

EXHAUST AIR FILTER AND HEAT RECOVERY SYSTEMS FOR STENTER FRAMES



KMA UMWELTTECHNIK



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ONE SYSTEM. TWO GOALS.

The exhaust air from stenter frames consists to a considerable extent of dust and oily aerosols but also of a valuable amount of heat from production processes. Therefore, manufacturers face the essential task of how to treat the exhaust air appropriately. As the leading solution provider with more than 60 years of business experience, KMA pursues two goals: Cleaning the air in textile industry while simultaneously recovering the heat. KMA ULTRAVENT® solutions combine the extraction and filtration of polluted exhaust air as well as the highly efficient recovery of heat energy in one system. Innovative filter technology by KMA provides cost-saving alternatives to conventional exhaust air treatment in favour of the production, the employees and the environment. KMA offers its clients custom-made filter solutions for all kind of textile fabrics which are processed in a stenter frame:

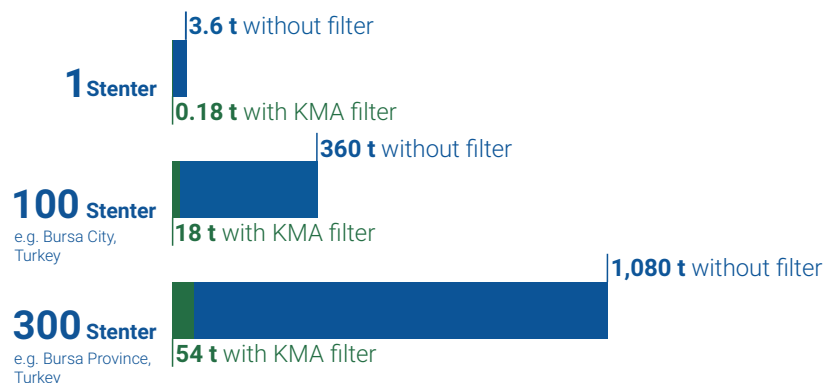
- natural fibers: wool, cotton
- synthetic fibres: polyacrylic, polyamide, polyester
- natural chemical fibres: viscose, acetate

AIR FILTRATION

The exhaust air is loaded with pollutant emissions as a result of the chemical and thermal treatment of textiles during the textile production and thermo fixation process. Strict national and local legal stipulations are placed upon textile manufacturers concerning air quality, occupational safety and environmental protection. A sustainable business policy also puts a strain on air pollution.

The electrostatic filter cells of KMA allow high-grade separation of fumes and aerosols even when faced with highly polluted exhaust air and sticky or greasy aerosols. They are characterized by high separation efficiency, durability and very low energy consumption. Depending on the mixture of exhaust air the ULTRAVENT® electrostatic filter cells can be combined with UV light tubes for the oxidation of odor. A filter replacement is no longer required due to the automatic filter cleaning system (CIP).

Tons of oil emitted by stenter frames per year



HEAT RECOVERY

Stenter frames can be operated with temperatures of more than 200°C depending on production mode or fabric type. For its operation the stenter requires a high consumption of energy – usually by cost intensive gas and thermal oil heating. In effect, energy costs can on average account for more than 20 percent of overall operating costs in the textile industry. Energy recuperation is an effective instrument to reduce operating costs in the textile industry.

With KMA ULTRAVENT® the valuable waste heat is energy efficiently reused. The integrated heat exchangers in ULTRAVENT® systems enable a recovery of the process heat. The recovered heat is then used for follow-up processes: it can be used to heat the supply air (e.g.: for the stenter frame) and / or to heat up water (e.g.: for the washing water in the dyeing mill).

Generally, the recovery potential is very large and can result in payback period of the entire system of less than

two years. That is how environmental sustainability is linked in an ideal way with increasing profitability.

Example of use:

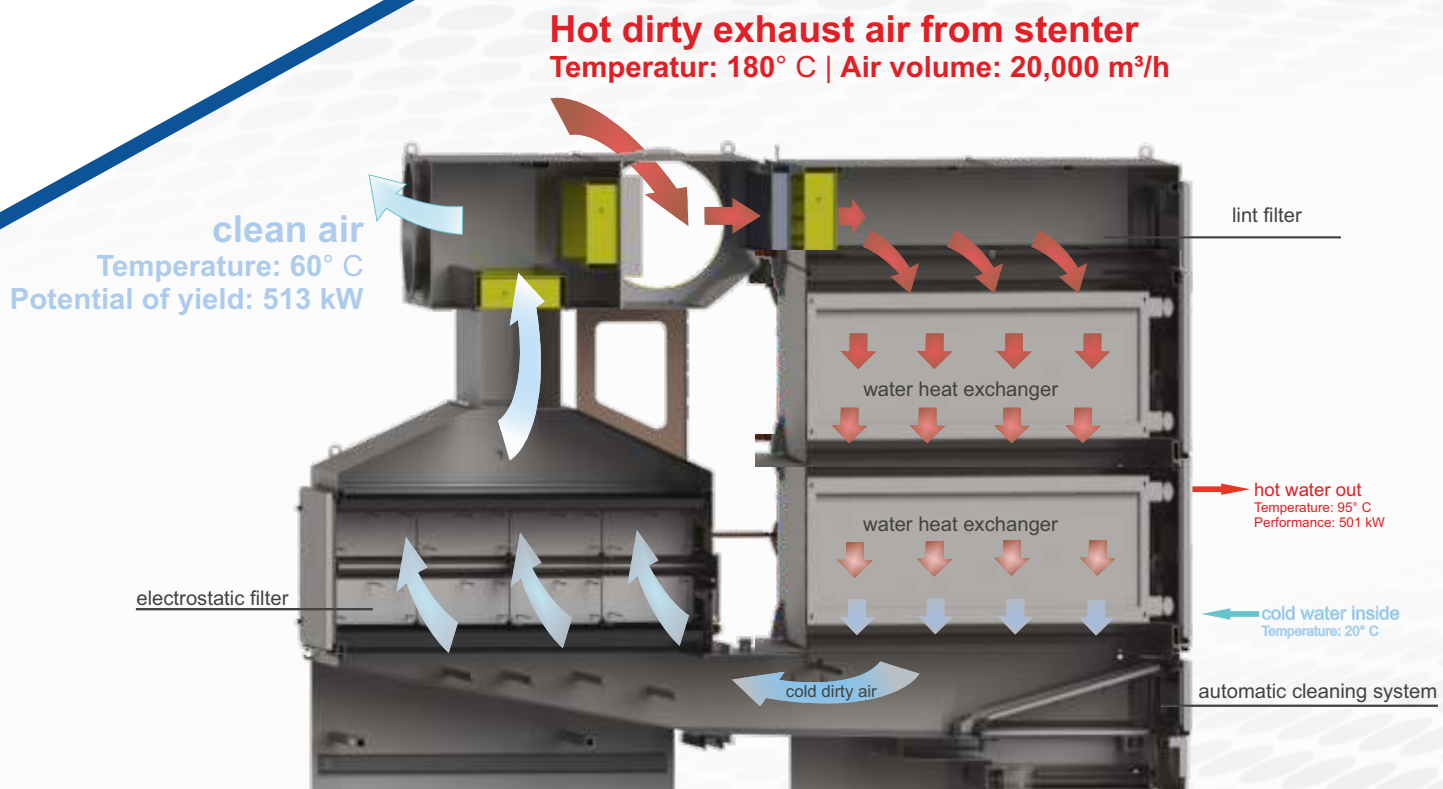
The amount of savings that can be achieved by using a KMA ULTRAVENT® system can be demonstrated by looking at a practical example: A customer has a stenter frame (6 fields) with an exhaust air volume of 20,000 m³ /h and 5,000 operating hours per year. The average exhaust air temperature is 180° C and the average ambient temperature in the factory is around 20° C. The recovered energy is used for heating up supply air as well as water. The savings potential is:

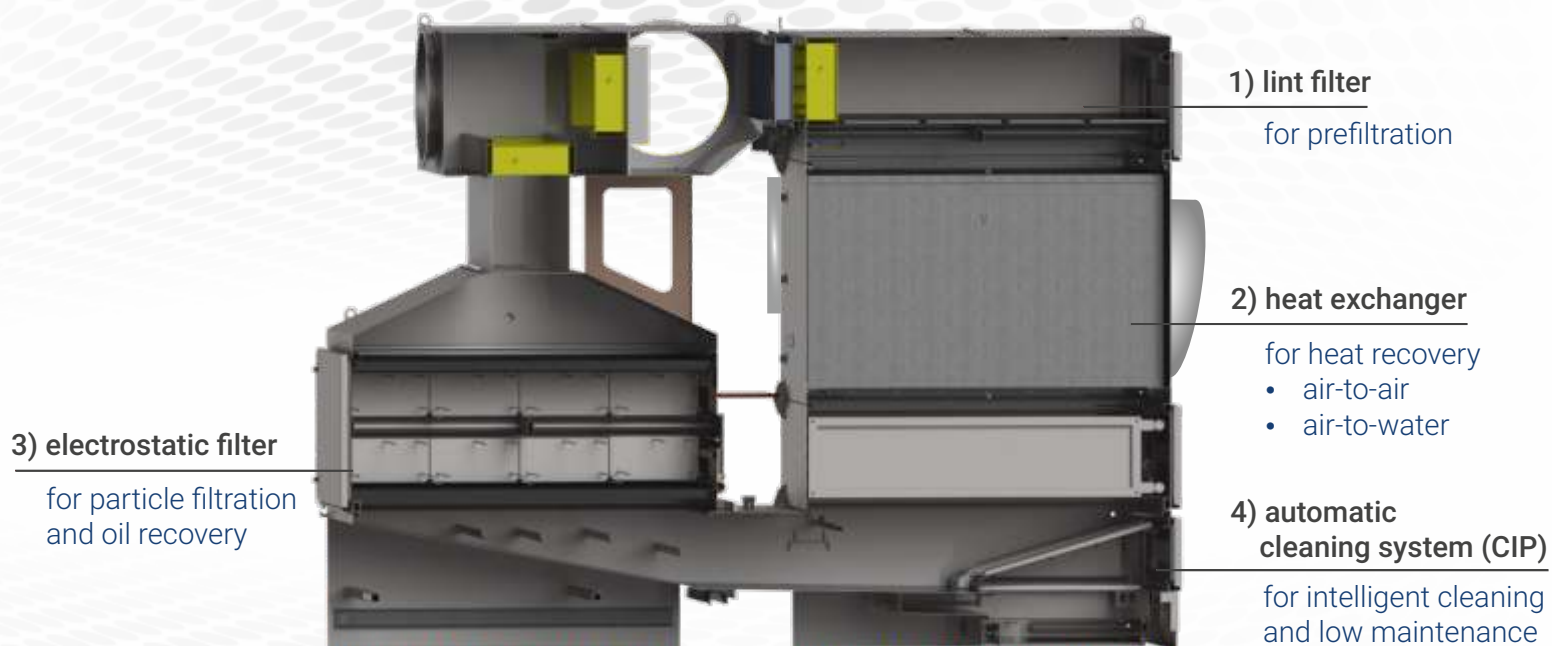
Heat recovery potential per hour	513 kW
Saved energy costs per hour*	12.82 €
Saved energy costs per year	64,000 €

*assumed gas price is 0,025€/kW

The benefits of KMA ULTRAVENT® at one glance:

- One compact system for highly efficient separation of oily smoke and aerosols as well as innovative heat recovery simultaneous
- Low energy consumption and a possibility of oil recovery equals a low payback period
- Filter replacement is not required through the automatic filter cleaning system
- Robust components (stainless steel housing) and no wearing parts – made in Germany
- Modular system with the possibility of retro-fitting
- Available in different capacity sizes
- Optional: highly efficient odor removal and / or integrated fire protection system





ULTRAVENT® SYSTEMS

THE MODULES FOR SUSTAINABLE OPERATION

1) Pre-filtration – lint separation

Processing rough materials from coarsely woven fibers usually create high amounts of lint ball particles. Here, a pre-filtration of the exhaust air is an imperative. Therefore, KMA offers in this case a lint filter. This consists of robust stainless steel wire mesh elements. The special shaping of the wire allows for a high separating capacity for coarse dust particles, for example lint balls.

2) Heat recovery by highly efficient heat exchangers

By integrating a heat exchanger in the ULTRAVENT® filter system a recovery of the process heat is made possible, in addition to the air purification. The recovered heat from the exhaust air heat can be used afterwards for follow up processes (e. g. air or water heating). For pre-heating of supply air a cross-flow heat exchanger (air-to-air operation mode) can be used. Alternatively, ULTRAVENT® offers liquid/air heat exchangers for heating up liquids like water (up to max. 90°C) or solar liquids (up to max. 160°C). The immediate installation of the heat exchanger next to the filter zone allows regular and frequent cleaning by the automatic filter cleaning system.

3) Particle filtration and oil recovery by high-performance electrostatic precipitators

ULTRAVENT® electrostatic filter cells assure the highly effective separation of smoke, dust and fine mist. The filter cells are characterised by the particularly robust design: frame, electrodes and carrying bars made of stainless steel, collector plates optionally in aluminum or stainless steel, insulators in oil-resistant ceramics and an optimised design for the separation of liquid or viscous substances. These features make sure that the electrostatic filter is an economical and durable filter medium for many applications. Often two categories of contaminants are captured in the electrostatic collection cell. One kind of the filtered substances is liquid, drips off the collection plates, and is collected in a recuperation tank. Often, the oil released during the process can be recovered and reused. The second type of contaminant forms a greasy or solid deposit on the filter surface. Unsuitable filter types can quickly plug and become ineffective, leading to excessive costs associated with filter replacement and disposal. However, KMA electrostatic precipitators never obstruct the air flow through the exhaust system.

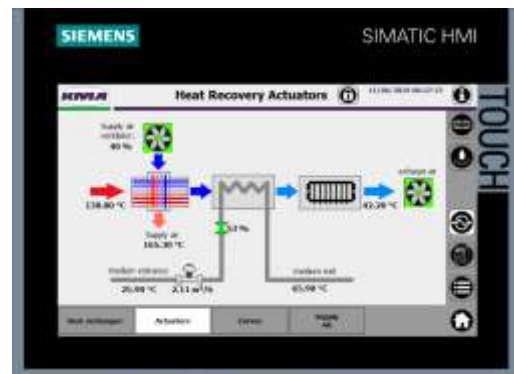


4) Low maintenance by automatic cleaning system (CIP)

As a standard, an automatic filter cleaning system is available for ULTRAVENT® emission control systems. It is suitable for cleaning all integrated filter media such as electrostatic collection cells or heat exchanger units. The automatic ULTRAVENT® washing system is unmatched in terms of comfort and cleaning results – due to its movable nozzle bar that moves back and forth above the collection cells during the filter washing process. It allows the regular and labour-saving cleaning of the filter cells with minimal water consumption, and thus ensures low maintenance requirements. The intelligent control of the cleaning system simultaneously reduces the consumption of water and of purifying agents. In the standard version the washing water is heated up by steam. Alternatively, the wash water can be electrically heated.

Programmable Controllers – PLC

A programmable control (Siemens S7 1500) monitors all the filter functions and controls the flow rates of the heat transfer fluid inside the heat exchanger depending on exhaust air temperature, volume and further target parameters. The display shows the actual heat recovery (current yield in kW) and the accumulated value of the recovered energy. The safety monitoring integrated in the PLC permanently controls the temperature at the inlet of the system and switches automatically to bypass operation in case of excessive temperature in the stenter frame. Simultaneously a signal will be given (e.g. to start the extinguishing process).



Furthermore, the PLC controls the CIP cleaning system and enables the comfortable programming of cleaning intervals, washing water temperature and many more parameters. All operation data is stored for a long period and can be provided if required (e.g. in the course of an ISO 14000 management). The comfortable touch display offers an intuitive operator guidance. A traffic light system (green-yellow-red) shows the current operating status of all the components. The forwarding of all relevant information to a central control system or integration in a remote maintenance system via profinet is possible. The system is equipped with an air-conditioned control cabinet.

ADDITIONAL OPTIONS

UV light for odour abatement

For odour problems the KMA filter system can be equipped by an integrated UV light module for energy-efficient odour abatement. For this, KMA uses vacuum UV tubes in moisture-resistant design. Due to the intense light treatment odorous VOC molecules are chemically oxidised. The result is a significant improvement in the odour situation.



Fire protection by fire extinguishing systems

ULTRAVENT® systems can be optionally equipped with fire sensors and fire extinguishing systems if there is a risk of fire. In case of fire, the system ensures that the filter device will be flooded with an extinguishing gas. As a result, further damage to the equipment can be avoided.

Ventilators

As further optional accessories, ventilators with silencers and frequency convertors are available. Generally, the original ventilation system of the stenter frame often can be used further because of the low pressure loss inside the filtration system.

FILTER SIZES AND MODULES

KMA ULTRAVENT® systems are available in three sizes with a filter exhaust air capacity of 15,000, 20,000 and 30,000 m³/h. For larger exhaust air volumes two or more KMA systems can be easily connected to each other.

The KMA exhaust air systems are based on a modular system, which combines several system components. Therefore, ULTRAVENT® system allows a precise adaptation to the needs of the stenter. According to the customer's request each system can be equipped with suitable heat exchanger modules. Thus, a KMA exhaust air system with one or two heat exchanger modules and two electrostatic filter stages is a common example.



TANDEM MODULE

Heat recovery for the heating of air & water

With the energy saving KMA tandem module the recovered heat can be utilized to heat up supply air and/or process water. As a result, the overall energy consumption of the stenter is reduced, since less energy from the cost intensive conventional heating methods such as gas or thermal oil heating is required.

KMA exhaust air filter in the tandem module are equipped with electrostatic filter cells for particle separation, heat exchangers for heat recovery, an automatic cleaning system for the cleaning of the filter modules and optionally UV-light for odour separation.

TOWER MODULE

Heat recovery for energy saving water heating

The KMA tower module uses the recuperated heat from the exhaust air for the heating of process water (up to 90°C) or solar liquids (up to 160°C). Consequently, the overall energy demand for water heating used in the dye house or laundry facilities is decreased substantially.

KMA exhaust air filter in the tower module are equipped with electrostatic filter cells for particle separation, heat exchangers for heat recovery and an automatic cleaning system for the cleaning of the filter modules.



CASE STUDIES

DOUBLE HEAT RECOVERY FOR DOUBLE EFFICIENCY

A 10-field stenter frame realized an energy recovery of 720 kW per hour and saved 90,000 € in energy costs annually. At the same time, CO₂ emissions have been reduced by over 680 tons per year.

Client application

A customer was looking for an energy-efficient way of heat recovery and exhaust air purification for his new stenter frame with an exhaust air volume of 30,000 m³/h. The goal was to reduce the high energy consumption of the stenter frame and to use the valuable heat from the exhaust air. The temperature of the exhaust air is 180°C on average.

KMA's solution

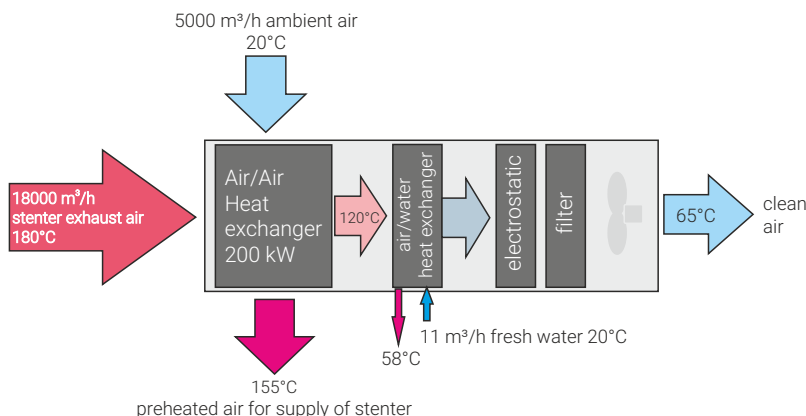
KMA supplied an ULTRAVENT® filter system with a double heat exchanger and a double electrostatic precipitator. The

KMA ULTRAVENT® filter system uses the valuable energy of the exhaust air in an extremely energy-efficient manner. The energy extracted from the exhaust air is supplied to the production process in two ways: first, by heating the supply air of the stenter frame. In this way, more than 200 kW heating energy can be saved. In addition, the energy recovery system heats about 11 m³ of industrial water for dyeing to 58 °C.

The result

The energy recovery of the system amounts to about 720 kW per hour and saves about 90,000 €* per year in energy costs. The payback period was less than two years. At the same time, the exhaust air is effectively cleaned and the company's carbon footprint improved by more than 680 tons per year.

*Based on gas energy cost of 0,025€/kW



HEAT RECOVERY FOR HEATING PROCESS WATER

By use of a KMA exhaust air filter system, a textile manufacturer cleans the exhaust air of its stenter frames and at the same time reduces its daily energy consumption by 300€. In addition, CO₂ emissions are reduced by more than 600 tons per year.

Client application

The client was operating a 6-field stenter frame with an exhaust air volume of 18,000 m³/h. He was looking for an exhaust air system which both should clean the exhaust air and at the same time reduce the energy losses of the stenter. The temperature of the exhaust air is 180°C on average. The goal was to use the valuable heat from the exhaust air for heating process water.

KMA's solution

KMA delivered for this project an ULTRAVENT® 20,000 filter system,

equipped with lint pre-filter, double electrostatic filter and double air/water heat exchanger. The existing ventilators and pipelines could be kept. The recovered heat is utilized for heating water for the laundry and dye-works. The energy recovery system heats about 6.3 m³ of water per hour from 20°C to 83°C. As a side effect, the oil which has been separated by the air filter, is drained and collected in barrels and can be secondary-used.

The result

Due to the high energy recovery of 450 kW per hour the company saves almost 300 € every day by the KMA Filter System. The CO₂ emissions are reduced by more than 600 tons every year. In addition, the client has recovered daily 35 - 50 liters of process oil for a second use. The mentioned cost advantages enable an amortization period of less than 2 years.



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