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■ VENTILATION ■

# Fans for fire smoke venting

**It is a well documented fact that the major cause of death in a fire is due to inhalation of hot toxic smoke. The control and effective removal of smoke from a burning building — especially in the vital first minutes, when personnel are being evacuated — has therefore become the central component of every fire protection scheme, writes Jim Wild, Woods' product application manager.**

AS SCIENTIFIC understanding of the behaviour of fire in confined spaces increases, and with the proliferation of ever larger and more complex building designs, traditional methods of exhausting smoke using natural venting techniques can prove inadequate and systems using controlled, powered fan units are more frequently being specified.

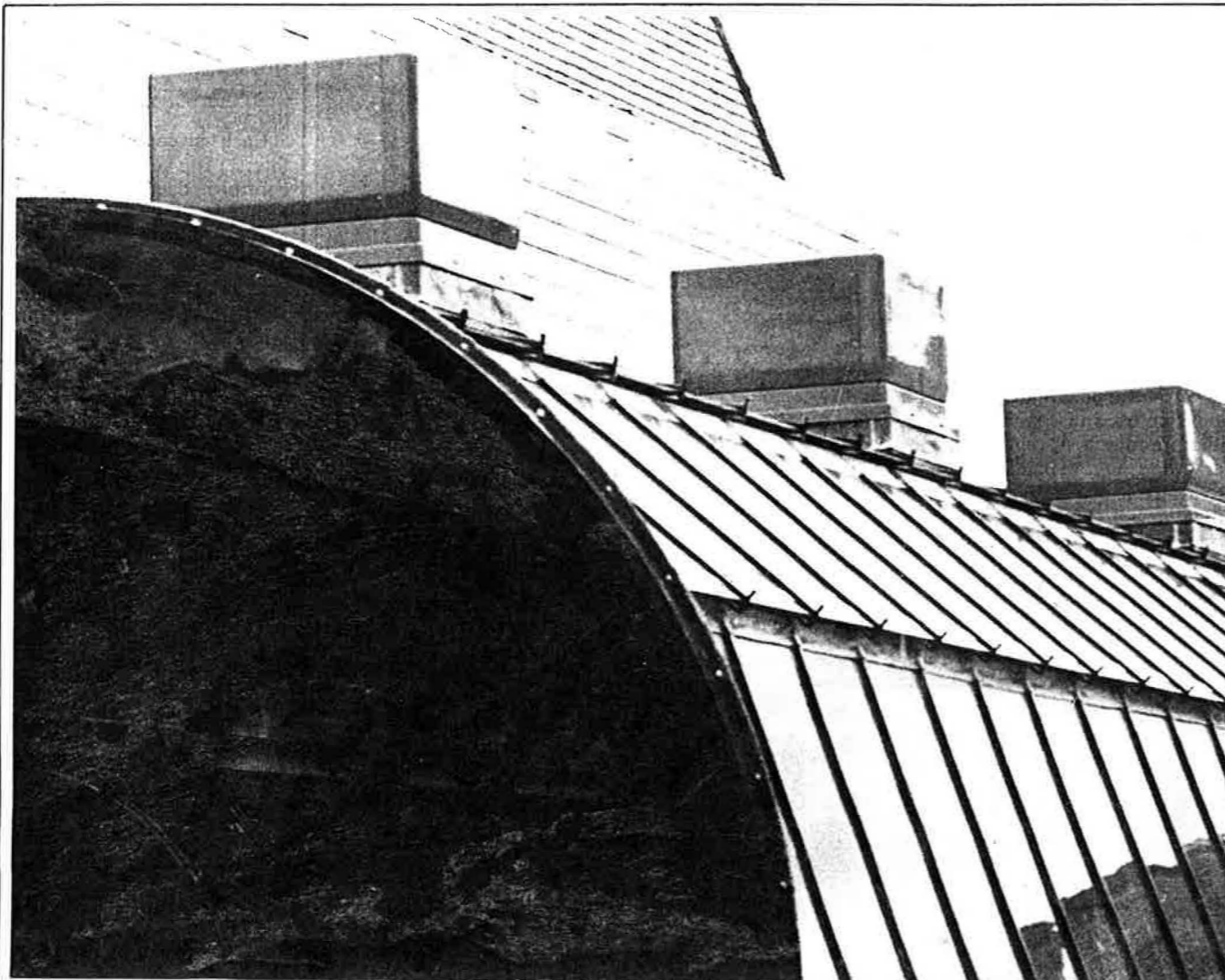
Extensive research in controlled conditions over many years has shown that the volume of smoke produced by a fire depends on its perimeter, the temperature of the flames in the plume and the effective height of the column of hot gases above the fire.

As the plume rises, surrounding cool air is drawn in and mixed with the hot smoky products of combustion, rapidly increasing the volume of toxic smoke.

#### Natural smoke ventilation

Early smoke venting systems were designed around single-storey factory buildings, where the height through which the smoke rose was relatively small. Smoke therefore remained hot enough so that, in combination with a relatively deep smoke layer, it provided the buoyancy required to force it through natural smoke vents.

It is this tendency of smoke to



2. Select from the category higher than the calculated maximum smoke temperatures;
3. Fans selected to handle fire smoke at the temperature calculated at the height of the fire will automatically remove some of the cooler smoke produced during the early critical stages of the fire;

4. Fan motors must be sized to have the power to allow the fan to handle air at the normal ambient temperatures;

Smoke venting fans require periodic testing, which is carried out at ambient temperatures. If fan motors have been derated to the power required to handle hot fire smoke, then motor windings could be damaged during ambient testing.

Equally, the actual smoke temperature will be lower than the fan temperature rating and the fan will almost certainly be called upon to handle relatively cool smoke during the early stages of a fire.

Reducing the costs of fans by derating the motors could prove fatal.

5. All fans and roof units can be provided with two speed motors — one for normal ventilation duties and another for smoke handling.

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It is this tendency of smoke to rise and expand in volume on contact with cooler air that has rendered natural venting ineffective in some modern buildings, many of which are designed around a spacious atrium to provide a light, airy atmosphere in the occupied spaces.

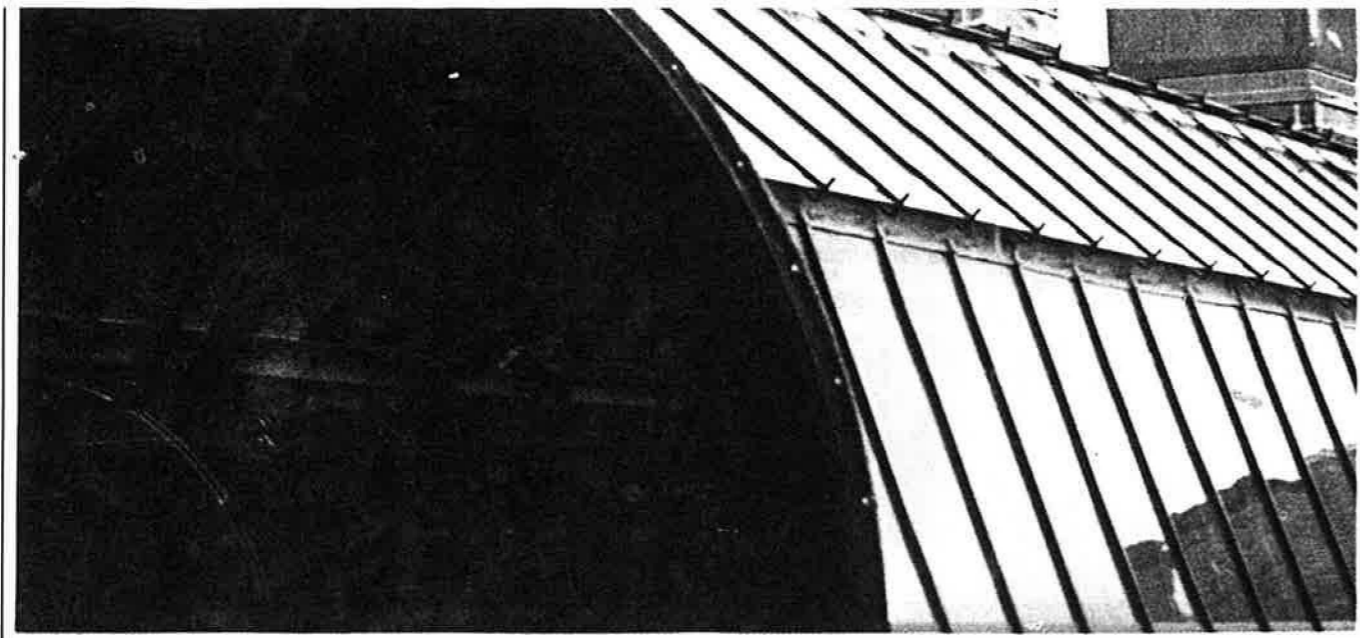
In this type of building it is often difficult to keep fire smoke out of the atrium, where it will rise and grow in volume. The higher it rises, the cooler it becomes, preventing the formation of a stable smoke layer with the necessary buoyancy to propel smoke out through natural vents.

Sprinkler systems serve only to further cool the air, arguably exacerbating the problem of smoke generation.

The modern shopping mall, with its combination of spacious walkways, large department stores and smaller shop units, also presents complex problems which natural ventilation often simply cannot begin to contend with. Because of these difficulties, mechanically powered ventilation systems, usually using electrically powered fans and roof mounted extract units such as those produced by Woods of Colchester, are increasingly popular and look set to become the norm for fire smoke venting in the very near future.

#### Mechanical ventilation

The primary requirement of a fan in a smoke venting applica-



**Woods of Colchester's Smokespill roof extract units. These units extract smoke in conditions of extreme heat and are installed for emergency ventilation in areas such as large shopping centres.**

tion is to extract hot smoky gases for a sufficient period of time to enable occupants to escape the building. It may also be required to keep a building free from smoke long enough to enable the fire services to locate and tackle the seat of the fire and, if possible, to assist in clearing smoke residues after the fire has been extinguished.

Even in a major fire, smoke temperatures rarely exceed 300°C and it has become generally accepted in the UK that a fan unit capable of operating to this temperature will be satisfactory for the largest proportion of applications.

As practical testing has shown that even the most complicated shopping centre can be usually evacuated within 20 minutes — provided the means of escape are clear — the life of a fan when handling hot fire gases need only be of 30 minutes' duration to introduce a sufficient margin of safety.

These two principles have resulted in the industry standard 300°C for 1/2 hour fan specification. In London, however, a by-law exists which enables the Fire Brigade to require that a building ventilation systems assist the fire fighting process, resulting in a demand for fan units with a life of one full hour, when handling smoke.

In many European countries, standards and specifications vary. In France, for example, specifications of 200° and 400°C for two hours are common, whilst in Germany, fans can be required to handle 600°C for up to 1 1/2 hours.

As a result of these varying duty requirements — and in order to ensure flexibility and economy for specifiers — it has become usual for fan manufacturers to offer a wide range of fan products, capable of a variety of temperature and time duties.

Not surprisingly, Woods of Colchester, one of the world's leading manufacturers of air movement equipment, are at the forefront of current industrial fan technology.

The company's HT range of smokespill equipment includes aerofoil, varofoil and bifurcated fans and a variety of roof extract units. Between them, Woods' fans are capable of handling smoke extraction duties at temperatures from 150° to 650°C for time periods ranging from 1/2 hour to five hours.

Every product in Woods' range has been subjected to rigorous mechanical and electrical testing to conform to exacting British, European and International standards. Many of these tests have been witnessed by independent auth-

orities, such as The Loss Prevention Council (FIRTO), or carried out in independent laboratories at CTICM in France and TU in Germany.

#### Fan selection

In specifying and using fans for fire smoke venting, the fol-

lowing principles and procedures should be borne in mind.

1. Calculate the volume of smoke to be exhausted and the minimum smoke temperature and decide the best type of systems to be employed — mechanical or natural;

which is carried out at ambient temperatures. If fan motors have been derated to the power required to handle hot fire smoke, then motor windings could be damaged during ambient testing.

Equally, the actual smoke temperature will be lower than the fan temperature rating and the fan will almost certainly be called upon to handle relatively cool smoke during the early stages of a fire.

Reducing the costs of fans by derating the motors could prove fatal.

5. All fans and roof units can be provided with two speed motors — one for normal ventilation duties and another for smoke handling.
6. Electrical supply to smoke venting fans must be from an independent protected source, connected by fire resistant cable.
7. Bifurcated fans always require a supply of ambient air to the motor compartment. For this reason, they are best sited away from the potential fire zone.

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