Technical Brief No. 28

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

Medical Devices
Noise Reduction
Quality Control

Quiet Medical Devices

Benefits are More than Less Noise!

Quiet Products for Greater Patient Acceptance

The major benefits of making a *quiet* product are that soothing sounds lead to greater patient acceptance, patient compliance and, consequently, a larger market share for the manufacturer. Equally important benefits include a more efficient product that is smaller, manufactured with fewer parts, and is less costly to produce. If noise is considered early in the design process, then these secondary benefits will be realized by the manufacturer, without unanticipated costs through "band-aid" solutions cutting into profitability.

Noise Control as an Afterthought

At RH Lyon we specialize in understanding what creates the noise and vibration of devices, be they medical devices, appliances, or computer accessories. So often, the products we receive for evaluation 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. Production costs are high, yet the sound is still excessive.

Patient compliance and confidence are closely linked to the sound quality of a medical device.

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, noise control treatment must be applied as an add-on, and expensive retooling may be required.

Examples of Noise Reduction through Proper Design

Moving air can be used either for cooling within a medical device or for the delivery of air as, for example, in a breathing-assist device. In either case, noise will be generated in various ways, but by proper design, it can be minimized. 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 close obstruction, such as a spider 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. An incorrect number of fan blades, improper fan blade angles, or non-optimized fan speed can also increase noise.

Air delivery passages may also act as resonators (e.g., as in an organ pipe). For the smaller medical devices, dimensions of passages are such that resonant frequencies are well within the sensitive range of human hearing. The simple 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 critical to noise, RH Lyon maintains its expertise in the allied fields of aerodynamics and hydrodynamics.

Vibration may also be converted into sound by radiation from the product's panels. This can be treated in various ways. Stiffer panels radiate sound better, so floppier panels are 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.

Expectations

Our 25 years of experience show that the sound level of most medical products that we evaluate can be reduced by 6 dBA. This decibel change would be judged by a listener to be quite significant. In associated design changes, a product can be made more efficient, with manufacturing costs reduced. These changes are easier to implement early in the design process. However, improvements, and sometimes surprising ones, are also possible in existing products.