

Technical Brief No. 26

All Technical Briefs are based on past projects at RH Lyon Division

**Air Flow
Noise Reduction
Quality Control**

Moving Air Quietly Benefits are More than Less Noise!

Quiet Products Offer Many Benefits

The major benefit of *quiet* products is that consumers find them more desirable. Quiet products are sought after and their manufacturers capture a larger market share. Less well recognized benefits of quiet products include a more efficient device that is smaller, manufactured with fewer parts, and less costly to produce. But unless engineers pay attention to noise early in the design process, these secondary benefits will be lost *and* unanticipated costs through "Band-Aid" solutions may cut into profitability. This is particularly true when the noise results from moving air.

Noise Control as an Afterthought

At RH Lyon, we specialize in understanding what creates the noise and vibration of devices, be they appliances, computer accessories, or medical devices. So often the products we receive for diagnosis are those where acoustics has taken a back seat to other concerns during the design process. Sure signs of this are a product stuffed with foam or plastered with damping mastic. Surfaces have been stiffened and elaborate gaskets have been devised. Costs are high, yet the sound is still excessive.

Stop Noise At Its Source

A better approach is to reduce noise early in the design process and right at its source; for once noise is generated, then noise control treatment must be applied as an add-on, or expensive retooling will be required.

Examples of Noise Reduction through Proper Design

Many products require the moving of air, either related to the primary function of the device or for cooling its components. In either case, noise will be generated in various ways, but by proper design it can be minimized. For example, if the airflow into an impeller is not smooth, then the variable forces on the spinning blades can result in noise. Likewise, air expelled from an impeller into a nearby obstruction such as a support or scroll cut-off also generates noise. Proper flow design avoids these problems. Fan blades can stall if the fan is improperly sized, leading to excessive noise. Improper fan blade angles or fan speed can also increase noise.

Air delivery passages may also act as resonators (e.g., as in an organ pipe). In smaller devices, dimensions of passages are such that resonance frequencies are well within the sensitive range of human hearing. The solution is: be vigilant in the design and avoid resonant cavities.

Typically, reducing flow noise is a win-win situation. The noise is lower when the air delivery process is more efficient. The added gains include smaller, lighter motors, reduced heat loads, and less energy use. Because flow problems are so important to noise, at RH Lyon we maintain expertise in the allied fields of aerodynamics and hydrodynamics.

Vibration, created by motors and fans, may also be converted into sound by radiation from the product's panels. This can be treated in various ways. Stiffer panels can radiate sound better, so "floppier" panels are usually preferred. Perforated panels do not radiate sound well because the air pressure difference between the front and rear is short-circuited by airflow through the perforations. Also, heavier panels are less responsive to vibration than light panels.

Attention to noise control, early in the design process, is a win-win situation.

Expectations

For 25 years we have worked with products that move air. Our experience shows that the sound level of almost any of these products can be reduced by 6 dBA. This decibel change would be judged by a listener to be quite significant. In associated design changes, the product can be made more efficient, with manufacturing costs reduced. These changes are easier to implement early in the design process, and greater noise reduction can be expected. However, improvements, and sometimes surprising ones, are also possible in existing products.