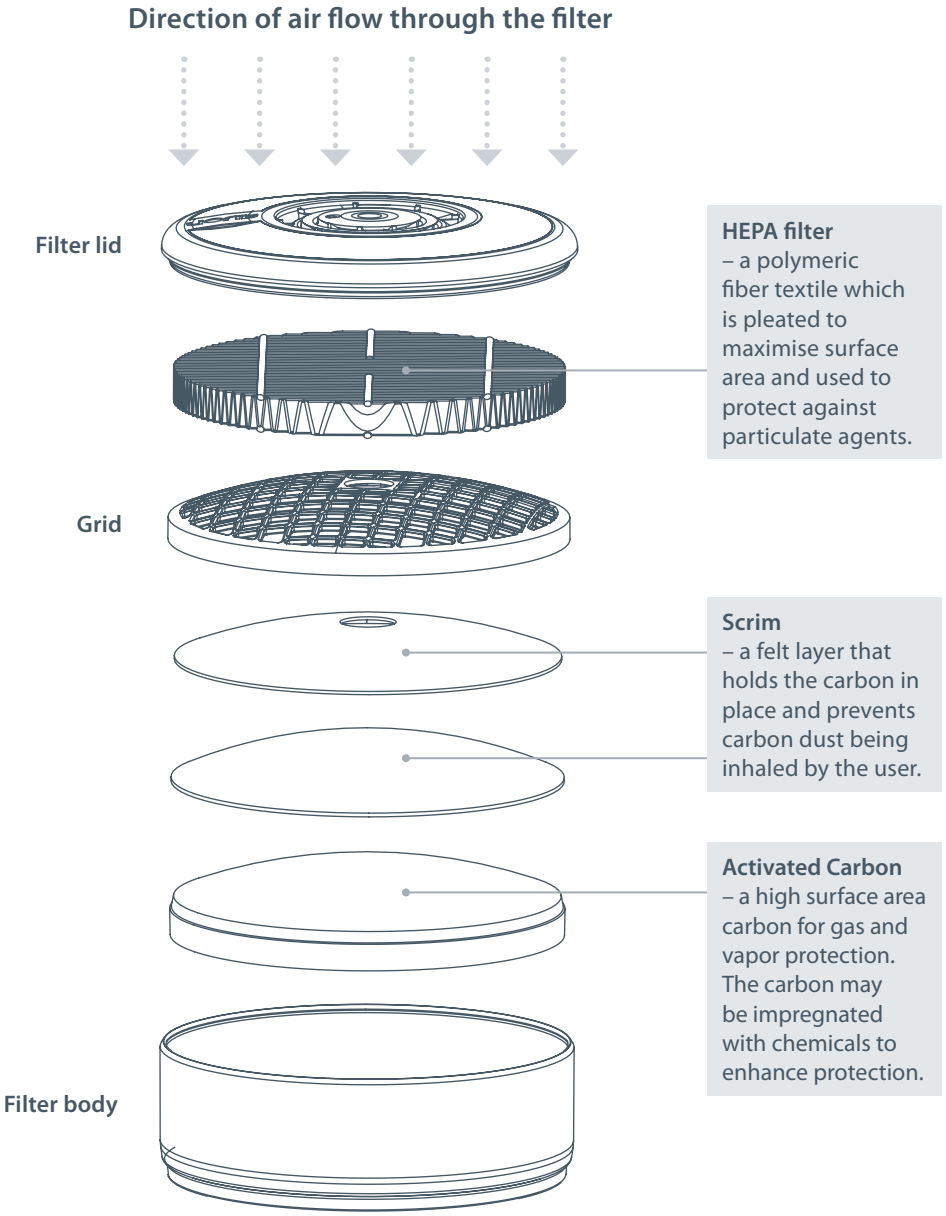
HOW DO MASK FILTERS WORK?

Air Purifying Respirators (APRs) such as the Avon Protection C50 mask require a filter to purify the air that we breathe, but how exactly does the filter do this?

PARTICULATE FILTRATION

Particulate filtration is the simplest of these techniques and represents the first level of protection inside a combination filter. When a user inhales while wearing an Avon Protection Air Purifying Mask and filter, the air must always first flow through a HEPA (High Efficiency Particulate Air) filter which are all rated to a minimum of NIOSH P100 or EN 143:2000 P3 particulate rating used in Europe. This protection level equates to a particulate protection performance of ≥99.97% (P100) or ≥99.95% (P3) filter efficiency against particles 0.3 microns in size such as dusts, mists, fumes, biological agents such as viruses and radioactive dusts. The approximate most penetrating particle size is 0.3 microns. Therefore, the filter will achieve even greater levels of particulate protection for particles both larger and smaller than this size. Some filter cartridges may only be made up of the HEPA filter which will provide the minimum of P100/P3 particulate protection but will not offer protection against gas or vapor chemical threats. As the filter traps more and more particulates, the breathing resistance through the filter will increase. For oil aerosols, the P100 filter protection may decrease, but will stay above the ≥99.97% filter efficiency requirement. For solid aerosols the efficiency at removing particles will actually increase as the filter loads.



CHEMICAL THREAT

A chemical threat requires a different approach, as chemicals can take the form of gases or vapours that are able to bypass particulate filtration, meaning a bed of activated carbon forms the second level of protection inside filter cartridges that offer protection against CBRN (Chemical, Biological, Radiological and Nuclear) threats. CBRN threats include CWA's (chemical warfare agents), TIC's (toxic industrial chemicals), and TIM's (toxic industrial materials). Activated carbon consists of granules of carbon derived from coal or plant matter that are activated by physical (high temperature steam) or chemical (high temperature acids or bases) means. The effect of this 'activation' process is that the carbon consists of millions of pores which create a very large surface area for it to interact with gases. This very large surface area allows it to adsorb gas molecules through intermolecular forces and chemical reactions. Examples of gases that will adsorb through physical, intermolecular forces are organic vapours like benzene and some chemical warfare agents like sarin or mustard gas. Removal of the smallest molecules with little intermolecular force interaction requires introducing additives to the carbon such as TEDA (triethylenediamine) and metals such as copper, zinc, and silver. During the filtration process, bonding sites begin to fill up as more and more chemicals are adsorbed.