Powerwave® Acoustic Cleaners for SCR Systems

Jake Shelton
GE Energy
Powerwave®
Acoustic Cleaners

Installations dating back to 1983
Acoustic Cleaners

Air operated horns that produce low frequency, high energy sound waves.
Acoustic Cleaners

The sound waves cause particulate deposits to resonate and dislodge from structural and dust collection surfaces.
D Series Sound Generator

- 1/4” Air Outlet
- Cover Plate
- Titanium Diaphragm
- Pedestal
- 3/4” Air Inlet
PowerWave Air Requirements

> **Air Pressure:**
  - 70 – 90 PSI
  - 4.83 – 6.21 bar

> **Air Consumption:**
  - 60 – 80 SCFM
  - 19 – 38 l/s
General Piping Arrangement

Air Header

3/4” Solenoid Valve

3/4” Flex Hose
PowerWave® Acoustic Cleaners

Frequencies from 360 Hz to 75 Hz

AH-10       ESP-75
AH-15       D-75
AH-25       DC-75
AG-20-B     D-230
Acoustic Lance
              D-360
              D-Fluidizer
Lower Frequency = Great Effective Cleaning Area

> The wave length of an acoustic cleaner with a fundamental frequency of 75 Hz is 3 times greater than the wave length emitted from an acoustic cleaner with a fundamental frequency of 230 Hz.

> An acoustic cleaner with a fundamental frequency of 75 Hz does not require as high of dB output to be effective in resonating fly ash deposits as an acoustic cleaner with a fundamental frequency of 230 Hz.
Model DC-75
Fundamental Frequency -- 75 Hz
PWMF -- 107 Hz
Effective Cleaning Area

Model D-230

4'9" Wave Length (1.44 m)

3' Cleaning Pattern

No Longer Effective

1 m  2 m  4 m  6 m  8 m  16 m

147 dB  141 dB  135 dB  132 dB  129 dB  123 dB

230 Hz
Effective Cleaning Area

Model D-75

14'9" Wave Length (4.49 m)

75 Hz

147 dB  141 dB  135 dB  129 dB  126 dB  123 dB

1 M  2 M  4 M  8 M  12 M (39')  16 M
Acoustic Cleaner Applications on Boilers

> Air Preheaters
> Baghouses
> Ductwork
> Economizers
> Fans
> Precipitators
> SCR Reactors
Advantages of Using the Model D-75

Low Initial Investment:

> A Model D-75 cost less than 25% of the cost of a rake style steam sootblower
Advantages of Using the Model D-75

Low Installation Cost:

> The majority of the installation cost for the Model D-75 is running a 2” or less air line to each acoustic cleaner as compared to running high pressure steam lines to each sootblower.
Model D-75s

1" Air Line

No Walkway

Obstructions
Advantages of Using the Model D-75s:

No Damage to the Catalyst

Lab & Field Tested
The acoustic energy emitted by the Model D-75 does not harm catalyst.
Advantages of Using the Model D-75s

Low Operational Cost

> The cost of operating one (1) acoustic cleaner that is sounded for 10 seconds every 10 minutes is $0.47 per day.

> This is based on the US industry standard of $0.25 per 1000 cubic feet of air.
Advantages of Using the Model D-75s

Low Maintenance Cost

> The Model D-75 has only 1 moving part, a titanium diaphragm.

> The diaphragm has a life expectancy of over 5 years.
SCR Installation Experience

• Installations on more than 100 SCR Reactors following coal-fired boilers.
• Installations on more than 20 SCR Reactors designed by Babcock Power.
• The first installation on a SCR Reactor designed by Babcock Power took place in 2001. Since that time, all of the SCR Reactors designed by Babcock Power have used GE Energy’s acoustic cleaners as the catalyst cleaning system.
• Installations on numerous SCR Reactors fitted with plate style catalyst as supplied by Hitachi.
SCR Installation Experience

GE Energy has installations on SCR reactors in low dust and high dust arrangements.

Low Dust Reactor

High Dust Reactor
SCR Installation Experience

Numerous installations on SCR reactors using a variety of catalyst designs

Honeycomb
Plate
Corrugated
Acoustic Cleaners vs. Sootblowers

PG&E Generating Co. Indiantown Station

Duke Energy Belews Creek Steam Station

Mirant Birchwood Power Facility

and Others
Model DC-75

Frequency: 75 Hz
Sound Pressure Level: 147 dB
Length: 94 3/4 inches
Mouth of Bell: 15 1/2 inches
Model DC-75
Tube Mount

Reactor Wall

Insulation

Lagging Wall

Catalyst
Model DC-75 Tube Mount
Model DC-75 Insertion Mount

Reactor Wall

Air Line

710 mm

Pressure Pulse Sensor

762 mm

Lagging
Isolation Valve

Air Header

¾” Solenoid Valve

Model D-75

Flex Hose
Solenoid Valve Location

Easy Access

Difficult Access
Powerwave ThermalWraps

Removable Insulating Blankets

Insulated Model DC-75

Insulated Model D-75
Model D-75s that have been insulated by the plant.
Ambient Noise

Continuous Noise Level -- 72.2 dB
Acoustic Cleaner Sounding – 88.6 dB
A properly designed acoustic enclosure can reduce the ambient noise by as much as 10 dB.
Model D-75s being installed on a SCR Reactor.

Installation Completed - The Model D-75s have been covered with Acoustic Enclosures.
Acoustic Cleaner Verification System

What it does...

The Acoustic Cleaner Verification Sensor monitors the pressure inside the horn. When the horn operates, the device senses the pressure waves as they travel down the bell sections, and triggers the output when the pressure waves reach a preset level. The Acoustic Cleaner Verification Sensor detects only the rapidly changing pressure caused by the sound pressure waves, so normal process pressure changes do not trigger the device.
Acoustic Cleaner Verification System

Output Active

Sound Pressure Waves

Change in Process Pressure
## Acoustic Cleaner Verification System Specifications

<table>
<thead>
<tr>
<th>Specification</th>
<th>Details</th>
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</thead>
<tbody>
<tr>
<td>Temperature Range</td>
<td>-25°C to 85°C (-77°F to 185°F)</td>
</tr>
<tr>
<td>Power Supply</td>
<td>24 VDC ± 10%</td>
</tr>
<tr>
<td>Output</td>
<td>24 VDC @ 3A *</td>
</tr>
<tr>
<td>Sensor Port</td>
<td>¼” NPT</td>
</tr>
<tr>
<td>Static Pressure Range</td>
<td>-75” H₂O to 75” H₂O</td>
</tr>
</tbody>
</table>

*Output current may be limited by external power supply.*
Horn Verification System
System Wiring

Horn Controller and/or Annunciator By Customer or GE

24 VDC Signal

Horn Verification Sensor

24 VDC Power

Horn

Horn

Horn

Horn

24 VDC Power Supply By Customer or GE

Horn

Horn

Horn

Horn

24 VDC Power
Any questions...

The End