT 06492; 800/727-7483), WattStopper (2800 De La Cruz, Santa Clara, CA 95050; 800/879-8585), and Leviton (59-25 Little Neck Pkwy., Little Neck, NY 11362; 800/323-8920).

**Humidistats.** Some newer fans — Broan's Sensaire series and Fasco's

Aware series, for instance — are available with built-in humidity-sensing controls (Figure 6). You can omit the wall switch altogether, or substitute a three-stage (on-off-automatic) switch available with the fan. The humidity-sensing model looks for a fast rise in humidity, but must be set for a base humidity — again, be aware of the need for seasonal adjustment. A much better strategy appears in Broan's MS90 Sensaire,

currently the only quiet fan available with a built-in occupancy sensor. However, no humidity-sensing fans are quieter than 1.5 sones.

## Ductwork Details

Depending on the design of the fan and motor, some quiet fans do not maintain a high airflow when pushing against excessive duct pressure. Airflow ratings for room-mounted fans are listed by most manufacturers and by HVI at 0.1 inch pressure, but it doesn't take much ductwork to bump pressures above this level, especially if 4-inch flex is used. Washington State has recognized that most bathroom fan ductwork has a higher back pressure and now requires all fans to have the minimum required airflow at 0.25 inch pressure. However, if you can keep the resistance down by picking proper duct size and materials, and by minimizing the total duct length and number of elbows, your installation will pull more air more quietly. And it will use less electricity.

The specs for the fans listed in Tables A and B show airflows at both 0.1 inch

## Sizing a Bath Fan

The Home Ventilation Institute guidelines recommend 8 air changes per hour (ACH) for typical bathrooms. To determine the cubic feet per minute (cfm) needed in the bath fan, follow these steps:

1. **Find the room volume** by multiplying floor area by ceiling height.
2. **Divide the volume** by 7.5 to get the required cfm (1 air change every 7.5 minutes is the same as 8 ACH).

For example, a 10x10-foot bathroom with 8-foot ceilings has a volume of 800 cubic feet (10x10x8). Dividing by 7.5 yields 107 cfm. A small, 6x8-foot bathroom (384 cubic feet) would require a 51-cfm fan (384÷7.5=51).

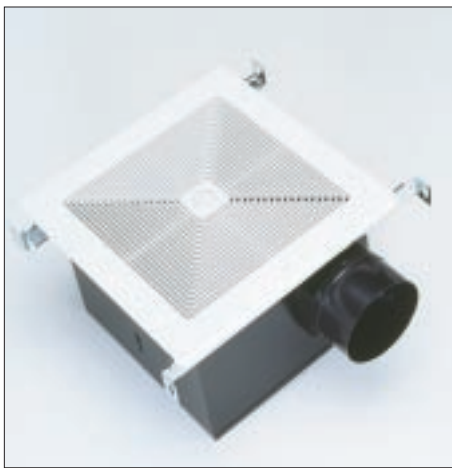
Note that a room with a hot tub may need a more powerful fan to remove the additional moisture. Note also that a long duct run will reduce the actual airflow that is listed on the fan. HVI listings are for 0.1 inch water static pressure. For longer duct runs, use a different static pressure.

**Table C. Sizing Ducts**

Duct Length (feet)	Air Flow (cfm)	Static Pressure (inches of water)				
		4" Flex	4" Rigid	5" Rigid	6" Rigid	6" Flex
10	50	.12	.10	.04	.02	.02
10	75	.29	.19	.08	.04	.05
10	100	.50	.39	.16	.07	.09
10	150	1.20	.87	.35	.16	.20
20	50	.16	.12	.05	.02	.03
20	75	.39	.27	.10	.05	.06
20	100	.65	.45	.18	.08	.10
20	150	1.62	1.00	.39	.18	.24
30	50	.19	.13	.05	.02	.03
30	75	.49	.31	.12	.05	.07
30	100	.80	.52	.20	.09	.12
30	150	2.03	1.13	.43	.20	.28

**Note:** Values in chart assume all ducts include two 90-degree elbows; values for flex duct assume an additional two 45-degree bends. Pressure drop due to inlet and outlet terminations is included.

**To find the correct duct size:** In the column labeled "Air Flow," find the cfm of the fan you plan to use and match it with the Duct Length you expect to use. Use any duct size that corresponds to a static pressure value of less than .15 (highlighted). If no value meets this criterion, increase the cfm of the fan.



**Figure 6.** Built-in humidity controls in Broan's MS90 Sensaire fans turn the fan on when humidity rises rapidly.

and 0.25 inch pressure. If the airflow drops off too much at 0.25 inch pressure, it means the fan is sensitive to duct pressure. Don't avoid these fans — they often use the least energy and are usually quieter — but pay closer attention to ductwork details.

**Duct selection critical.** Use Table C to pick the duct diameter and material for your particular installation. I have seen many jobs where duct selection

and sizing is left up to the electrician with the lowest bid. The result was cheap rattler fans attached to 30 feet of flex duct held up with an occasional piece of duct tape. These are the homes that end up with moisture problems in the bathrooms, the ducts, or the attics. Providing a clear specification to bidding electricians as to fan make and model, duct material, and location can avoid this problem (see "Ductwork Do's and Don'ts").

Notice in Table C that 4-inch-diameter flex duct is only recommended for duct runs of 10 feet or less and for flows up to 50 cfm, unless the fan is capable of supplying the needed airflow at higher pressures. On the other hand, rigid 4-inch duct can be used for 50 cfm of flow up to 30 feet and still maintain relative low pressure (0.13 inch).

Another point to note is that 6-inch flex (I prefer the preinsulated type that comes in 25-foot lengths) can be used for quite a long distance without much increase in pressure. Remember, however, to avoid sharp bends and to stretch out the duct as much as possible: Kinks and bends will restrict air-

flow. If the fan outlet is too small for 6-inch duct, use the appropriate duct adapter.

My favorite 4-inch duct material is rigid thin-wall PVC drainpipe, the kind used for foundation drainage. It's inexpensive and readily available, the joints and fittings glue up easily, and the smooth surface minimizes pressure drop.

**Replacement air.** No matter how good the fan or the duct, however, you can't get air out of the room if there is no way to get replacement air in. Remember to undercut the bathroom door 1 inch above finished floor level.

In unheated attics and unheated crawlspaces, be sure to insulate all the ducts and in-line fans. I have seen condensation in uninsulated ducts that was so heavy during cold periods it was mistaken for roof leaks. A side benefit of the insulation is further sound reduction, particularly with insulated flex duct. ■

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## Sources of Supply

### MANUFACTURERS:

American Aldes  
4537 Northgate Blvd.  
Sarasota, FL 34234  
800/255-7749

Broan  
P.O. Box 140  
Hartford, WI 53027  
800/548-0790

Continental Fan Manufacturing  
2296 Kenmore Ave.  
Buffalo, NY 14207  
800/320-0504

Fan America  
1748 Independence Blvd., Suite G-4  
Sarasota, FL 34234  
800/838-4074

Fantech  
1712 Northgate Blvd.  
Sarasota, FL 34234  
800/747-1762

Fasco Consumer Products  
P.O. Box 150  
Fayetteville, NC 28302  
800/334-4126

Nutone  
Madison and Red Banks Rds.  
Cincinnati, OH 45227  
800/543-8687

Panasonic  
Matsushita Electric Corp. of America  
One Panasonic Way, 4A-2  
Secaucus, NJ 07094  
201/392-6782  
800/277-1860

Tamarack Technologies  
P.O. Box 490  
West Wareham, MA 02576  
800/222-5932

### SUPPLIERS:

Air Supply  
3018 Livingston Rd.  
Bryans Road, MD 20616  
800/843-9510

Energy Federation  
14 Tech Cir.  
Natick, MA 01760  
800/876-0660

Positive Energy  
P.O. Box 7568  
Boulder, CO 80306  
800/488-4340