SONIC CLEANING

for

Power- and Heatingplants

Kockum Sonics

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The embryo of Kockum Sonics was formed already in the 1870's when Kockums Shipyard launched its first new-building.

In 1918 Kockum Sonics was awarded the patent for the Kockum ship whistle – now a world wide standard!

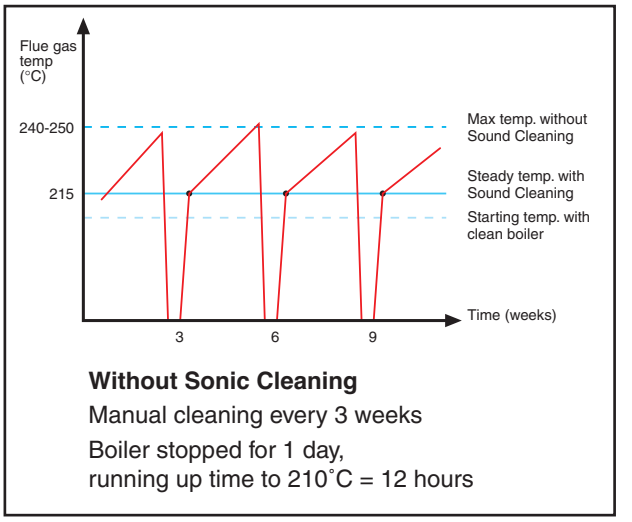
Ever since we at Kockum Sonics have explored different industrial- and commercial areas where our expertise in acoustics and sound generation can be applied.

In the late 1960's the first trial with sonic cleaning for industrial use were conducted in Europe, today we have thousands of installations in a wide variety of applications all over the world.

Basic theory of cleaning by sound

The basic principle of sonic cleaning is to create a sound wave carrying an energy level exceeding the forces that tend to make particles suspended in a gas flow to adhere to each other and the surrounding surfaces, i.e. preventing a build up by breaking up the particles before they can form a hard layer.

In practice this is achieved by activating one or more sound emitters for a short insonation period and repeat this insonation cycle continuously with certain intervals, more frequently for harsher conditions and with longer intervals between insonation for lighter conditions.



Without Sonic Cleaning

Manual cleaning every 3 weeks

Boiler stopped for 1 day,
running up time to 210˚C = 12 hours

This continuous on line cleaning method can decrease costly shut downs and increase product recovery with virtually no wear on the process.

To obtain optimal cleaning results it is important to comply with the following conditions:

- the build up has to be dry and powdery, the lower the moisture content the better the cleaning result
- the sound pressure level has to be high enough throughout the whole volume that is supposed to be cleaned, i.e. make certain a correct number of sound emitters are engaged
- the time interval between insonations must be short enough to ensure that particles do not become firmly adhered to each other (a normal cycle is 10–15 seconds of insonation every 5–10 minutes)
- in installations with vertical gas flow, such as boilers and cyclones, gravity alone will transport the loosened parts, in other cases a minimum gas velocity of 5 m/s is required
- start with clean surface, sonic cleaning is a method of preventing build ups to form

Economical benefits achieved by Cleaning with Sound

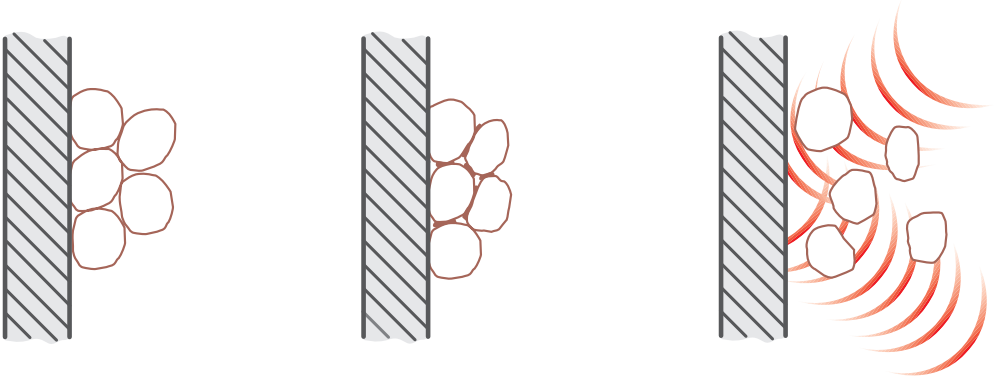
- Increased Power Output
- Higher fuel efficiency
- Improved heat transfer & filter efficiency
- Decreased maintenance and operation costs
- Improved life time on boiler tubes and filter bags
- No dead spots – Sound waves reaches everywhere

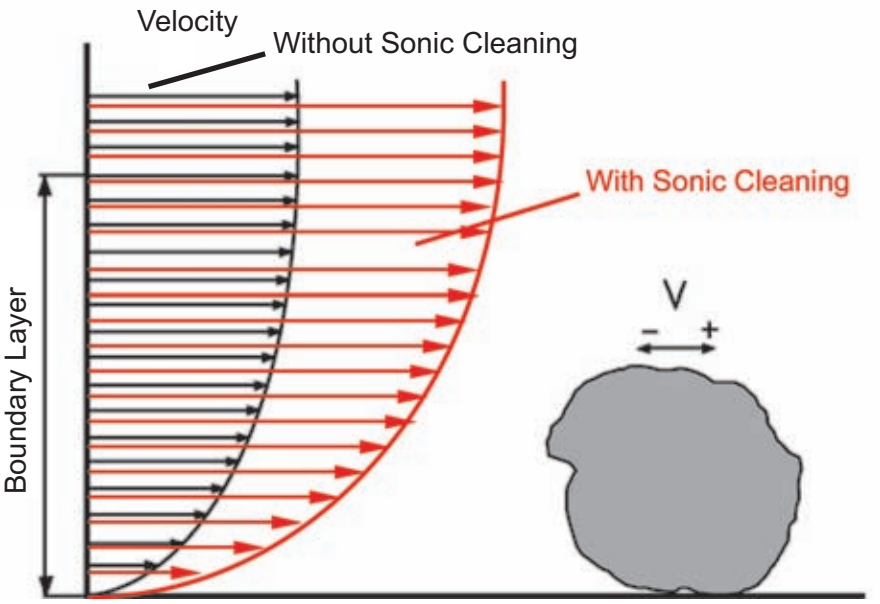
Main forces of Sound Cleaning

1. The sound energy vibrates the ash particles and thus tears them away from each other.

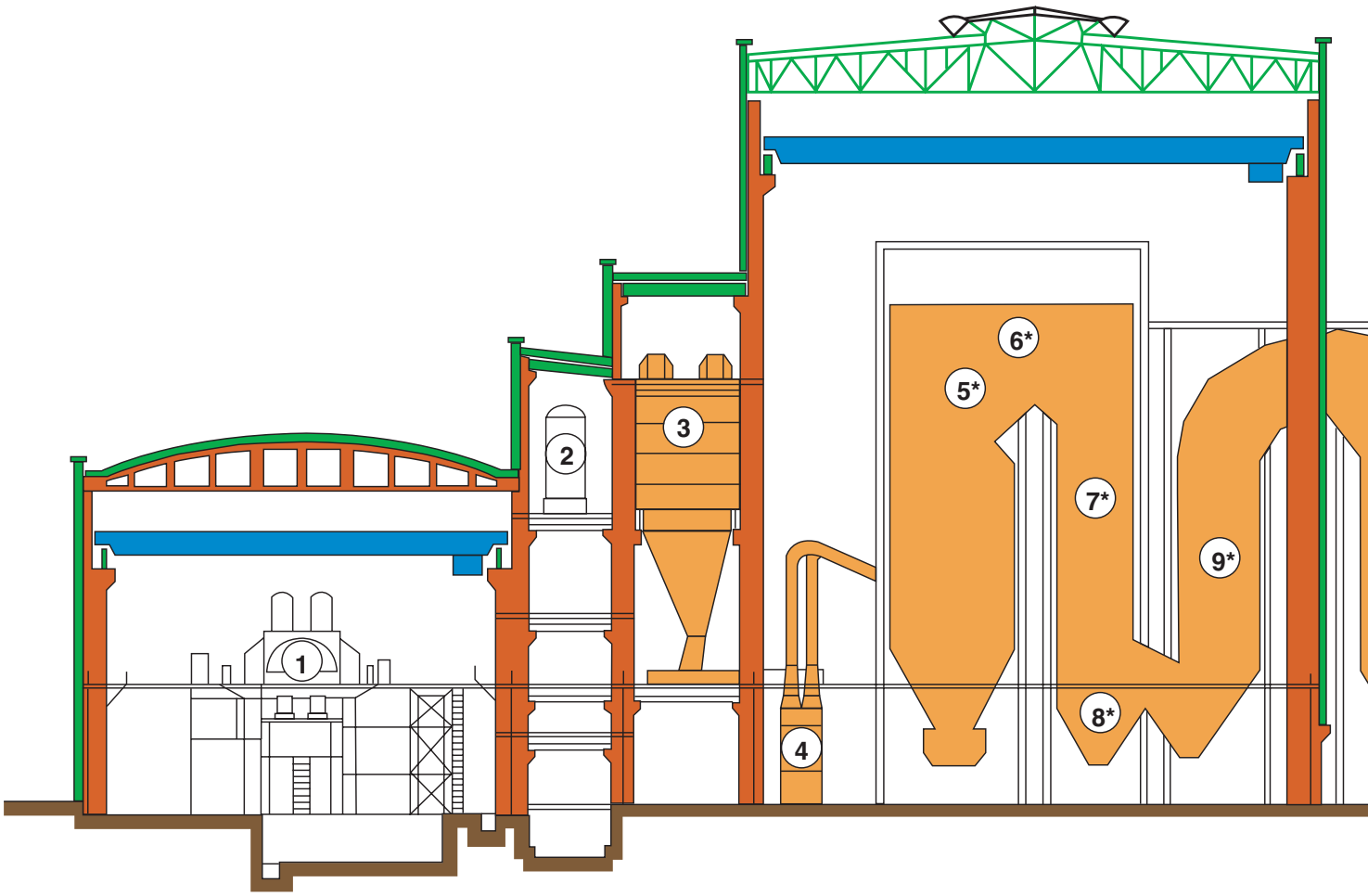
2. A high enough sound pressure level collapses the boundary layer above a surface. When this happens your own flue gas velocity will pass extremely close to the surface and thus blow away all ash particles.

General – the pause time between activations should be short enough to prevent the ash particles to sinter together.



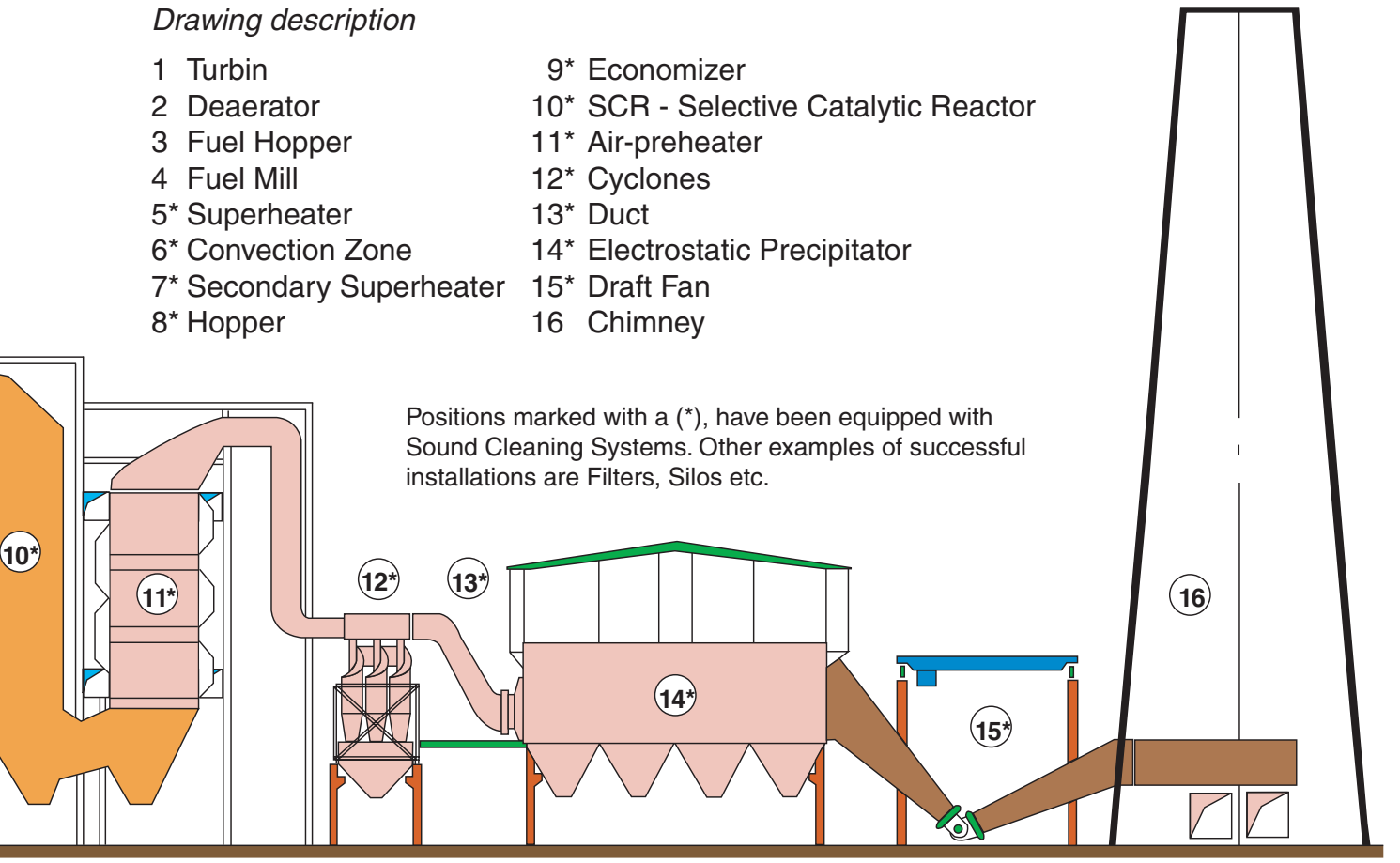


Sonic Cleaning for Power- and Heatingplants



Drawing description

1 Turbin
2 Deaerator
3 Fuel Hopper
4 Fuel Mill
5* Superheater
6* Convection Zone
7* Secondary Superheater
8* Hopper
9* Economizer
10* SCR - Selective Catalytic Reactor
11* Air-preheater
12* Cyclones
13* Duct
14* Electrostatic Precipitator
15* Draft Fan
16 Chimney



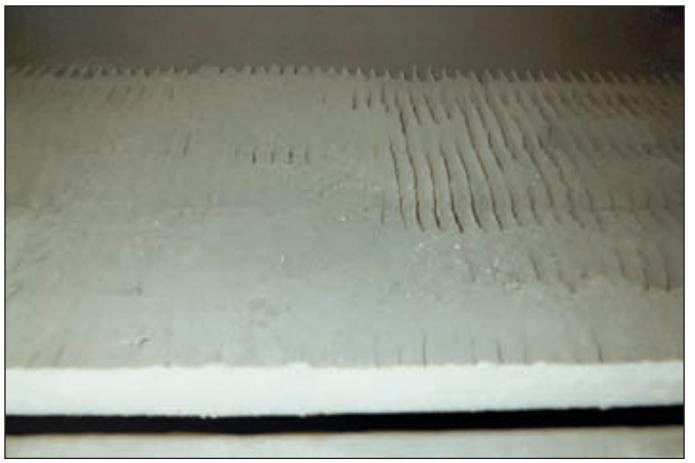
Positions marked with a (*), have been equipped with Sound Cleaning Systems. Other examples of successful installations are Filters, Silos etc.

Sonic cleaning have successfully been used with the following fuels/dusts:

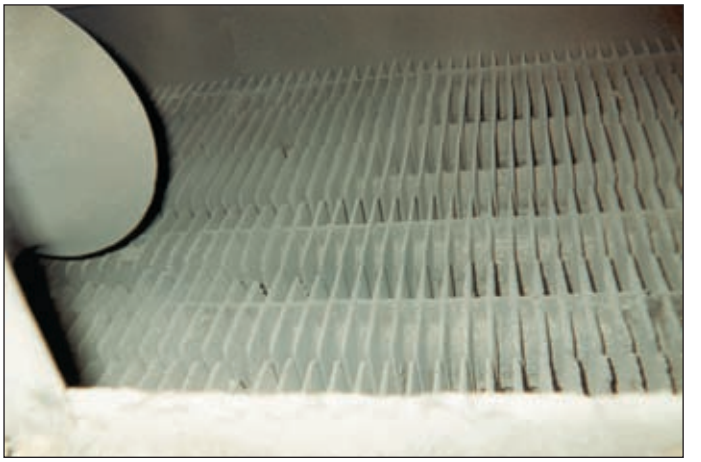
- oil
- coal
- wood
- peat
- straw
- black liquor
- red liquor
- waste
- cement dust
- sintering dust
- ore dust
- etc.

Some Typical Sonic Cleaning Applications

ECONOMIZER



Economizer section, after one month process without Sonic Cleaning. The entire boiler has to be shut down at this time.



Economizer section, after one month process with Sonic Cleaning.

AIR PREHEATER

Air preheater, after four months process without Sonic Cleaning. The entire boiler has to be shut down at this time.

Air preheater, after four months process with Sonic Cleaning.

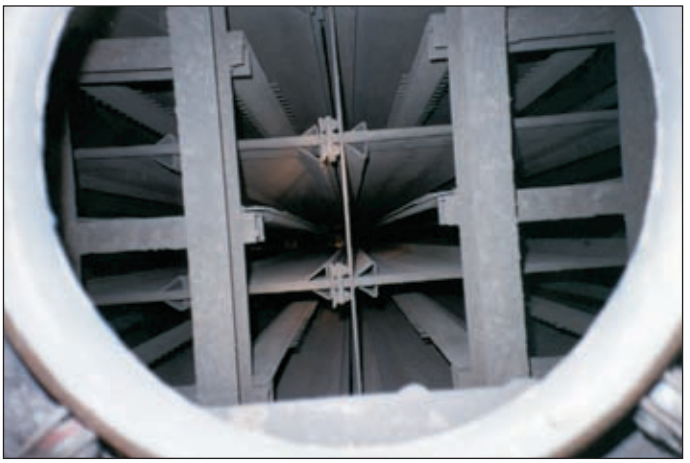
ELECTROFILTER

Process running without soundemitters activated.

Process running with soundemitters activated.

ELECTROFILTER

After six weeks production without Sonic Cleaning. Dust emission 29.4mg/Sm^3



After six weeks production with Sonic Cleaning. Dust emission 13.5mg/Sm^3

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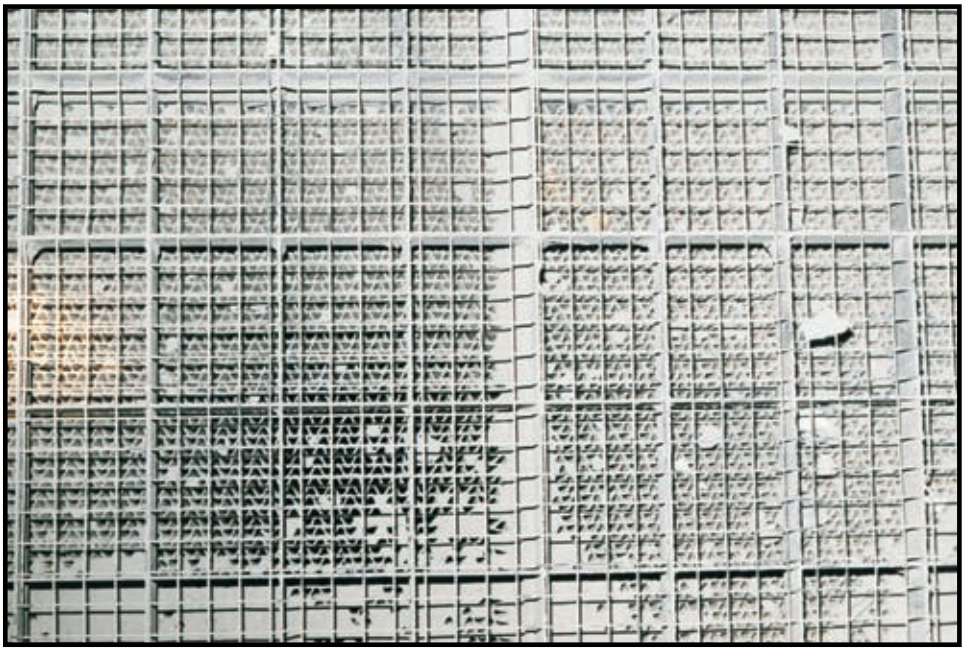
SONIC CLEANING

SCR: POWER PLANT, FUEL: COAL

SCR, AFTER SIX MONTHS PROCESS:
WITHOUT SONIC CLEANING



SCR, AFTER SIX MONTHS PROCESS:
WITH SONIC CLEANING

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