First and foremost, St. Charles considers a fume hood to be a **Safety Device**, designed to safeguard and protect the operator and those in the surrounding environment. It must be designed to meet the performance standards demanded by varied laboratory procedures. And, in addition, it should be a quality constructed and aesthetically pleasing element in the laboratory design. To produce these Fume Hoods, St. Charles draws on over fifty years of experience in the innovative design, engineering, manufacturing and servicing of fine quality products.

The St. Charles Research and Development staff utilizes our Fume Hood Test facility to provide invaluable data on the individual components and combinations that make fume hoods perform properly. The work done on the American National Standards Institute/American Society of Heating, Refrigerating and Air-Conditioning Engineers Inc. standard (ANSI/ASHRAE 110-1985) provides an outstanding tool with which to quantitatively measure hood operating performance.

St. Charles has tested and certifies our major hood designs at published levels of performance under the ANSI/ASHRAE 110-1985 standard.

**Quality, Safety and Performance** are designed into the mechanics of operation and pleasing structural appearance. St. Charles has taken defined positions on such items as types of sash handles for safer operation, method of baffle adjustment, safety of auxiliary air systems and others. We welcome the opportunity to demonstrate the design and test data on which our Fume Hoods are based.
Our concern for customer satisfaction goes beyond the design and manufacture of quality products to include timely delivery, installation and followup service.

Our efficient production scheduling and careful selection of carriers assures on-time, damage-free delivery.

To insure proper installation and service, St. Charles' field organization has been selected with great care and trained in the technicalities of product installation and service. They are located in major markets nationwide for close coordination at the installation location.

We at St. Charles are proud of our products and our people. We would be pleased to count you among our many satisfied St. Charles customers.
Would you like to test the performance of your Fume Hood configuration ideas? You can—in St. Charles' totally instrumented Hood Test Laboratory. The Test Facility is operated by St. Charles' highly competent and experienced staff—a staff that has been associated with fume hood design and development for over 25 years. In addition, the services of independent consulting organizations are retained to verify performance standards and test results.

Qualitative testing utilizes Titanium Tetrachloride smoke to visibly demonstrate air movement into the hood and the air patterns within the hood chamber. Auxiliary air capture efficiencies are demonstrated by the use of entrained smoke in the Auxiliary Air proper.

St. Charles uses the ANSI/ASHRAE 110-1985 test to certify quantitative fume hood performance. The test, has been published as the accepted quantitative test for the American Conference of Governmental Industrial Hygienists regarding Laboratory Fume Hoods.

Each St. Charles fume hood is shipped with a certificate detailing ANSI/ASHRAE 110-1985 fume hood performance levels.
Through its programs of continuous hood development and testing, St. Charles has developed an acute awareness of the extreme importance of each design detail to total hood performance. Maximum efficiency is accomplished when each part makes its individual functional contribution.

A laboratory fume hood is above all, a **Safety Device**. St. Charles recognizes the many performance requirements of fume hoods in the laboratory, but always places the requirement for safety of the operator above all others.

The St. Charles staff and Test Facility are available to architectural and engineering groups interested in exploring the latest technology in fume hood design and operation. A variety of hood types and sizes are available for operation and testing. Special operational needs of each project are explored and viable solutions developed.

If your responsibility is the design and/or operation of Laboratory facilities, take advantage of St. Charles Fume Hood Test Facility and the knowledge of the staff to explore your project needs. While you’re with us, tour the manufacturing facilities for Hood and Laboratory Furniture as well.
A Fume Hood is basically a Safety Device to protect laboratory personnel. To achieve maximum performance, three factors must be considered: 1) Fume Hood Design, 2) Fume Hood Location, 3) Fume Hood Face Velocity.

Fume Hood Design:
An aerodynamically shaped hood entrance provides a significant improvement in hood performance as compared to a square faced or conventional unit. The angled entrance foils reduce frontal hood turbulence and create a smooth flow of air into the hood chamber. Engineering construction detail readily separates "look-alike" designs that may exhibit vastly different performance criteria.

Rear Baffle slot dimensions are critical and adjustment should only be allowed by personnel recognizing the effect of baffle adjustment. Since most vapors and/or gases used or generated in hoods are heavier than air, the bottom baffle should not be adjustable but of a fixed opening size. The center slot—if present—should also be of a fixed size. The top baffle adjustment can reallocate air distribution within the hood with just one adjustment. Normally the top slot opening should be approximately ¾" and only changed for high heat loads, 4 KW and more, or for a quantity of lighter than air gases. **Hood Performance Declines Dramatically** if the top baffle is in a full open (roughly 2 inches) position without defined requirements. Tests, as conducted with Dr. Gerhard W. Knutson, indicate an increase of from .02 ppm to more than 10 ppm of freon as this maladjustment is profiled. St. Charles has only a top adjustable baffle and recommends that in-lab baffle changes be done only by qualified personnel.

Behind the sash leakage of air can account for 10% to 25% of the hood exhaust volume. A sash sealing system to eliminate this leakage is a must in design and construction. Sash leakage consumes room quality air (it eats energy) and does not contribute to the fume hood face velocity (safety). St. Charles uses an exclusive teflon air gasketing system or flush internal sash configuration to eliminate sash leakage.
Fume Hood Location:

The 19th Edition of Industrial Ventilation* specifically addresses hood location in reference to laboratory traffic patterns and laboratory supply air.

Hoods should be located in areas of the lowest possible cross traffic and away from doorways.

The terminal discharge velocities of supply air should be no more than 1/3 to 1/2 of the hood face velocity.

Perforated ceiling panels provide a better air supply system than do grilles or ceiling diffusers. If grilles or diffusers are used, their location is vital to good hood performance.

Fume Hood Face Velocities:

For many years the trend of hood face velocities was ever upward. In the 1950’s 50-75 FPM in a properly designed hood was considered by many as acceptable. As hood population and usage increased, the concern about hood safety was in many cases modified by increasing face velocities on the premise that “more” is “better”.

In 1978 Caplan & Knutson published the first acceptable quantitative method of evaluating fume hood performance. Their results, while not startling, were very sobering and definitely indicated “more” was not “better”. The American Conference of Governmental Industrial Hygienists published in their 17th Edition of the Ventilation manual the following guidelines on face velocities:

<table>
<thead>
<tr>
<th>Conditions</th>
<th>cfm/sq. ft. Open Hood Face</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ceiling vents properly located with average panel face velocity 40 fpm.</td>
<td></td>
</tr>
<tr>
<td>Horizontal Sliding Sash Hoods. No equipment in hood closer than 12 in. to face of hood.</td>
<td>60</td>
</tr>
<tr>
<td>Hoods located away from doors and traffic ways.</td>
<td></td>
</tr>
<tr>
<td>Same as above, some traffic past hoods.</td>
<td>80</td>
</tr>
<tr>
<td>Ceiling vents properly located with average panel face velocity 60 fpm.</td>
<td></td>
</tr>
<tr>
<td>Hoods located away from doors and traffic ways or Ceiling diffusers properly located, no diffuser immediately in front of hoods, quadrant facing hood blocked, terminal throw velocity 60 fpm.</td>
<td>80</td>
</tr>
<tr>
<td>Hoods located away from doors or traffic ways.</td>
<td></td>
</tr>
<tr>
<td>Same as above, some traffic past hoods.</td>
<td>100</td>
</tr>
</tbody>
</table>

St. Charles recognizes the importance of the Caplan-Knutson report and has been testing hoods using this procedure starting in 1979. It is our conviction that all fume hood designs should be so tested and so classified prior to purchase by any laboratory facility. Only by doing this can laboratory personnel be assured of maximum safety at a selected face velocity.

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St. Charles is dedicated to the manufacture of sophisticated and performance oriented laboratory fume hoods and systems. We made a firm commitment to improve on existing Fume Hood designs and laboratory systems constructed between 1950 and 1975. Many specific areas of improvement were indicated. Here are but a few, but major, areas of hood user concern and complaint.

**Auxiliary Air Hoods may create uncomfortable drafts on the hood user's head and neck.** Many manufacturers produce auxiliary air hoods without any appreciable or acceptable research on the required exit velocity of the auxiliary air from the auxiliary air chamber. St. Charles testing clearly dictates limits of this chamber terminal velocity. For optimum results, it should be close in value to the hood face velocity (for bench hoods) and 50 FPM higher than the face velocity for walk-in hoods. There is no single design that provides a universal unit for a wide spectrum of percentages of auxiliary air the fume hood is to use. This terminal chamber velocity is critical to safety as well as to user comfort. Auxiliary Air must be conditioned so that it is room temperature in the Winter months and no more than 15°F warmer than room air during the summer months; humidity should be controlled, where required, to a maximum of 85 grains.

**Horizontal sash can greatly hinder activities of hood users.** This was most obvious in many existing hoods, caused by inattention to dimensional design. There is no question that fully raised vertical sash hoods are most convenient for the user and it is concurrently true that this results in a substantial increase in the quantity of exhaust air. St. Charles research indicates that for user convenience, the maximum width of the individual sash for horizontal sash bench hoods should not exceed 14". The dimension for walk-in hoods is not as critical. With the 14" size the sash serves the dual purpose of sash and safety shield. The one recognized advantage of a horizontal sash configuration vs. a vertical sash hood in a partially closed mode is that the horizontal sash allows full vertically oriented access to the hood in the open sash area. A vertical sash hood, partially closed makes it difficult, if not impossible, to adjust experimental apparatus located in the mid to upper part of the hood interior chamber.

**Hoods work well when new, but how do you monitor continued hood performance?** Many research organizations have a staff of capable people that routinely monitor hood performance and insure continued user safety. However, St. Charles is a firm believer that there should be some indicator at each hood or general hood location that can be readily checked by the user to show the immediate operational capability of the hood. St. Charles manufactures solid state alarm systems that continually monitor the operation by sensing either the exhaust duct static pressure or hood face velocity and an alarm sounds if the hood drops beyond preset parameters.

**Hoods can make a lot of noise and disturb laboratory environment.** Properly designed hoods do not cause noise. Noise, if present, is caused by the exhaust ducting and blower systems. The hood manufacturer must provide an exhaust duct collar configuration and size so that the velocity of the air leaving the hood does not exceed 1600 to 1700 FPM. Too small exhaust duct collars can increase this to 2000 FPM and more and does result in a disturbing whistling noise. St. Charles is most conscious of this design parameter and exhaust duct collars are specifically sized to be compatible with the required hood exhaust volume.
Hood Exhaust System Cost Analysis Program

"Can Auxiliary Air Hood Exhaust systems save construction costs and/or operating energy costs?"—That question receives many varied answers. Most of them are "guesstimates" and not based on total systems performance for an entire laboratory. Many evaluate summer air conditioning costs, but do not indicate year-round performance.

St. Charles feels that factual answers to system costs are vitally important to architects and engineers when designing for more energy efficient laboratory buildings.

As a result, the HESCA Program has been developed as a vital and viable guide to assist design staffs in evaluating fume hood design and hood exhaust systems as a part of a total HVAC System.

HESCA shows capital day-one HVAC dollars for both the heating and cooling seasons on an installed price. The program is based on a design project by a professional engineering group in Chicago that synthesized a laboratory building HVAC system and exposed it to predetermined operational guidelines. To explore the widest possible variations, the building was operated with six different hood systems including auxiliary air and non-auxiliary air. In addition to system variation, geographical location was considered as being of prime importance. Example: What is cost effective in Houston may not produce a similar result in Boston or Salt Lake City. The loads were calculated in accordance with ASHRAE established methodology.

This is a specific HESCA review of Austin, Texas of a hood face velocity of 60 FPM.

<table>
<thead>
<tr>
<th>LABORATORY SETUP</th>
<th>HOOD AUX</th>
<th>HVAC TOTAL</th>
<th>AUX TOTAL</th>
<th>INITIAL OPERATING</th>
<th>INITIAL PLUS FIVE YEARS</th>
</tr>
</thead>
<tbody>
<tr>
<td>VERTICAL SASH - FULL OPEN 0% AUXILIARY AIR</td>
<td>2900</td>
<td>0</td>
<td>4.17</td>
<td>$11,750</td>
<td>0</td>
</tr>
<tr>
<td>HORIZONTAL SASH - FULL OPEN 50% AUXILIARY AIR</td>
<td>2900</td>
<td>120</td>
<td>4.72</td>
<td>$12,654</td>
<td>1,194</td>
</tr>
<tr>
<td>VERTICAL SASH - FULL OPEN 50% AUXILIARY AIR</td>
<td>2900</td>
<td>120</td>
<td>4.72</td>
<td>$12,654</td>
<td>1,194</td>
</tr>
<tr>
<td>VERTICAL SASH - FULL OPEN 70% AUXILIARY AIR</td>
<td>2900</td>
<td>179</td>
<td>6.99</td>
<td>$17,152</td>
<td>2,241</td>
</tr>
</tbody>
</table>

Heating costs are based on the degree day method and cooling on full load operating hours.

HESCA is a computer program based on these studies that profiles immediate geographic climatic conditions against hood exhaust system capital and operating costs. Based on specific project input, it shows operating costs for a 12 month year. In addition, it will compare results of hoods operating at various face velocities from 60 FPM to 125 FPM.

HESCA is available to all qualified design groups as applied to a laboratory in any designated geographical location within the design parameters of the model building.

- 20 Laboratories, 18' x 30'
- 2 ea. 6' Fume Hoods laboratory
- Laboratory Heat Loading
- Operating 10 hrs. per day—220 days per year
- Quality of Laboratory Air & Aux. Air identified

Hood System Design Criteria in the model building:

- Vertical Sash—No Auxiliary Air
  - 50% Auxiliary Air
  - 70% Auxiliary Air
  - 95% Auxiliary Air
- Horizontal Sash—No Auxiliary Air
  - 50% Auxiliary Air

Take advantage of the availability of this St. Charles service to help you review various system options and to aid in the selection of the best and most energy efficient system for new or remodelled laboratory buildings.