INDUSTRIAL HYGIENE REPORT

Spray Paint Use in Ductless Hood;

Measurement of LEL

December, 2009

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Date of visit: **December 16, 2009**

SPRAY PAINTING PROJECT

Introduction: Ductless hoods are used to enclose operations that may release noxious or hazardous gases or vapors that may adversely affect the worker or others in the immediate environment. The liberated gases or vapors are typically filtered to remove particulates and passed through a sorbent such as activated charcoal to remove organics such as toluene or xylene. Low molecular weight organics such as propane or butane are not removed by treatment with charcoal. Although flammable, low molecular weight hydrocarbons are generally of low toxicity and are effectively dispersed in the building ventilation system.

Purpose: A typical application of the Sentry Air Systems ductless hoods is to contain operations that may generate flammable gases and/or vapors. An example of this kind of operation is spray painting small parts with paint contained in pressurized cans (e.g., ColorPlace™ fast dry spray paint). It was desired to measure the concentration of flammable vapors generated by spray painting to determine if the LEL (lower explosive limit) would be exceeded in the hood exhaust. This information could then be used to provide user guidelines for safe operations.

Discussion: Spray Paint is composed of three main ingredients: pigment, solvent(s) and propellant. The rate at which the paint is expelled from the can is limited by the nozzle orifice and the time the nozzle is depressed. The propellant (propane and butane) is liquid under pressure but vaporizes instantly upon exiting the container. The solvent(s) in which the pigment is dispersed are volatile liquid organics and dry in several minutes to hours. Both the propellants and the solvents are highly flammable. According to the Material Safety Data Sheet (MSDS), the propellants account for 30-35% of the can contents, the solvents, 59-64% and the non-volatile pigments, 6%. See the attached MSDS for more details. The lower explosive limit (LEL) in air is 1%, or 10,000 parts per million (ppm). For safety, it is recommended that the atmosphere entering the exit duct at the top of the hood not exceed 50% of the LEL, or 5000 ppm.

Experimental: A Sentry Ductless Hood (Model SS-330-DSH) was used to house several small metal parts to be spray painted. The hood was operated with the Plexiglas cover in the down position, leaving an 8" x 30" opening through which the operator conducted the painting operation. The average face velocity of the air entering the hood was measured to be 70 feet per minute, which equates to a volumetric air flow of 117 cubic feet per minute through the hood (0.667 x 2.5 x 70). An LEL meter ("Eagle" Gas/LEL Detector, RKI Instruments)[1] was used to measure the concentration of flammable gases entering the hood outlet before entering the particulate filter and the 10-lb. pack of activated charcoal. Spray painting was begun using 10 oz. cans of ColorPlace™ Fast Dry Spray Paint. The following measurements were obtained (see Table I):

Table I

Operation	Result
One can, spraying parts normally	36% of LEL; 4,000 ppm (Peak concentration)
Two cans, spraying parts normally	62% of LEL; 6,500 ppm (Peak Concentration)
Two cans, spraying continuously	100% of LEL; 11,000 ppm

The activated charcoal did a good job of removing the solvents in the spray paint, as judged by the lack of odor in the exhaust air from the hood. The propellant gases (propane and butane) are nearly odorless and are not removed by charcoal and are dissipated by the building ventilation system.

Results and Conclusions:

1. Using one can of spray paint at a time in "normal painting" mode resulted in producing a mixture of air and volatile organics that reached a peak value of 36% of the lower explosive limit (LEL). A second test produced a peak reading of 31% of the LEL.

[1] http://www.ajaxrentals.com/uploads/2/2/2/0/2220590/eagle.pdf

Results and Conclusions, cont'd.

2. Using two cans of spray paint at a time in "normal painting" mode resulted in producing a mixture of air and volatile organics that reached 62% of the lower explosive limit (LEL).
3. Spraying two cans of spray paint continuously resulted in a mixture of air and volatile organics that reached a peak value of 100% of the LEL.
4. The Sentry Air Systems Ductless Hood, operating at a flow rate of 117 cubic feet per minute, effectively contained the typical (one can) spray painting operation and did not exceed the recommended 50% of the LEL. This is the recommended mode of operation for spray painting in the ductless hood.
5. Users should be aware that the propellants (propane and butane) are not absorbed by the activated charcoal filter and therefore it is important that there be adequate room ventilation to prevent a buildup of these gases.
6. The charcoal filter should be replaced when its absorption capacity is reached or exceeded, as evidenced by odor in the hood effluent.

If you have any questions or comments regarding this report, please contact me at 713-983-7910 or by e-mail at BobCIH@aol.com.

Respectfully submitted,

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