



# ABOUT AIR, FIRE AND FLAME

Air filters are all-round talents. They take care of clean intake air, prevent premature wear of engine components, ensure optimal air/fuel mixture – and when equipped accordingly, can even extinguish fires.



**ON TEST: NORMAL FILTER PAPER VS. FLAME RETARDANT FILTER MEDIA**

The air flow that can be expected in the engine compartment of a driving car is simulated via a blower. With an open flame, it is then attempted to set fire to a filter fitted to an opened filter housing.

**None flame-retardant paper**

1 The filter has been ignited with an open flame: the flame spreads rapidly. (The experiment was aborted afterwards to extinguish the fire manually.)

2 Here it can be seen clearly how the flame spreads rapidly towards the clean side (engine) – with all the undesirable consequences.

**Flame-retardant paper**

3 The paper has been ignited with an open flame.

4 However, the fire is extinguished after a few seconds..

One of the most important requirements for optimum engine performance, high torques, low fuel consumption and minimised pollutant emission: clean intake air. This, however, depends very much on the air filter, which has to prevent dust, soot and tyre wear particles from entering the intake system.

**THE ESSENCE OF A GOOD AIR FILTER**

An important quality characteristic is the so-called collection efficiency. It is measured in percentage and indicates the proportion of particles from the intake air that remains in the filter. MAHLE and Knecht air filters achieve here up to 99.9%. This means that practically everything that can affect the function and service life of the engine is filtered out by them – and this creates the conditions for long engine service life even under extreme temperatures or chemical effects.

**FIRE HAZARD: THE DISCARDED CIGARETTE-END**

However, air filters are subject to not only dust, soot, heat, cold and various chemicals during their operation. In addition, there is the threat of another hazard: that of catching fire – caused by the widespread nuisance by some car drivers of disposing of a burning cigarette end through the open window of the moving vehicle. If the burning heat of 500°C gets into the intake system of a vehicle travelling behind, its air filter can be set on fire – with the disastrous result of a fire in the engine compartment. The most well-known example for this is probably the catastrophe in the Mont Blanc Tunnel, in which a lorry caught fire that was proved to be caused by a discarded cigarette end.

However, a survey of workshops indicated that the majority of engine compartment fires are smouldering fires that are often not recognised as such when they are taking place. In the event of such a fire parts of the air intake system, which is mainly made from plastic, will generally melt. When the vehicle does not start the next morning, only a glance under the bonnet will often explain that there has been a fire.

**FOR INCREASED ROAD SAFETY: THE FLAME-RETARDANT DESIGN**

In order to prevent engine compartment fires, the car manufacturers have taken special design measures. These include grids in front of the air intake opening or suitable positioning of the air intake duct. Another option for fire prevention is the design of filter elements with flame retardant properties such as those developed by MAHLE in cooperation with car manufacturers and paper makers. Such filter media with flame retardant properties are mandatory in the specification books of car manufacturers for future vehicle generations.

**THE THREEFOLD SAFE EFFECT**

The basis for achieving flame retardant properties is a special resin used to impregnate the filter paper. The resin proportion for filter media with flame retardant treatment is between 25 and 30% (for normal filter paper this is only 15 to 20%). The paper treated in this way can catch fire, but extinguishes very soon afterwards. The effect is based on three fire extinguishing measures:

- ➔ Release of nitrogen (N<sub>2</sub>) to smother the fire as an inert gas.
- ➔ Release of water to quench the temperature to below the combustion point.
- ➔ Release of acid to oxidise the cellulose fibres so that they become incombustible.