

## ENERGY-EFFICIENT GAS CLEANING

Optimal design of the exhaust system



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### CHALLENGE

In the past, the gas cleaning plant was an ancillary unit which was given little attention. However, in order to comply with environmental specifications and receive an operating license as well as to ensure economic operation, today's plants have to be significantly more efficient and need to be optimized as regards energy consumption. In order to comply with the statutory limit values for dust concentration at the workplace, the number of extraction points was continuously increased. The growing amount of exhaust gasses produced in this way would then be extracted with energy-intensive fixed-speed induced-draft fans.

However, the fixed-speed fans lack flexibility. Only by controlling the negative pressure at the gas inlet to the filter house it is possible to adjust the overall system to ensure that the required extraction capacity is provided at all extraction points. As a consequence, at remote points only a reduced extraction capacity is available. This effect can only be reduced by constantly increasing the fan speed, which in turn will lead to a noticeable increase in power consumption and therefore energy costs.

### SOLUTIONS FROM SMS SIEMAG

Today, the focus lies on meeting the statutory requirements and achieving an economic, i.e. resource-saving collection of dust particles from various emission sources. SMS Siemag uses flow simulations to ensure the optimum design of the entire gas cleaning plant, adapting the geometry of the plant components such as hoods and furnace roofs to the current level of knowledge.

The X-Pact® Gas Cleaning Assistant is a patented new development by SMS Siemag. An optional automation module for controlling the complex gas transmission system. The module implements an algorithm into the system which provides for dynamic and ideal damper controlling at each extraction point and ensures maximum extraction performance without unnecessarily increasing the speed of the variable-speed induced-draft fan. The combination of flow-optimized components and the simultaneous control of all control damper at the extraction points, which is adapted to the respective operating conditions, achieves a very high rate of dust particle collection. All processes are executed by the X-Pact® Gas Cleaning Assistant during ongoing operation.

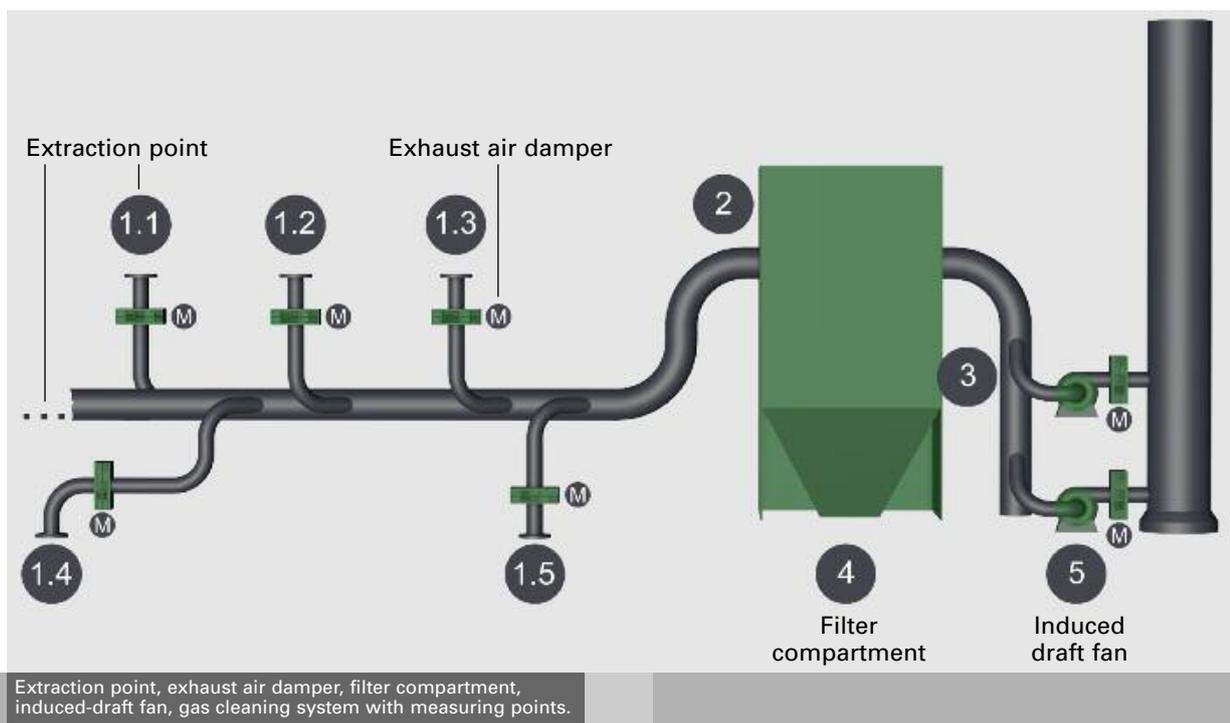


## STRUCTURE OF AN EXHAUST SYSTEM

Typically, an exhaust system consists of three sections. Dust is extracted at various extraction points in the steel plant. The dust then is conveyed through a piping system to a filter compartment. Induced-draft fans generate the negative pressure required for this purpose.

1. (1.1 - 1.5) Determination of the desired volumetric flow rates at the extraction points (typically up to 20). There is no limit to the number of extraction points.
2. Negative pressure measurement from the mixer / filter house and volumetric flow rate: These measurements are the basis for an optimal control of the induced-draft fans.

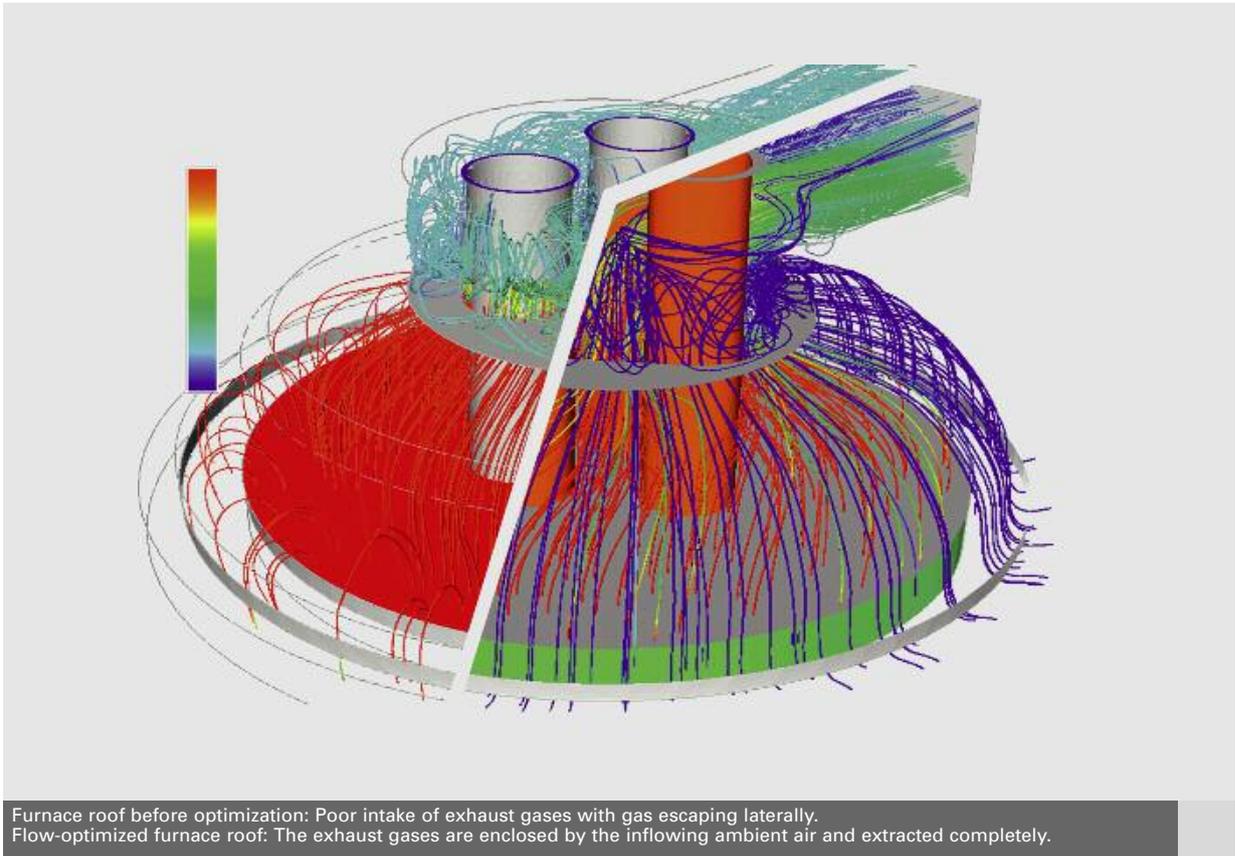
3. Level measurement at the filter hopper (and at further potential points where dust is collected in the system considered): The level measurement serves to monitor the occurring amount of dust.
4. Differential pressure measurement, filter house: This measurement serves to determine the degree of clogging of the filter.
5. Speed control of the induced-draft fans: Depending on the process requirements, the speed of the induced-draft fan can be increased or reduced.



## FLOW-OPTIMIZED EXTRACTION

Components at the extraction points and in the gas piping system which are not flow-optimized generate heavy turbulences and therefore impair the removal of the exhaust gases. To compensate for the pressure loss thus generated in the overall system, the performance of the induced-draft fan has to be increased. This in turn leads to a significantly higher power demand, while the quality of extraction decreases. That is why SMS Siemag uses special

software to simulate the exhaust gas flows and detect ineffective bottlenecks and turbulences. Based on the results provided, the component design can be adapted in order to ensure an optimal gas flow. These measures minimize the pressure loss in the overall system. In this way, significantly lower fan speeds are sufficient to achieve the desired extraction quality, so that the power demand at the fans is noticeably reduced.



# X-PACT® GAS CLEANING ASSISTANT

## Optimum control of the extraction process

The figure shows the direct comparison of a secondary dedusting plant with the new X-Pact® Gas Cleaning Assistant and a conventional control system. The process situation presented here shows that both plants have two extraction points in operation at the torpedo car and the converter. However,

the processes vary as regards the volumetric flow rate removed **1**, the negative pressure in the system required for this purpose **2**, the input of electric power **3** and the resulting energy consumption of the induced-draft fan **4**.



### CONVENTIONAL CONTROL SYSTEM

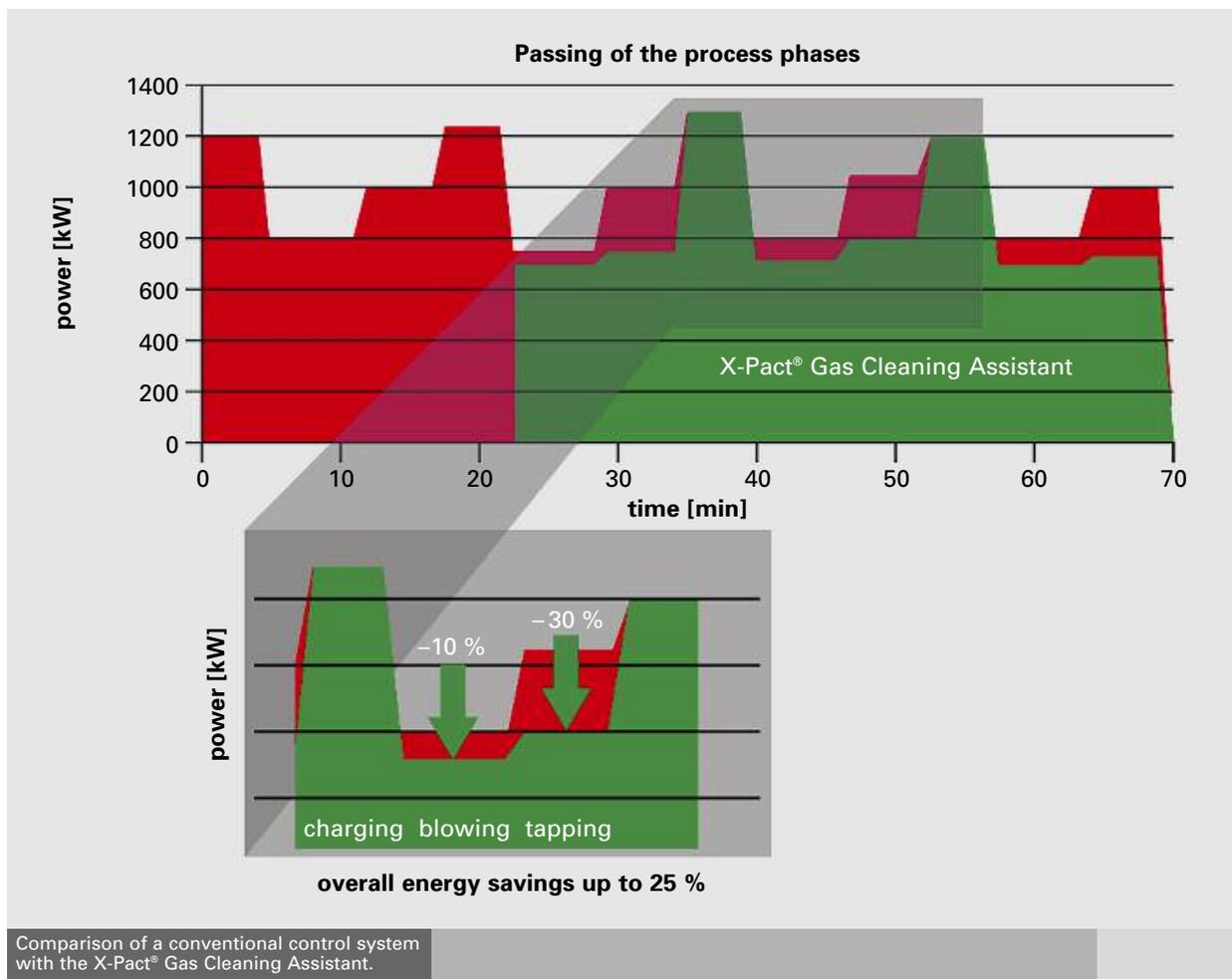
A conventional dedusting plant has defined damper positions for various process situations, which are permanently stored in the control system. The number of extraction points required to operate simultaneously results in an additional pipe resistance. Due to the defined damper positions, the extracted volumetric flow rates are not optimally distributed. The extraction capacity at the individual extraction points is either too high or too low **1**. The required negative pressure in the dedusting system is held at a constant high value **2**. This results in a high power input **3**.

### X-PACT® GAS CLEANING ASSISTANT

The gas cleaning assistant has a control algorithm which is based on a mathematical model. Depending on the process requirements and the number of extraction points in operation, the optimal damper positions are calculated online. In this way, an ideal volumetric flow rate at the extraction points is provided for **1**. The optimal negative pressure is calculated and set individually for each process requirement **2**. Compared to a conventional control system, the power input is reduced by up to 25% **3**.

## ENERGY-EFFICIENT OPERATION WITH THE X-PACT® GAS CLEANING ASSISTANT

- Energy requirement reduced by approx. 25% thanks to controlled induced-draft fans and control damper
- Effective and homogeneous extraction at all extraction points
- Adherence to statutory limit values
- Ready for integration in existing automation systems



## INDUCED-DRAFT FANS

The variable-speed induced-draft fans are designed specifically for the process requirements. The X-Pact® Gas Cleaning Assistant adapts the speed to the various operating conditions. In this way, the fans always work at the optimal operating point. This results in an increased service life and a reduced amount of maintenance. The high quality of the mechanical equipment used is ensured by SMS Siemag in cooperation with renowned fan manufacturers offering specialized products for this type of application.

## SERVICING AND MAINTENANCE

Furthermore, the X-Pact® Gas Cleaning Assistant includes intelligent process monitoring. The monitoring functions ensure reliability in long-term planning for operation and servicing of the plant. In this way, the system e.g. recognizes premature wear of the exhaust air damper or provides a forecast for the amount of dust occurring in the filter compartment.

### FEATURES AND BENEFITS

- High energy efficiency
- Optimal dust extraction
- Long-life high-quality components
- Intelligent process monitoring
- Intuitive operation
- Easy integration with existing automation systems

## USER-FRIENDLY DESIGN

In order to ensure that the operating personnel is provided with a good overview over the technical status of the plant at any time, special emphasis is put on a transparent and clear presentation of the processes.

That is why the HMI 2015 developed by SMS Siemag is used here. The operator interface is characterized by an intuitive design, so that the operators only need a short training phase to become familiar with the interface.

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