State of the Industry – Laboratory Fume Hoods

Key Fume Hood Design Issues and Current Trends
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Main elements reviewed by customers during the fume hood selection process are proper containment levels, potential energy savings and ergonomic features. Often overlooked, but of equal importance, is fume hood construction and quality of materials utilized to manage the high abuse environments typical to hood applications.

First and foremost are safety features. The containment capability of the fumes generated within the hood is the most discussed safety concern. Containment capability can be validated by incorporating the ANSI[1]/ASHRAE[2] 110 tracer gas test procedure, which was introduced to the market in 1985 and is continually updated by a committee of industry experts. Introduction of this test procedure to the industry has witnessed an upgrade in fume hood product design and performance.

Well designed hoods are capable of operating at containment levels near or below the minimum detection of applicable instrumentation. Governing bodies including ANSI and ACGIH[3] have adopted the tracer gas test procedure. Recommended containment levels of 4.0AM0.05 for factory tests and 4.0AI0.10 for field installed hoods are typical, near the minimum detection range and rational.

Unfortunately there has been an influx of "*suggested modifications*" to this test procedure by various sources. Caution should be regarded on any suggested changes unless the modification has good cause and sound science behind it. Some suggested modifications are no more than marketing strategies or an approach to expand billable hours by third party consultants.

In the last 5 to 6 years considerable research has been applied to fume hoods on the development of "low flow" designs. During this development Hamilton and other industry engineers determined that if any fumes escaped the hood the leakage occurred near the work surface and only in front of an operator's body. As a result of this finding all low flow hood designs incorporate measures of improved fume control at the work surface. Some manufacturers have raised or otherwise modified the front airfoil to act as a barrier to stop this reverse flow and loss.

Hamilton redesigned the airfoil to purge the work surface of containment and stop the reverse flow. The airfoil is flush with the work surface to eliminate tip hazard and provide user comfort. The baffle was also redesigned to increase the draw of airflow at the work surface. The new design retains low hood static pressure and noise levels – and does not compromise evacuation elsewhere within the hood. These design changes greatly improved containment levels while functioning at lower (60 fpm) face velocity. This sill and baffle design is utilized in the Hamilton Concept and SafeAire II product lines.

Research to develop an even more robust hood for retrofit labs or those with poor room conditions resulted in Hamilton incorporating entirely new technology into the Pioneer product line. Within the hood the escape location of fumes has been determined to be directly in front of the user's body. To eliminate the problem area the Pioneer hood incorporates an additional managed airflow in front of the user. This air is clean room air, introduced at a controlled low velocity and pattern only when the sash is above the 18" operating position. The Pioneer hood is the first to be commercially available with what may be considered a "push- pull" design.

Energy savings have driven new hood designs into the market. Reductions in exhaust volume have been achieved by use of smaller sash operating openings and/or lower face velocities. Use of combination sashes have been on the increase and are common in low flow hoods such as Concept and Pioneer. An improved airfoil and baffle design enables these hoods to retain proper containment down to 60 or 50 fpm levels, even with the sash in the full open set up position. This reduction in exhaust volume and related energy savings varies with different hood and sash designs.

Interest in comfort designs of fume hoods began in 1990 with the introduction of ergonomic requirements set by the Americans with Disabilities Act (ADA). These accessible designs made the hood more comfortable for all users–not only the physically challenged. The redesign of the front airfoil making it flush with the work surface eliminated a tip hazard and improved reach into the hood. New combination sash frames with low profile bottom rails made this sash option comfortable for the user. Higher viewing sight lines with no increase in access opening or exhaust volume are standard on Concept and Pioneer hoods. Additional spill containment has been built into the Horizon, Concept and SafeAire II product lines to further enhance safety.

Fume hoods have taken a quantum leap in improved capture, energy savings, and ergonomic benefits over the last 5 years. Hamilton has led the way on many of these design features and offers them in an extensive Hamilton fume hood product line.

[1] *American National Standards Institute www.ansi.org/* [2] *American Society of Heating, Refrigerating and Air-Conditioning Engineers www.ashrae.org/* [3] *American Conference of Governmental Industrial Hygienists www.acgih.org/home.htm*