ACOUSTIC CLEANING SYSTEMS

Introduction to acoustic cleaning

The operation principle of acoustic cleaning is based on high-energy sound waves generating pressure differences on dust and ash particles. By constantly switching direction, the waves exert power on each individual particle, eventually shaking them loose from the surface. Depending on local conditions, the detached particles are then carried away with waste gas or by gravity.
As part of this process, it is essential that the residual damp of the material to be cleaned lies below 15% and the sound pressure level is above 130 dB(C).

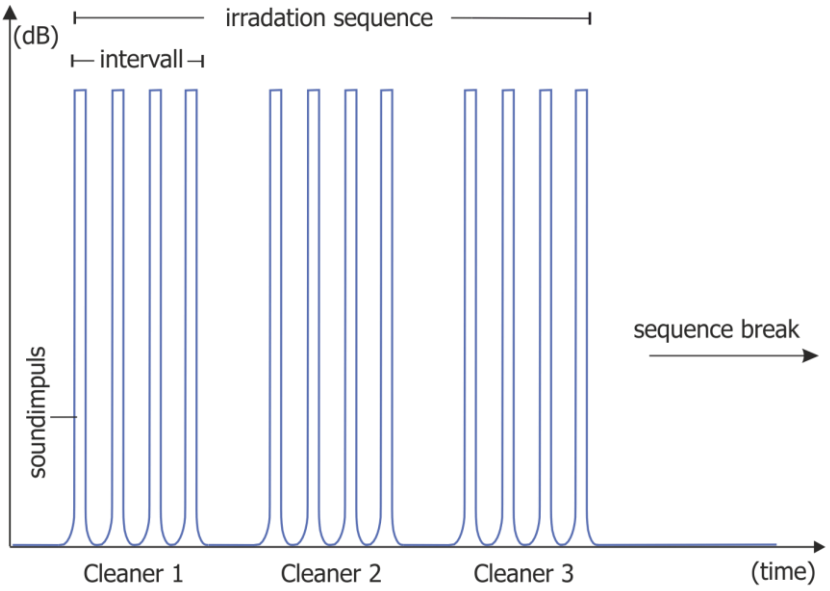
In accordance with these physical values, our pneumatically operated acoustic cleaners generate a sound with peaks in the frequency range between 80 and 250 Hz which enables effective cleaning. Depending on the quality of the local compressed air supply, the sound pressure lies at a maximum of 162 dB(C).

Mode of operation

At the core of the acoustic cleaner is a generator. A prestressed membrane between the lid of the acoustic cleaner and the body of the generator is made to vibrate using compressed air, thereby generating sound waves.

The base frequency of the generated sound wave determines the acoustic cleaner's frequency spectrum, depending on the length of the flaring horn which is attached to the generator. So as to achieve maximum cleaning results, we have chosen very low frequencies for our acoustic cleaner.

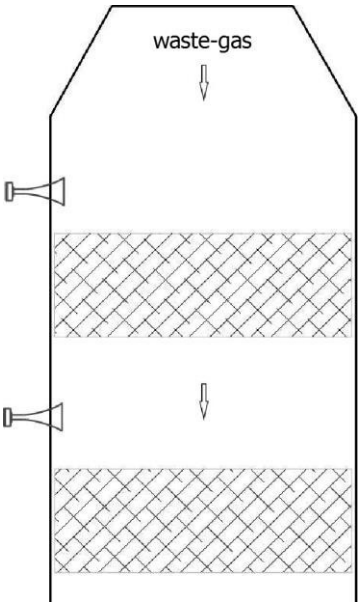
The effectiveness of the acoustic cleaner depends not only on the type of material deposits, but also on the waste gas temperature, the size and shape of the absorbing surfaces, and the structure of the elements to be cleaned.
Only 6.5 bar compressed air and a 230 V power supply for the control unit are required for operating the system. In addition, when determining the dimensions of the compressed air supply, it is important to check that the acoustic cleaner has the necessary compressed air for generating sound; the quality of the air supply has a direct impact on the performance of the acoustic cleaner.



The number of acoustic cleaners (sonic horns) and sound wave sequences need to be adjusted to fit specific local conditions. The length of the sound impulse generally lies between 4 and 6 seconds. Normally, 4 impulses are delivered per sound interval. The sequence break varies from 10 minutes to several hours.

Installation

The acoustic cleaner can be installed between individual cone sections with a wall flange, or it can be directly welded onto any suitable surface. The position of the relevant facility component varies widely. However, in planning the installation, the following general factors should be taken into account (cf. diagram on the right):



• The installation should always be carried out on the waste-gas side of the object to be cleaned, with at least 1 meter of free space in front of the horn to ensure that the sound wave can expand properly.

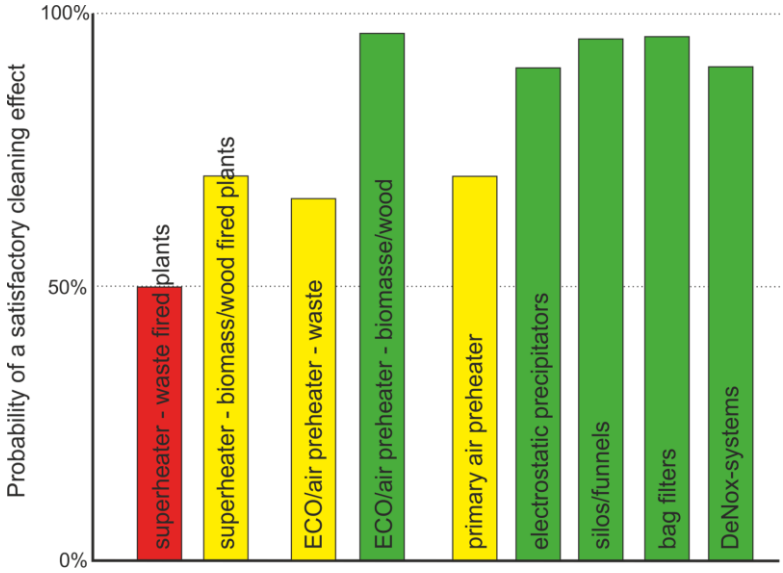
• The space between the horn and the facility component to be cleaned should be kept clear (not blocked by deflector plates, etc.).

• To avoid dust or ash getting into the horn or generator, the funnel opening must never face upwards or be counter-directional to the waste-gas stream.

• Since sound waves expand spherically and the cleaning effect is largely impacted by the reflexion of sound, the opening of the horn funnel does not necessarily need to be directed straight towards the object to be cleaned.

Areas of application

All industrial processes working with particles and powdery goods are faced with more or less serious problems concerning caking and unplanned material deposits. These affect both the efficiency and overall functioning of the facility. Acoustic cleaners offer a varied range of applications. Besides the removal of ash and dust deposits in pipes and on heat exchanger surfaces in **air preheaters** (of any type), **economisers** and at times **superheaters**, deflector plates and waste spouts of **electrostatic precipitators** can also be kept clean for the long term.
Beyond that, acoustic cleaning has proven to be a safe and energy-efficient method for cleaning **DeNOx systems** and **bag filters**, keeping **fan wheels** free of dust and removing fine dust from **silos, waste spout discharges** and **multicyclones**.



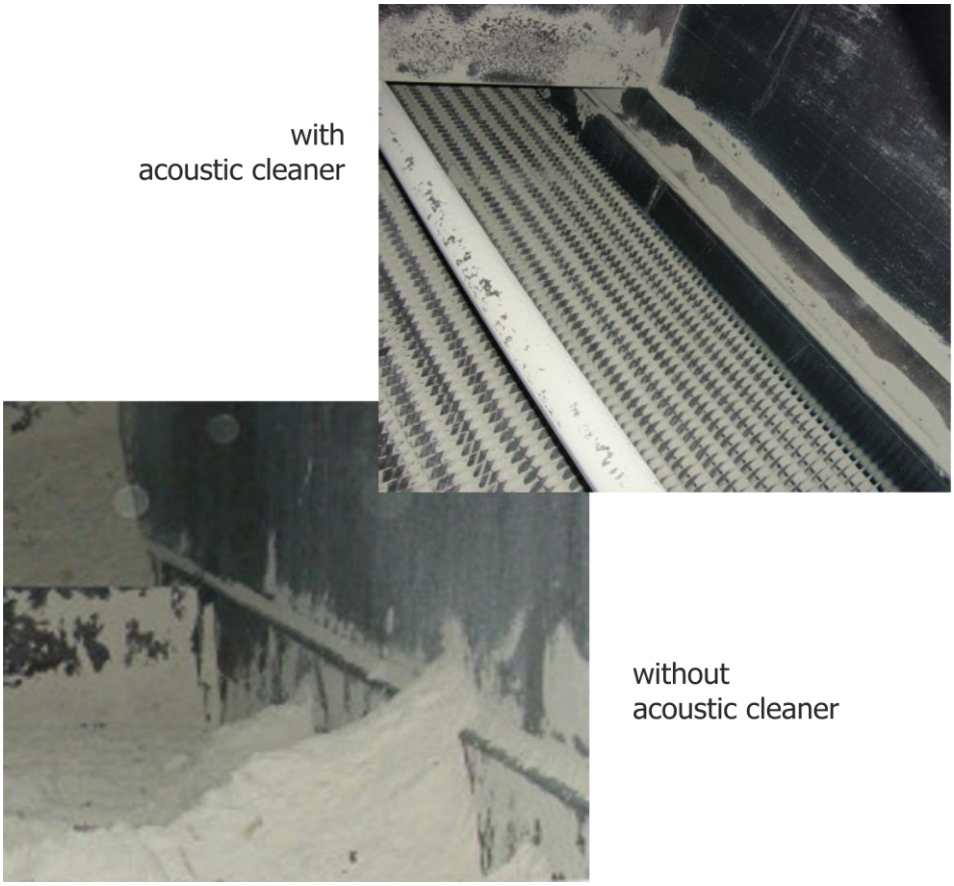
Since every type of facility works differently, it is impossible to guarantee a 100% satisfactory cleaning effect through the application of acoustic cleaning systems (see *Trial periods* under the *Services* section).
The graph to the left aims to provide an overview of the prospects for a successful application of acoustic cleaners. The data is based on the relationship between all the trial periods we have carried out and those that were successfully completed.

Why opt for acoustic cleaning?

Our acoustic cleaners are ideally suited for removing ash, powdery and fine-grained materials such as colour powders, cement dust, rock flour, plastic granulate and washing powder from a wide variety of surfaces without process interruptions.

The main benefits of acoustic cleaning:

- Easy installation due to variable positioning (e.g., in existing manholes)
- Low costs for purchase and installation
- Minimal and maintenance and operational costs
- No mechanical or corrosive wear of existing structures
- Continuous cleaning while in operation with no impact on the process temperature or cycle
- Good cleaning effect in otherwise inaccessible areas, due to acoustic reflection
- improved heat transfer during operation and extended period of operation
- reduced cleaning effort during maintenance downtime
- long life period due to usage of high quality materials



Products

Acoustic cleaners

A. W. Akustik GmbH offers a variety of sonic horn types, both straight and curved models, which can be adapted to fit individual customer specifications. The modular structure of the horns and the option of adapting them to special demands (regarding, for example, high temperatures) enable us to offer our customers the ideal solution for any installation and many different temperature ranges.

Our horns are manufactured by means of a precision casting process using stainless steel (1.4308 - standard alloy/ 1.4581/1.5415) or aluminium; generators and compressed air tubes are also made from stainless steel (1.4301). We use a special titanium steel alloy for the membranes and carbon for the seals.

Our acoustic cleaning systems are supplied pre-assembled, having been tested in our sound chamber, complete with ¾" air service unit and compressed air hose.

The service units are supplied with a ball valve with forced venting, a pressure regulator and a solenoid valve (coils 24V DC) with a bypass for cooling and purge air as well as manual bridging.

The solenoid valve can be controlled either via the client's existing control system or a programmable control unit. We use a control unit based on a SIMATIC S7-1200 with a KTP 600 PN 5.7" STN mono-display touch panel as our standard control system.

As a test control system, in the case of very straightforward requirements or with a small number of acoustic cleaners, we typically use a control unit based on a Siemens "LOGO!" module. Its 4 outlets can be controlled either in parallel or in cascade operation. The functioning of individual acoustic cleaners can also be tested via rotary switches.

The quality of the existing compressed air is typically sufficient. Should problems involving dampness or material build-up arise, microfilters and/or condensate traps can be installed in central locations.

The systems can be mounted between the individual cone sections using an existing wall flange, or directly welded onto any part of the outside of the horn.

K types*

K* type acoustic cleaners are typically used whenever the space to be treated is small and/or the predominant temperature is low (e.g., in silos, funnels or DeNOx systems).

Sound power level (max.): 162 dB

Upon request, we can produce smaller generators for applications which only require low acoustic pressures.

We can also produce the cones in special alloys on customer demands (minimum order quantity 20 pce.).

L types*

L* type acoustic cleaners are typically used whenever the space to be treated is large and/or where the predominant temperature is high (e.g., in superh-eaters, economisers or electrostatic precipitators).

Sound power level (max.): 160 dB(C)

For Type LSSO, a D cone is flanged onto the CF cone. The D cone is handmade from high temperature resistant steel to meet individual client requirements and installation positions.

Services

Trial periods

Our extensive experience enables us to reliably predict the positive effects of our cleaners in many areas of application. In other areas, however, predictions regarding the effectiveness of our systems are difficult or impossible to make. For this reason, we offer our clients the option to try out our systems.

In collaboration with our technician, the customer determines the place of installation, type of cleaner and duration of the trial period. Together, they identify ways of testing the effectiveness of the system during this trial phase. This checking of effectiveness and results can be done visually or by using existing measuring equipment and comparing results with previous records.

Our service team carries out the start-up procedure and monitors the process. This enables customers to see for themselves, before making a purchase decision, the effect and efficiency of our acoustic cleaners. We will be pleased to provide you with a detailed, made-to-measure quotation that precisely meets your requirements (trial period duration and number of systems).

Maintenance and servicing

All types of acoustic cleaners require regular servicing. Insufficient servicing can lead to a significant loss of effectiveness and, as a consequence, even complete failure. We regularly (usually twice a year; latest after 100 operating hours) check the functioning of our installed acoustic cleaning systems – even those of our competitors if necessary!

Any defective components are replaced and the systems are repaired. Should clients wish to carry out maintenance themselves, we offer the relevant training of on-site personnel and supply any required replacement parts.

Noise protection enclosures

In areas with special requirements regarding noise emission, we offer noise protection enclosures for our acoustic cleaners. The standard sound insulation reduces the acoustic noise emitted by the generator's head to approximately 90 dB(A). Upon request, even greater noise reduction can be provided.

However, it must be borne in mind that part of the noise emission is due to the insufficient insulation of the facility area requiring cleaning (normal heat protective insulation has little effect on the propagation of sound in the emitted frequencies). We are always happy to speak further with our customers regarding the implementation of relevant noise protection measures. Insulation can be adjusted to meet individual client needs and installation situations and can be custom-made using a variety of insulating materials.

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