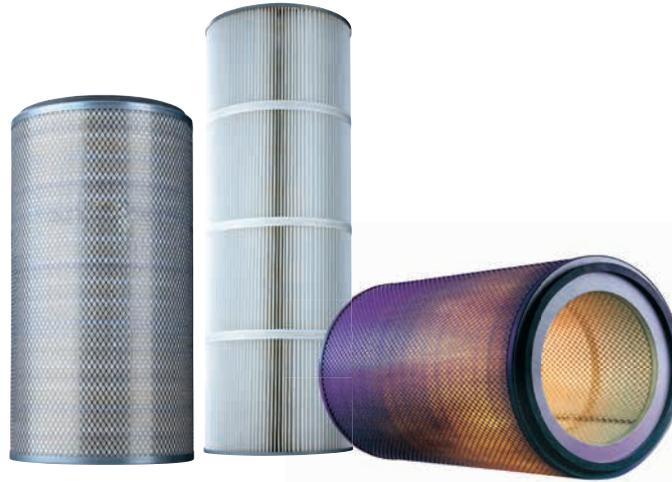


Extraction of Welding Fumes and abrasive Dust with a central Dust Collector System - Cartridge Filter



SFC filter cartridges

i Welding fumes are complex mixtures of substances made of metal oxides, silicates and fluorides, which occur during machining procedures, such as welding, thermal cutting and related processes such as soldering, thermal spraying and flame hardening. These fumes arise if metallic materials are heated beyond boiling point, changed into gases, which then cool down in the air and condense into ultra-fine particles. These particles, whose diameter is almost exclusively less than $1\mu\text{m}$ ($<0.001\text{mm}$!), should be categorised as very hazardous to health because they can penetrate the pulmonary alveoli when inhaling. In higher concentrations or with frequent exposure, these harmful substances can lead to immediate symptoms (vertigo, headaches, "metalworker's fever"), chronic obstructive respiratory diseases (chronic bronchitis, asthma, lung cancer) and damage to the central nervous system (Parkinson's disease).

For high-alloyed steels, which contain more than 5 percent by weight in total of alloying elements such as chrome, nickel and manganese, even lower thresholds are compulsory for the work environment of the employee. In this case, recirculated air operation of the filtered air is strictly not permitted. Notwithstanding this principle, the air extracted in a working area may be returned there if it is sufficiently cleaned of such substances using official procedures or those recognised by Employer's Liability Insurance Association (e.g. safety filter H13 as an afterfilter or energy recovery using a heat exchanger) or equipment (e.g. W3-certified equipment).

TRGS 528 provides information about "Weld smoke" and TRGS 560 provides information about "Air return when handling cancer generating hazardous materials".

We would be glad to provide consultations about this subject.

Problem

Zambelli Technik is a metal-working SME in the Czech Republic, which enjoys a good reputation as a manufacturer of ovens and chimneys and as a supplier of the automobile industry. The export-focused company has grown strongly in the last few years and has successively expanded its production capacities as a result of this. During production, both welding fumes and abrasive dust arise as part of the procedures.

The harmful substances should be extracted via a central filter system, which should preferably be installed outside the production hall. The filtered air should be returned to the hall during the heating period via a summer/winter set-up in order to use fewer resources and save heating costs.

In addition welding fumes are classified as combustible, because during metal processing, i.e. when sanding, ignition sources cannot be excluded, resulting in a piping and filter fire. Conventional deflector plates and diversion offer no definite protection here, meaning that fire protection tasks must be taken into consideration during the system planning.

Solution

As described in the info box, approx. 99% of the particles of welding fumes are smaller than $1\mu\text{m}$ and put the highest demands on the filter medium. On one side, the filtration of ultra-fine harmful substances must be reliable in order to guarantee that the workplace and clean air concentrations are at least below the existing thresholds. However, on the other hand, moderate pressure losses should exist during long service life of the filter cartridges in order to facilitate low operating costs.

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SFC system

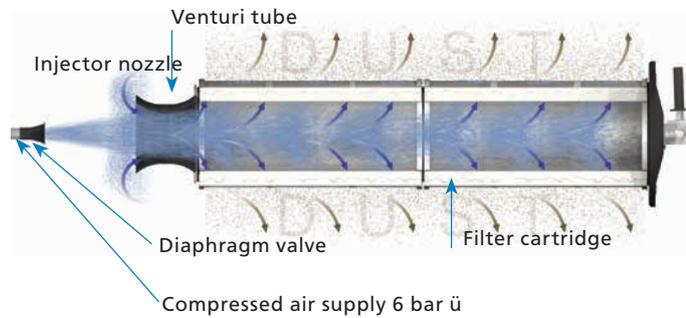
Since 2007, United Air Specialists provides a range of innovative filter cartridges with nanofibre technology, which satisfies these demands. They are among the best surface filters available on the market. The advantage of filter cartridges with regards to filtration efficiency and service life is rooted in an ultra-thin, synthetic fibre, which is applied to the surface of the conventional filter substrate during the production process with the help of the jet spinning procedure and forms a fine fibre layer (see cross section). The particles are filtered in this fine-pored layer and form a filter cake on the surface, which can be automatically cleaned using compressed air in the equipment, consequently achieving longer service life than conventional filter media, in which the particles are irreversibly deposited in the substrate.

Filter media with PTFE membranes also work according to the principle of surface filtration, but the PTFE fibres are thicker (approx. 1-10µm) than UAS nanofibres, due to the melt blown production procedure which leads to the filtration efficiency and service lifetime being lower.

In comparison: the nanofibres of United Air Specialist have a diameter of just approx. 100nm (0.1µm or 0.0001mm), a service life of considerably more than 8,000 hours can normally be achieved in industrial processing procedures (i.e. 1 year of continuous operation with 3 shifts). The outstanding filtration efficiency of the filter media is shown in various certifications, which were issued by independent testing institutes. According to UAS knowledge, no surface filter, except the company's own filter cartridges, currently has the filtration efficiency MERV 15 in accordance to ASHARE 52.2 anywhere in the world.

SFC COMPRESSED AIR BLAST:

Patent 6, 902, 592



This was also shown in the onsite measurement of harmful substances on the clean air side. Upon commissioning of the filter, the values were directly beneath 0.1mg/m³.

A further advantage of UAS nanofibre technology is that the manufacturing costs are considerably lower in comparison with PTFE membranes, which results in lower replacement parts prices.

In addition, the two remaining parts of the task were also solved by UAS: the outdoor installation, which is possible without any problems (and without a surcharge!) due to the robust steel construction and powder coating of the dust removal filter and the preventative fire protection, which UAS engineering has incorporated directly into the design of the system in order to take the risk of ignition into account.

We thank Karel Muk (Zambelli Technik) for approving this article.

Nanofibre cross-section

