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# ACOUSTIC CLEANING SYSTEMS

## Manual

## 1. Safety notes

The operation of the acoustic cleaning system generates a significant level of noise, which also affects the area around it. The noise level can, however, be controlled and reduced to an acceptable level if the sonic horn and the surrounding components are insulated with suitable absorbing material. In practice, most emissions emanate from the entrance holes of boilers and the openings of steam cleaners. By effectively insulating such places, the noise level in the surrounding area may be reduced.

Make sure never to obstruct a hot acoustic cleaner's air supply – the cooling air must have free access to the sonic horn at all times, since the membrane may be damaged by temperatures exceeding 300°C.

Always wear ear protectors when you are near an acoustic cleaner.

Make sure to affix a clearly visible warning sign next to the acoustic cleaner to warn people of the noise emission (please observe currently valid regulations).

Never switch on an acoustic cleaner without taking the necessary safety measures beforehand.

Always shut off the acoustic cleaner's air pressure supply before carrying out service or maintenance work. Make sure that the power supply of the magnetic valves is also turned off.

When carrying out a test, always make sure that no one is near the horn or inside the respective area of the plant. All involved parties should wear ear protectors at all times.

The installation locations of the acoustic cleaning systems must be freely accessible at all times for maintenance work either by a platform or fixed scaffolding.

For insulation work, be sure that the electric and compressed air connections to the acoustic cleaners are switched off.

Always wear protective gloves during maintenance work and when carrying out construction work on the acoustic cleaners during operation.

## 2. Installation

### *General information*

**Please observe the safety notes before starting up the acoustic cleaning systems or carrying out maintenance work on them!**

Various methods exist for installing the acoustic cleaner's bell to the wall or manhole opening of a plant. The opening of the bell must be directed either downwards or horizontally, but never upwards. This prevents large amounts of dust from gathering in the bell and blocking the membrane.

To optimise the sound quality, at least 1 meter of free space should be left in front of the opening.

A prestressed membrane is installed in the sound bell's head, the so-called generator, between the frame and the lid of the generator. This membrane consists of a special hardened titanium alloy. The membrane is made to oscillate by compressed air to create sound waves in the bell. The air vibrations, which are thus generated, turn into sound waves in front of the horn. Depending on the type of acoustic cleaner, cleaning-efficient frequencies lie between about 65 and 250 Hz at a maximum sound pressure of about 162 dB(C).

Dust particles tend to both stick together and stick to surfaces. Sound pressure separates the individual particles from one another, as well as from the surfaces to which they are attached, because it is stronger than adhesive power. After the individual particles have been detached, they are either removed by the flue gas flow or simply fall to the ground.

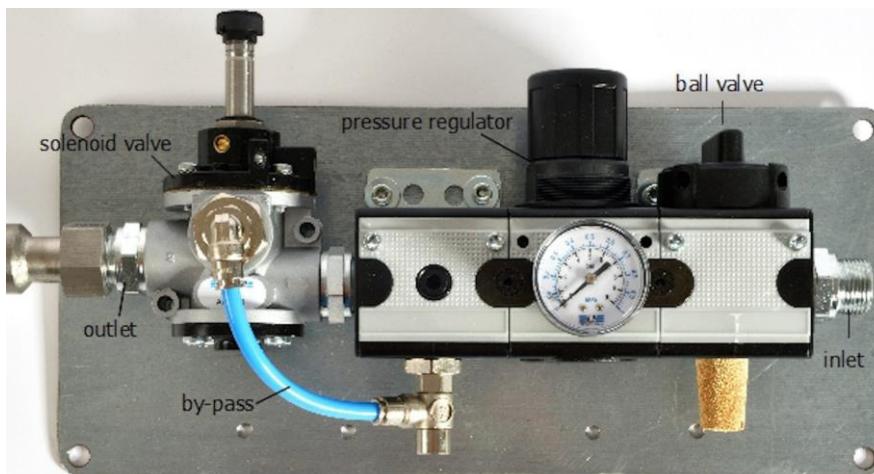
The effectiveness of acoustic cleaning not only depends on potential soiling but also on the temperature of the medium (e.g., flue gas), the surface and the structure of the elements to be cleaned. These factors determine the number of required acoustic cleaners, the sound duration and sound intervals. Ideally, one acoustic cleaner is enough to start with in a new or freshly cleaned plant. In such cases, the sound vibration prevents particle deposits from accumulating on surfaces in the first place.

### *Compressed air supply*

The acoustic cleaners are operated with compressed air. Usually, regular industrial compressed air is used. If this is not possible due to the nature of the plant, the acoustic cleaner can also be operated with nitrogen or carbon dioxide.

The compressed air is used for operation as well as for cleaning and cooling the generator.

The existing air quality is usually sufficient. If the air contains large amounts of pollution or too much humidity, a filter/water separator must be fitted upstream.



The air maintenance unit consists of a ball tap, a pressure regulator and a 3/2 multi-way valve with scavenging air bypass. A small adjusting screw is found in front of the magnetic valve and is used to adjust the cooling and scavenging air (bypass valve).

The pressure level of the compressed air on the supplied compressed air valve must be at least 6 bar. During the sound generation, the pressure on every acoustic cleaner must be at least 4.5 bar. The highest efficiency of the cleaning system is reached at a compressed air ratio of 5:6.5 bar.

The required flow rates are typically reached through the compressed air supply provided along with the system. If this is not the case, the necessary air reservoir and, if required, screw compressor, can be installed. An internal diameter of 1.5" is usually sufficient for a 5-10 m supply pipe. For longer distances, pipes with a diameter of 2" need to be provided for.

The pipes require thorough cleaning before being attached to the compressed air supply. The surrounding temperature in the area of the compressed air maintenance unit must not exceed 50°C. The air supply must never be turned off when the acoustic cleaner is hot. Cooling air must have free access to the bell at all times in order to protect the membrane from damage.

## *System control*

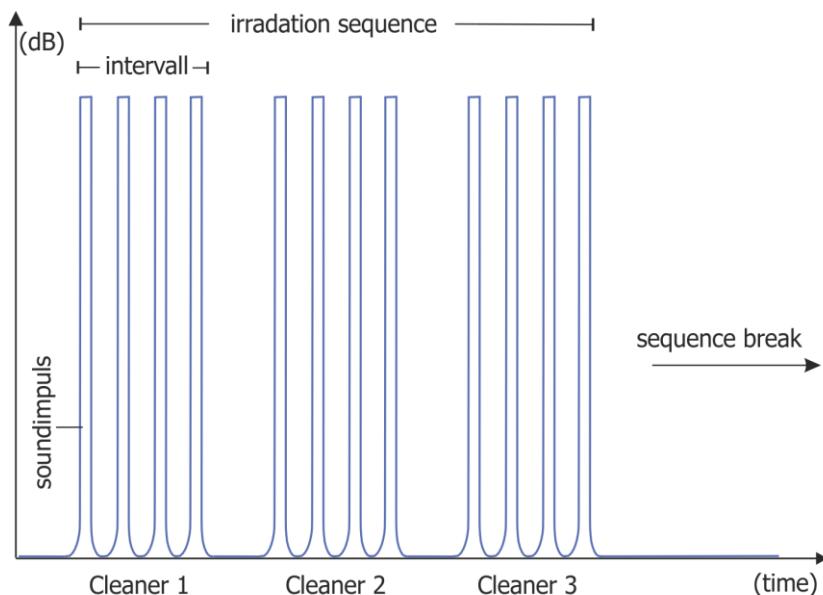
The acoustic cleaner's operation is controlled via a 3/2 NC magnetic valve (solenoid valve). The magnetic valve can be operated using a variety of different coils for various direct and alternating voltages (24 VDC or 230 VAC/50-60 Hz).

The acoustic cleaning system is delivered complete with a programmed control system. Depending on the respective system requirements, the control system works using Siemens LOGO! or Siemens S7-1200. The system can also be controlled via the central control system.

The temperature surrounding the control unit may not exceed 50°C. The control voltage of the acoustic cleaners' magnetic valves must be turned off during a plant standstill or during maintenance work.

## **3. Operation**

As a rule, short sound impulses are created in the cleaning process, since tests have shown that effectiveness is highest at the beginning of each sound. Longer sound intervals do make sense, however, for very large amounts of deposit.



In most cases, the length of the sound impulse varies between 4 and 6 seconds with a break of around 3 seconds between individual sound impulses. In one interval usually four sound impulses are transmitted. The sequence break varies between 10 minutes and several hours. Application-specific parameters must be adjusted on the basis of existing experiences and operation requirements of the respective plant.

## 4. Service and maintenance

### *Adjusting the acoustic pattern*

The scavenging air at the compressed air unit and shut-off valve of the generator must be carefully adjusted when necessary (e.g., when replacing worn parts). The following steps must be followed in the given order:

- Supply air to the compressed air system and completely open the back pressure valve of the generator.
- Open the bypass valve until a sound can be heard from the generator. If there is no sound (which can happen when the membrane is flipped or when a new membrane is used), activate the acoustic cleaner a few times without the back pressure valve.
- Close the bypass valve until the noise disappears again.
- Activate the acoustic cleaner by bridging the magnetic valve.
- Close the back pressure valve until an even, undistorted sound becomes audible.
- Close the manual bridging and activate the control.

The above steps are only tips for generating a clear and undistorted sound. Only a qualified technician can ensure perfect installation that guarantees the acoustic cleaners' optimal effectiveness. We recommend having the acoustic cleaning system serviced by our technicians on a regular basis. It is possible that over time the air ducts of the cleaning systems may become soiled during operation or that deposits may clog up the bell body. We therefore recommend that the quality of the generated sound be checked once per day to observe potential changes. If the sound is no longer clear, the sound pattern can usually be restored by cleaning the soiled components and readjusting the system.

### *Checking the membrane and generator*

The generator should be given maintenance on a regular basis. This involves opening and cleaning the generator as well as checking the membrane, seal and back pressure valve.

The wear of the membrane is affected by the cleaning frequency, temperature and dust exposure of the generator. Make sure to replace the membrane on a regular basis since a broken membrane can damage the generator's casing.

The ideal frequency of replacing the membrane can only be established after sufficient operation time. Generally, a membrane must be flipped after approximately 6 months and replaced after about one year. If cracks are discovered in the membrane, it should be immediately replaced.

Since the membrane's vibrations create friction on the casing foundation and cover, which, in turn, result in mechanical wear, we recommend that you contact our technicians for a general overhaul of the system 3-5 years after putting it into operation (this period can vary depending on the respective system). To ensure the disruption-free operation of the acoustic cleaner, we recommend having our technicians provide it with maintenance every 6 months.

### **Only use original spare parts!**

The use of components by other manufacturers can lead to performance losses or even to the complete failure of the acoustic cleaners.