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Increasing the profitability of filtration technology in concrete processing

The applicable occupational health and safety regulations prescribe effective extraction from the working environment, in particular where carcinogenic fine quartz dust is generated. Individually designed filter systems for the individual process steps are the state of the art today. The recovery of the waste heat by recirculating the filtered exhaust air makes an important contribution towards increasing the profitability of the extraction, with energy savings of several thousand euros per year. To achieve this, however, the highest demands have to be placed on the filtration technology with regard to the separation grade and safety. With its separation grade comparable to dust class H and its unique wear resistance, the pure surface filtration of the Herding® sinter-plate filters ensures the required efficiency and process reliability.

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During the processing and machining of concrete, an alveolar dust fraction of crystalline silicon dioxide is generated - the so-called fine quartz dust. Alveolar means that dust particles with an aerodynamic diameter of less than 10 µm can deposit themselves in the lung alveolus. No occupational exposure limit values are specified by the legislator for quartz dust. Quartz dust is also not listed as a carcinogenic substance in TRGS 905 'Directory of carcinogenic, mutagenic or teratogenic substances'. However, activities related to the handling of quartz dust are classified as carcinogenic in TRGS 906 'Catalogue of carcinogenic activities or operations pursuant to Article 3 Section 2 No. 3 GefStoffV [Ordinance on Hazardous Substances]'. This means that there is no classification with regard to the bringing of quartz onto the market, but measures are to be taken for carcinogenic substances in accordance with the Ordinance on Hazardous Substances for activities in relation to quartz. Hence, it follows that the employees must be effectively protected in accordance with the state of the art against contact with such types of dust (→ minimisation requirement). In addition, for preventive occupational health care, obligatory medical examinations are prescribed for employees who are involved in the grinding of screed and concrete, the grinding, cutting, slotting and milling of materials containing quartz using high-speed machines, the demolishing of mineral buildings and building sections and the application of shotcrete or the removal of plaster.

As a matter of principle, workplaces at which dust is generated should be spatially separated from the other workplaces as far as possible. Work booths with dedicated

dust extraction are an effective means of preventing exposure of employees to dust. A respirator must be worn when entering the booth for production, cleaning or maintenance work. A corresponding work instruction is monitored by documentation and regular checks. Where such preventive measures are not possible, a flexibly adjustable extraction system with efficient dust collection is to be provided directly at the place of machining, or systems with integrated dust extraction are to be used. The functional capability and use by the employees should be checked regularly.

Pure surface filtration prevents clogging of the filter

Important for the best possible effect of the extraction are in any case the optimal

design of the flow and a constant and reliable mode of operation of the entire filter system. The optimum matching of the raw air line design, the filter characteristics and the fan dimensioning in accordance with the task are particularly important in the design. Decades of practical experience, continuous comparison of practically measured values with theoretical computer models in the most diverse areas of application as well as high development expenditure through long-serving trained and experienced employees are necessary in order to be able to ensure reliable solutions in the field of filtration of hazardous substances for the optimal protection of the employees on site.

Surface filtration with the patented Herding sinter-plate filter has proven itself over many



Herding Flex as a central filter plant in use at the Godelmann company



Herding Delta und Delta² filtering media

years to be an effective and reliable method of separating abrasive and ultra-fine quartz dust. Thanks to its sintered rigid PE body it is extremely resistant to mechanical stresses such as compressive forces or alternating pressure loads. A coating with PTFE is firmly embedded as a filter-active layer into the surface pores of the homogeneous rigid PE body. This combination of extremely stable and at the same time homogeneous sinter structure and the coating with PTFE embedded in it makes the sinter-plate filter so remarkable. The dust particles separated out of the exhaust air stream at the filter layer deposit themselves on the filter surface. Penetration through the filter-active coating into the rigid body is not possible. This pure surface filtration rules out the clogging of the filter due to the lodging of solid particles in deeper filter layers as is encountered in deep-bed filtration in fabric filters. The cleaning of the filter surface by so-called jet pulses - a compressed air pulse against the direction of flow - is thus very simple and effective. The low primary pressure necessary for this and above all the very short valve opening time provide for a low energy consumption for the cleaning. Efficient cleaning and the pure surface filtration result in an almost constant pressure drop behaviour of the filter over the entire life cycle of the filter systems.

The extraction thus remains homogeneous and safe. That is an important requirement for the necessary workplace safety when working where hazardous substances are

generated. The operating company has taken all necessary safety precautions according to the state of the art only if the extraction is ensured at all times with the necessary intensity and without malfunctions.

The optimal energetic design of the operating point of the fan as well as its constant operation at the energetic optimum ensure the best possible efficiency.

No wear without shear forces

Abrasive materials such as quartz dust are separated out without damaging the filter-active layer. The absolutely stable support structure of the sinter-plate filter prevents flexing work of the filter medium and thus the occurrence of abrasive shear forces. The embedded filter-active layer remains intact over the entire service life - frequently more than 10 years. The cleaning jet pulse, which is directed contrary to the direction of flow, forms a short-term air cushion between the filter-active layer and the separated solids. Characteristic of rigid body filtration is the flaking off of the filter cake in the sedimentation direction as opposed to the fine spraying that occurs with conventional filter media. Among other things this allows a compact design of the systems, since the filter elements can be mounted with only a very small distance between one another. The extraction of particles from deeper fabric layers is not necessary with the pure surface filtration of the sinter-plate filter.

Photographs taken with a high-speed camera have clearly documented the advantages of surface filtration.

The filter elements are in addition insensitive to relative and absolute humidity as well as water. If necessary, the sinter-plate filter can easily be rinsed off by hand at the surface with water in accordance with the manufacturer's washing instructions.

Dust class H for safe recirculation of exhaust air

Quite some time ago, investigations carried out by the employer's liability insurance associations for the quarrying industry proved the outstanding quality of the Herding filter technology with the sinter-plate filter in dealing with quartz dust. The machine test of a Herding filter system from the Flex series by the employer's liability insurance association resulted in transmitances from 0.00016 up to max. 0.00068 % - always significantly lower values than the limit value of 0.005 % specified in EN 60335-2-69 for the dust class H. Unlike the EN standard, not only the filter but also the entire filter unit with all sealing points was tested here. Also unlike the EN standard, testing took place not with a test aerosol, but with real existing fine quartz dust. Thus it was confirmed that the Herding Flex filter system with the integrated sinter-plate filter can be used for air recirculation even in areas where there are hazardous substances such as fine quartz dust.

The decisive advantage of recirculating air operation for the operating company is the saving of heating energy during the yearly cycle. With each cubic metre of warm room air and each degree C of temperature loss, approximately 1.26 kJ of energy are lost or have to be replaced by heating power. At the usual extraction rates of a mid-size operation of 10,000 m³/h, around 12,600 kJ are lost per hour with each degree C. That corresponds to a permanent loss of energy of 3.5 kWh. From autumn until spring, temperature differences between indoors and outdoors of 10 degrees C and more are quite normal in our geographical region. In the case of a period of operation of, for example, 10 hours/day and a medium temperature difference of 10 degrees C on 200 days in the year, the heat recovery by recirculating the exhaust air results in a saving of energy of around 70,000 kWh/a. As energy prices continue to rise, recirculating air operation thus makes an increasingly important contribution towards the lowering of operating costs and hence an increase in competitiveness. The relevant



High-speed photo: comparison of deep-bed filtration with surface filtration

and applicable guidelines for the proportionate supply of fresh air naturally have to be observed and implemented.

Statement of a satisfied user

Godelmann GmbH & Co. KG, a leading premium manufacturer of high-quality concrete systems for garden, landscape and road construction, has used Herding filter technology for years for this reason. During the mixing of the raw materials, on the various production machines or during the individual refinement processes such as shot blasting, Herding filter systems ensure effi-

cient and reliable extraction of the carcinogenic fine dusts. "The Herding filter technology impresses us in particular due to the low maintenance expenditure and long service life. Beyond that, the excellent support provided by Herding Filtertechnik is very important to us as quality and innovation leaders", says owner and CEO Bernd Godelmann. The premium manufacturer Godelmann is thus well equipped to stay one step ahead of the competition in the future as well, with new creative products made of concrete, the universally usable material for open space design.

Over 35 years of experience and expertise

The matching of filter element and filter system on the one hand, as well as the optimal integration of the complete system into the complete process on the other, ensures an overall efficient and safe extraction of the generated fine dusts. Many years of experience in the design of filtration systems are necessary in order to keep the optimum flow velocity constant at the collection point and in the entire piping system over the entire period of operation. If the flow velocity falls locally below the solid-dependent limit velocity, this inevitably leads to deposits in the piping system and thus to a creeping reduction in the extraction performance. Particular attention is paid to the design of the collecting device at the point of dust generation. Since the flow velocity decreases with increasing distance from the pipe at a rate 20 times faster on the suction side than on the exhaust side, the matching of the volumetric flow rate to the structural design of the collection point is of decisive importance for workplace safety.

With the pure surface filtration of the sinter-plate filter, the loading of the filter elements can be monitored permanently and very effectively by means of differential pressure measurement. There are no known cases where the filter element has clogged up due to penetration of fine dust fractions into



From left to right: owner B. Godelmann, Herding project engineer R. Kraus, Godelmann production manager G. Linsmeier, Herding project engineer M. Mussemann



Booth extraction with clean air recirculation into a compressor room

deeper layers of the filter medium. The automatic cleaning of the filter surface by means of compressed air against the direction of flow is thus very reliable and efficient. The quality of the extraction performance remains constant over the entire service life.

Due to its high degree of separation and its sturdiness, the patented sinter-plate filter is thus a very economical filtration method for dedusting in concrete processing plants and all comparable areas of application. Decades of experience have confirmed this again and again.

Herding Flex – a compact filter system for all types of dust

In the Flex series Herding Filtertechnik offers extremely compact and very variable filter plants for many areas of application. The compact units consist of a noise-insulated fan unit, the vertically installed sinter-plate filter elements with jet pulse cleaning system and the dust discharge system. Appropriate connectors are included for all common types of connection for the raw gas inlet and the clean gas outlet. The dust can be discharged in several different ways, for example by means of a dust collecting container, a cellular wheel sluice, a discharge screw or by pneumatic discharge. Due to the low space requirement and the high variability, a retrofit or space-saving replanning is easily possible.

Extensive successful references with processes such as a mixing, grinding, sieving, bush hammering and sanding speak for themselves. Furthermore, Herding filter systems are used in the extraction of raw materials in quarries, in concrete block manufacturing and in all refinement processes in the concrete and stone industry. ■



Herding Flex filter system