



## APPLICATION NOTE

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# Recirculating Fume Cabinet Technology

**Recirculating fume cabinet technology is a viable alternative to traditional ducted fume cupboards in many applications.**

## Introduction to Recirculating Fume Cabinets

Whereas a ducted fume cupboard simply discharges untreated fumes to the atmosphere, a recirculating fume cabinet forces fume-laden air through an adsorption filter, which strips the fumes from the air. The clean air is then recirculated safely back into the laboratory.

Recirculating fume cabinets have been available for many years, but have not been widely utilised outside of the UK, France and a few other countries. There are a number of reasons for this:

1. They have been sold into applications for which they were not suitable.
2. Ducting fume outdoors seems safer.
3. Some manufacturers have skimmed on adsorption media in the filters resulting in inferior filter life.
4. Older cabinet designs did not incorporate a good seal around the adsorption filters. This led to filter bypass and degraded performance.
5. Gas sensor technology has been expensive.

Reputable manufacturers have addressed the third and fourth problems and gas-monitoring technology is now relatively inexpensive. This article addresses the first two problems.

Recirculating fume cabinets offer significant advantages over traditional ducted fume cupboards:

- Mobility. They can be moved within the laboratory or to another laboratory.
- Installation savings. No ducting or building penetrations are required.
- Energy savings. A supply of make-up conditioned air is not necessary.
- Environmentally friendly. Fumes are trapped in the filter, and not pumped into the atmosphere.

## Applications

Recirculating fume cabinets are **not always the best solution**. They are precluded for use with large volumes of volatile chemicals and for use with boiling chemicals, as the adsorption filters would load too fast. They are also precluded for perchloric acid digestions and in the case of abnormally high laboratory temperature or relative humidity. They may be more expensive than ducted fume cupboards – especially when the buildings allows for straightforward installation of ducting etc.

Recirculating fume cabinets are ideal when the adsorption filter is expected to load slowly. If the fume cabinet is not used continuously or if relatively small volumes (say less than 0.5L) of cold chemicals are used, then the filter can last for years.

The filter life depends mainly on the weight of adsorption media, the adsorption ratio for the vapour (how much vapour can be adsorbed per mass of media) and the rate of vapour passed into the filter. In order to estimate the filter life, and to select the optimal adsorption filter, the cabinet supplier needs to know the chemicals to be used in the fume cabinet, the quantities, and the hours per week of use.

Recirculating fume cabinets should be considered when mobility is an issue. It is often feasible to have one mobile system rather than multiple fixed systems.

And they should be considered when the cost of installation of a ducted system is prohibitive as in the case of a laboratory in the basement of a multi-storeyed building.

### **Safe Use of Recirculating Fume Cabinets**

A recirculating fume cabinet, like a ducted fume cupboard is a protective device. Its purpose is to protect the operator from fumes released within the cabinet. Like any protective device, it only provides protection when used correctly. The Australian standard covering recirculating fume cabinets, AS 2243.9 –1991, is generally accepted in New Zealand. This standard offers very good guidance for selection, use and maintenance of recirculating fume cabinets. Make sure any fume cabinet you buy complies with this standard.

A recirculating fume cabinet should be tested by an accredited test laboratory when it is installed on site. Thereafter, it should be checked and maintained at 6 monthly intervals by maintenance staff or an accredited test laboratory. This testing and maintenance is similar to that for a ducted system, and may cost a little less because an IQP report for building warrant of fitness is not required for recirculating fume cabinets.

In addition to this testing and maintenance, the operators may need to monitor vapour concentration to detect saturation of the adsorption filter.

For vapours with low toxicity and strong odour, the “smell” test is a sufficient indication of filter saturation. In the case of moderate toxicity vapours, weekly testing using a test kit may be satisfactory. The more expensive fume cabinets are fitted with filter saturation detectors and no such operator system is required.

For moderate to high toxicity vapours, a safety filter provides extra protection. A safety filter is fitted downstream of the primary adsorption filter. When the primary filter saturates and vapours break through, the secondary filter will continue to adsorb the vapours and protect the operators until the breakthrough is detected and the filters replaced. Regular monitoring (or automatic monitoring) of the air-stream between the filters will thus detect saturation of the primary filter before the operator is exposed.

A spare set of filters should be kept on site in a sealed package so they can be installed immediately filter saturation is detected. In a well-designed cabinet, filter change can be done easily and safely by the operator.