The Purpose of Fume Extraction

This article is based on an original publication by Hakko.

Solder technicians inhaling flux smoke for prolonged periods of time may develop short- and long-term respiratory illnesses, eye irritations, headaches and more. The activators found in fluxes are often organic compounds that release byproducts of incomplete combustion when heated. Byproducts containing noxious fumes, particulate matter, aerosols and gasses may be responsible for workers' symptoms. Therefore, the extraction of fumes is necessary to minimize exposure to contaminants. Flux types include resin-based, no-clean and water-soluble.

Resin-based flux is the oldest, most popular and the most effective. It primarily consists of colophony, a complex resin found in pine trees and linked to allergic reactions. The active agents are abietic and plicatic acids, which react with the metallic oxides on the joint to facilitate wetting. When these organic acids are exposed to high temperatures and combine with oxygen they yield products of partial combustion. These products may irritate the skin and eyes or worsen existing respiratory conditions. Abietic acid at room temperature may also cause skin irritations.

Some resin-based fluxes facilitate soldering by making the compound more acidic than usual with the addition of organic fatty acids or other chemical activators. This addition may introduce more airborne irritants.

Resin-based flux leaves a residue on the board upon completion that must be cleaned. Usually isopropyl alcohol or methyl alcohol is used for this purpose as they are effective, fast and inexpensive. However, alcohol fumes may be offensive.

No-clean fluxes do not leave a residue behind, so no cleaning is required after use. While some are organic and some are not, most are more acidic than resin fluxes. They all yield chemical residues and products of partial combustion that are more likely to cause irritation than their resin-based counterparts. Many no-clean fluxes are organically based, have a low solid content and break down alcohols, yielding solder smoke containing ethane, acetone, formaldehyde, toluene, terpenes, carbon monoxide and carbon dioxide as well as alcohol fumes.

Although some water-based no-clean fluxes exist that do not produce the organic compounds of alcohol-based fluxes, they are nonetheless extremely active and may cause severe skin irritation. These water-based fluxes also require the use of special equipment to prevent splattering and testing to verify acid concentration.

Water-soluble fluxes may be washed off the board and components with hot water. Many contain carboxylic acids and a detergent or surfactant that can produce irritating fumes. Sometimes saponifiers are added to help with the cleaning process; they are alkaline and may be corrosive. Splatter may become a problem during the wash process.

As most soldering fluxes are organic compounds, they may emit objectionable fumes, regardless of type, due to the chemical reaction between the acid in the flux and the oxides on the board.