Factory Process & Equipment Noise – Engineered Controls

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Webinar Moderator

- Joined AMCA in 2017
- Leads development and publication of technical articles, white papers and educational materials.
- Editor-in-chief of the award-winning AMCA *inmotion* magazine.

TODAY'S WEBINAR SPONSOR

KINETICS Noise Control®

Introductions & Guidelines

- Participation Guidelines:
  - Audience will be muted during the webinar.
  - Questions can be submitted anytime via the GoToWebinar platform and will be addressed at the end of the presentation.
  - Reminder: This webinar is being recorded!
  - To earn PDH credit for today, please stay clicked onto the webinar **for the entire hour**.
  - A post-webinar evaluation will be emailed to everyone within one day, and it must be completed to qualify for today's PDH credit.
  - Every person that wants to receive PDH credit must be individually registered. If people are watching in a group and want credit, please contact Lisa Cherney (*lcherney@amca.org*) for a group sign-in sheet.

Q & A

To submit questions:

- From the attendee panel on the side of the screen, select the "Questions" drop down option.
- Type your question in the box, starting with the name of the presenter for whom your question is for.
- Click "Send".

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ENGINEERING
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REGISTERED CONTINUING EDUCATION PROGRAM

Attendance for the entire presentation AND a completed evaluation are required for PDH credit to be issued.

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John Sofra

Member, AMCA Acoustic Attenuation Engineering Committee

- Over 32 years of experience including acoustics division manager for a sheet metal duct and fitting manufacturer.
- Currently the North America market manager for the Airflow Attenuation, Industrial and Environmental markets.
- Actively involved in several AMCA committees including: Acoustic Attenuation Engineering, Louver Engineering and North American Region Marketing.

Factory Process & Equipment Noise – Engineered Controls

Purpose and Learning Objectives

The purpose of this presentation is to review louver features and performance, different louver types, materials and finishes.

At the end of this presentation you will be able to:

1. Identify the 8-hour time weighted average noise level set by OSHA that requires the implementation of a hearing conservation program.
2. Identify the three main characteristics of effective noise control.
3. Describe the advantages of implementing engineering controls in lieu of personal protective equipment.
4. Identify different products used for controlling noise in a factory setting.

WHICH ARE YOU MOST LIKELY TO SAY?

"Wow, that is a nice sound!"

"Wow, that is a nice noise!"

NOISE & SOUND

- **Noise is unwanted sound.**
- Sound is a propagating disturbance (a wave) in a fluid or solid.
- In a solid *(structure-borne sound),* this disturbance travels as bending, compressional, torsional or shear waves. (vibration)
- In a fluid *(airborne sound)*, this disturbance travels as a longitudinal compression wave. (*This is what your ears sense, a fluctuation in sound pressure).*

WHEN IS NOISE CONTROL REQUIRED?

OSHA's Noise standard *(29 CFR 1910.95)* requires employers to have a hearing conservation program in place if workers are exposed to a time-weighted average (TWA) noise level of 85 decibels (dBA) or higher over an 8-hour work shift.

Level (dBA)	Comment
65	normal conversation
90-95	hearing loss from sustained exposure
125	start to experience pain
140	quickly causes irreversible hearing damage

OVERALL SOUND LEVEL (dBA)

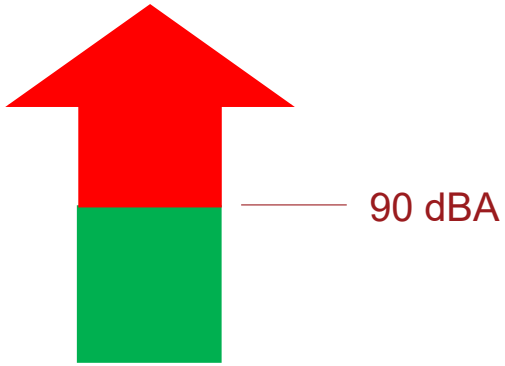
- Noise sources – levels for comparison

OSHA "Action Level" 8 hrs. Exposure	85 dBA, TWA
Common Sound	**Noise Level**
Pneumatic Chipper	115 dBA
Generators	105 dBA
Vacuum Pumps	105 dBA
Hammer Mills	102 dBA
Exhaust Fans	101 dBA
Air Compressors	99 dBA
Chop Saw	98 dBA
Metal Recycling	95 dBA
Forklift Traffic	87 dBA
Corn field, Middle of Nowhere at 4:00 am	25 dBA

NOISIEST MANUFACTURING INDUSTRIES

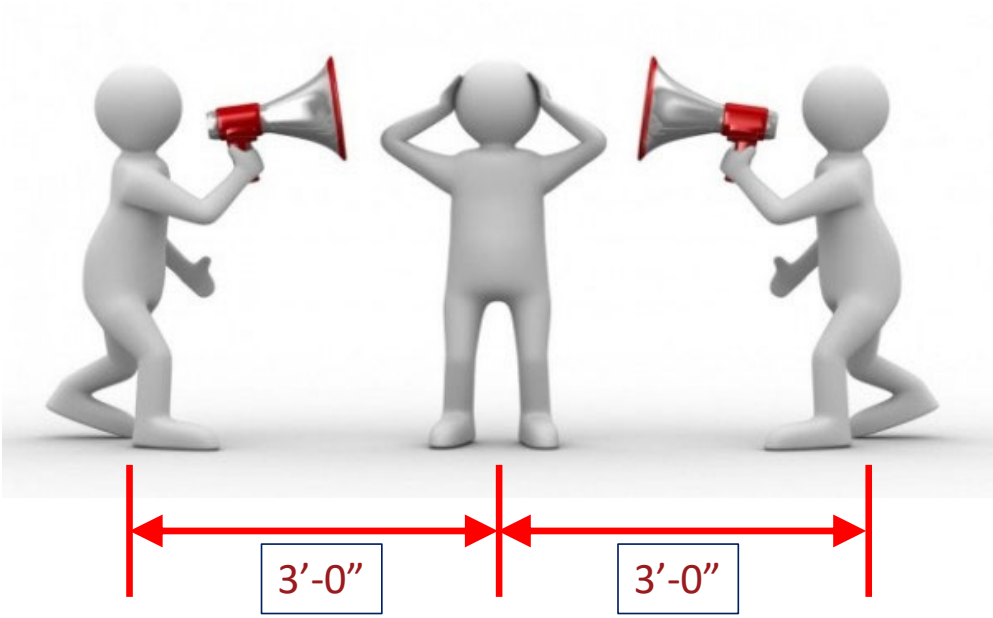
Personnel exposed to noise levels above 90 dBA:

- Lumber & Wood
- Textiles
- Petroleum & Coal
- Utilities
- Paper
- Chemicals
- Printing & Publishing
- Fabricated Metals
- Food
- Furniture & Fixtures
- Rubber & Plastics
- Stone, Clay & Glass
- Apparel Manufacturing
- Etc.



RULE OF THUMB

When you feel the need to shout in order to be heard 3 feet away, the noise levels are probably 85 dBA or more and “action” is required.



TYPES OF CONTROLS

- Engineering – Eliminate or engineer out the noise, by using noise control products or replacing loud, older equipment with new, quieter equipment.

- Administrative – incorporate changes in work procedures such as reducing the duration & frequency personnel are exposed to high noise levels.

- PPE - personal protective equipment

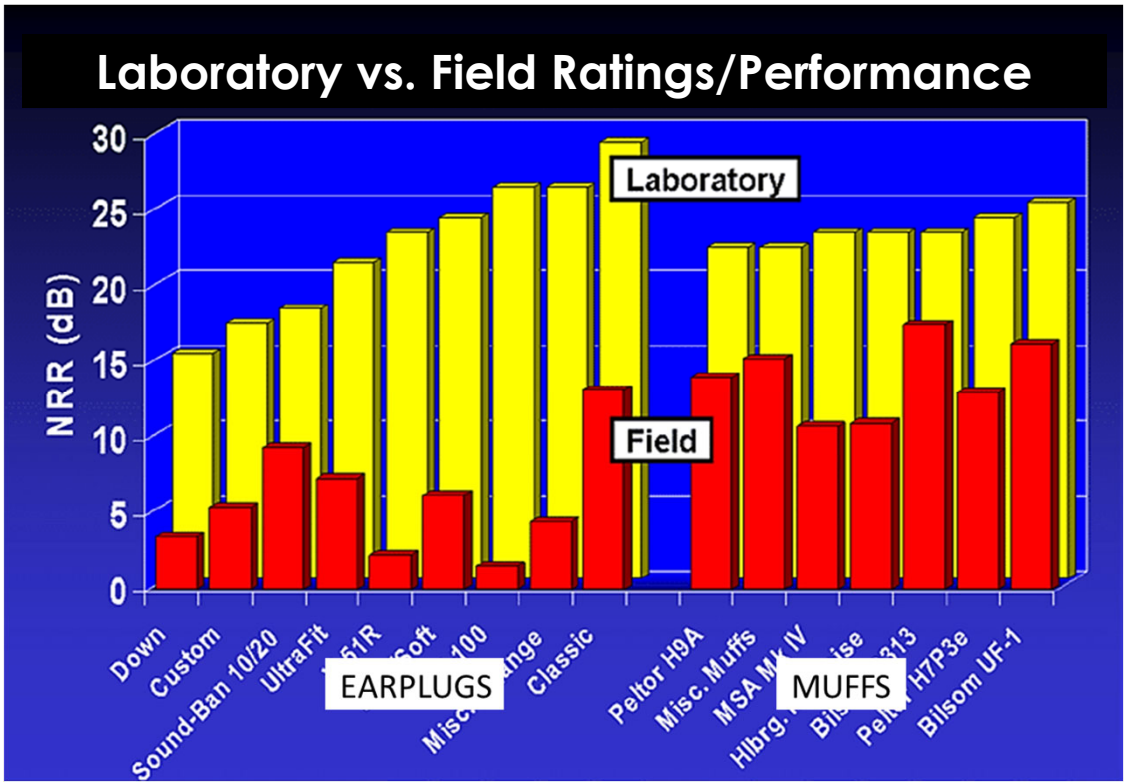
FOAM EAR PLUGS – P.P.E.

They are letting you down.

- Periodically removing ear plugs to use a radio, make a phone call exposes your ears to high noise and productivity suffers.
- Some people find foam earplugs uncomfortable no matter standard or custom fit. Foam earplugs can wiggle loose, requiring work stops to refit them.
- Do not have listen-through technology. They block important noises including traffic, alarms, warning shouts.
- Ear health risk, bacteria love foam resulting in ear infections or tinnitus (constant ringing in the ears).

THE TRUE STORY

Earplugs and muffs – noise reduction rating NRR



COSTS - HEARING CONCERVATION PROGRAM

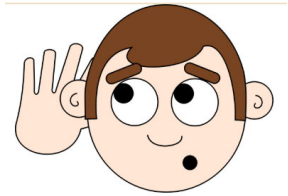
Hearing conservation programs (HCPs) mandated by the US Occupational Safety and Health Administration (OSHA) cost an employer about $350/worker/year.

No. of Factory Employees	Total Estimated Cost Per Year
10	$3,500
30	$10,500
50	$17,500
100	$35,000
250	$87,500
500	$175,000

……PER YEAR

#1 NOISE CONTROL MYTH

Engineering controls are expensive.



Compared to what?

- Paying disability claims for noise induced hearing loss and Tinnitus?
- Paying for employees in a hearing conservation program?
- Reduced safety risk?
- Reduced situational awareness?

ROI – USING ENGINEERING CONTROLS

Studies show a 10:1 ROI on dollars spent on engineering controls verse paying disability claims.

Many engineering control projects exhibit an ROI of 2-4 years verse hearing conservation costs which continue year over year, over year, over year…etc.

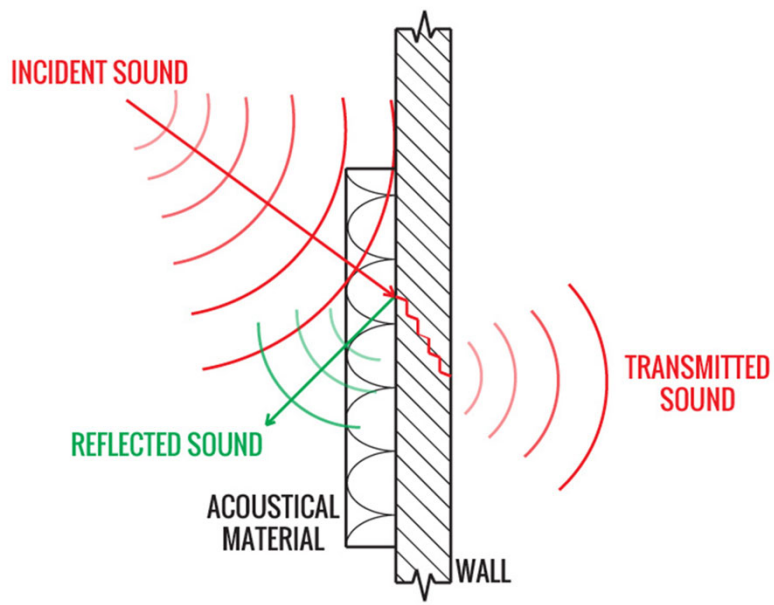
LEARNING THE ABC's OF ACOUSTICS

SOUND ABSORPTION

- If it is not possible to reduce noise at its source, then sound absorption in the space should be considered.
- Noise reduction targets of 10 dBA or less are suitably obtained using sound absorption techniques. (10 dBA reduction is perceived as sounding half as loud and significant).
- Walls and ceiling of the space become the focus.
- Key factors:
  - Construction of walls, ceiling and floor
  - Length, width and height of the space
  - Lighting, sprinklers and other obstructions

SOUND ABSORPTION

A material takes in sound energy as opposed to reflecting the energy. Part of the absorbed energy is transformed into heat and part is transmitted through the absorbing body.



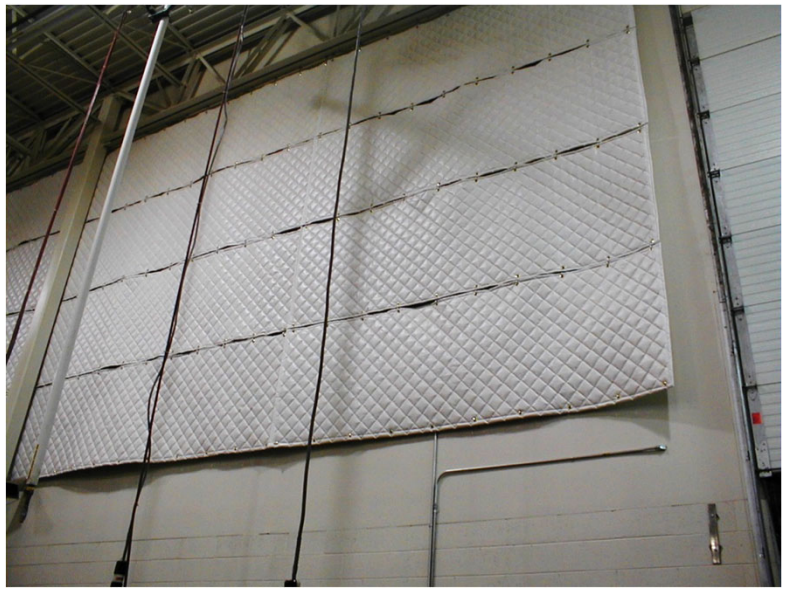
QUILTED ABSORBER

- Issue– Reverberant (echo) industrial facilities:
  - Automotive Garages
  - Environmental control booths
  - Material handling wrap
  - Machine housing

- The thicker the material the better the sound absorption.

QUILTED ABSORBER

High bay area – very congested processes.



HANGING BAFFLE

- Reverberant (echo) industrial facilities:
  - Warehouses
  - Conveyor facilities
  - Mail handling facilities
  - Printing facilities

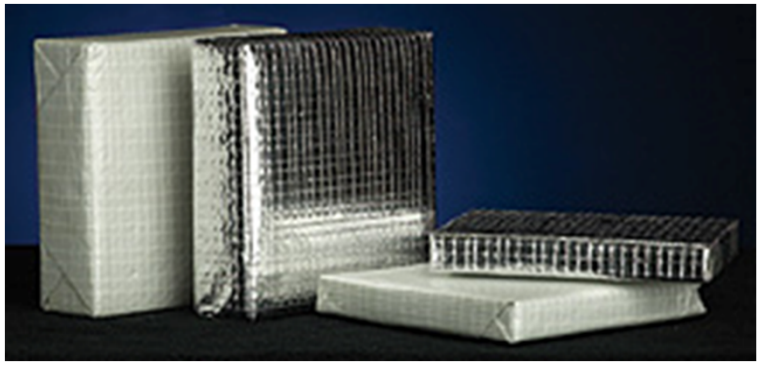
- Various facing materials standard and FDA approved.

HANGING BAFFLES

Candy factory, congested process, FDA approved facing required.

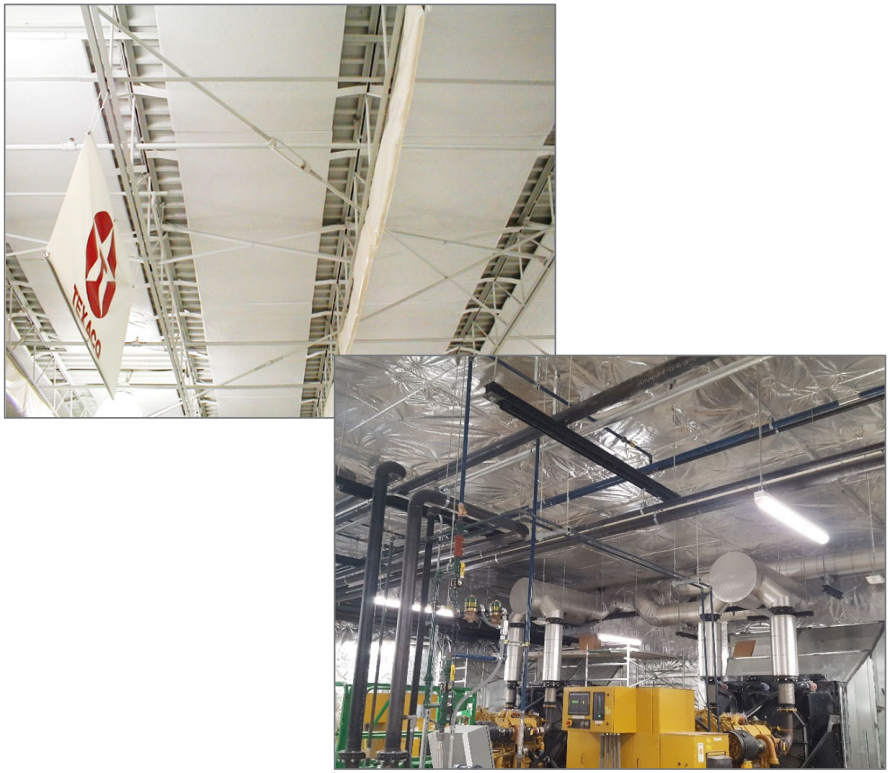
SOUND ABSORPTION PANEL

- Reverberant (echo) industrial facilities:
  - Warehouses
  - Conveyor facilities
  - Mail handling facilities
  - Printing facilities



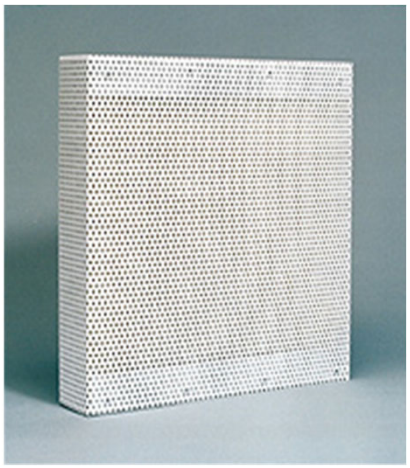
SOUND ABSORPTION PANEL

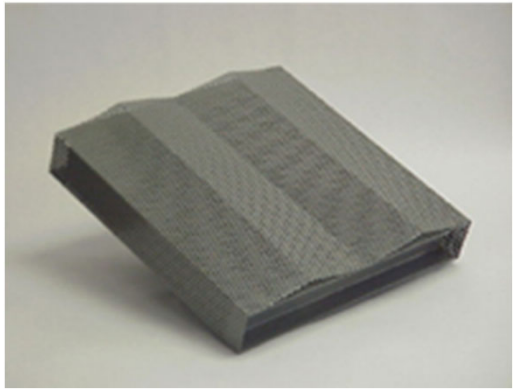
Shipping and receiving - forklift traffic & pump room



RIGID PANEL ABSORBER

- Reverberant (echo) industrial facilities:
  - Wastewater Treatment Plants
  - Indoor or outdoor equipment yards
  - Shipping containers used for generator enclosures
  - Anywhere where high durability is required





RIGID PANEL ABSORBER

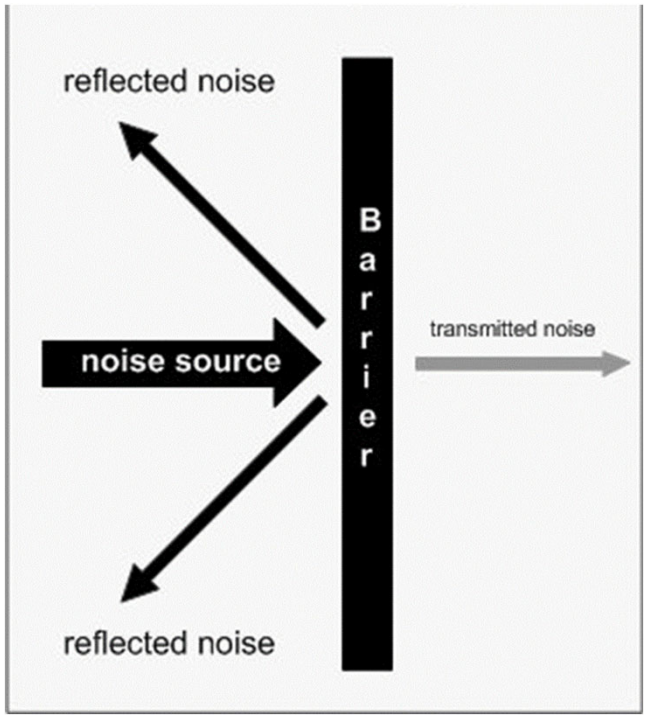
Process manufacturing & test cell applications

SOUND BLOCKING

- Significant amount of noise can be reduced by using blocking.
- Noise reduction targets range from 18 dBA – 45 dBA.
- Treating noise at the source becomes the focus.
- Key factors:
  - Proper ventilation of heat radiating equipment.
  - Access for routine and catastrophic maintenance.
  - Visual access (i.e., ports, process, personnel, etc.)

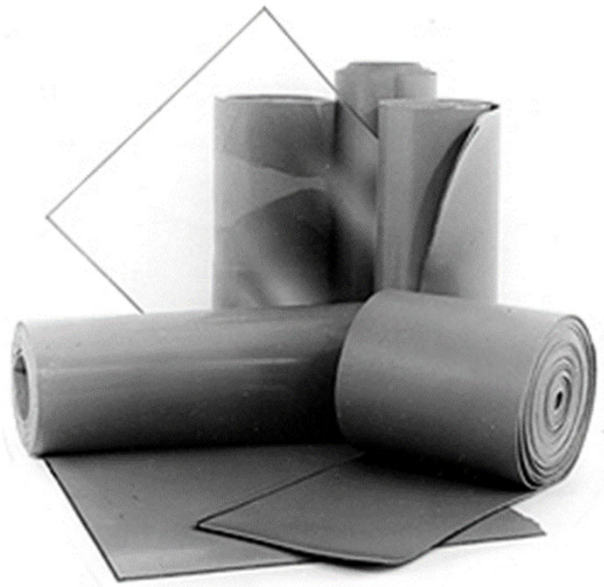
SOUND BLOCKING

Some sound energy is reflected while some is blocked. The magnitude of sound energy blocked is in direct relation to the mass of the material (lb./ft2).



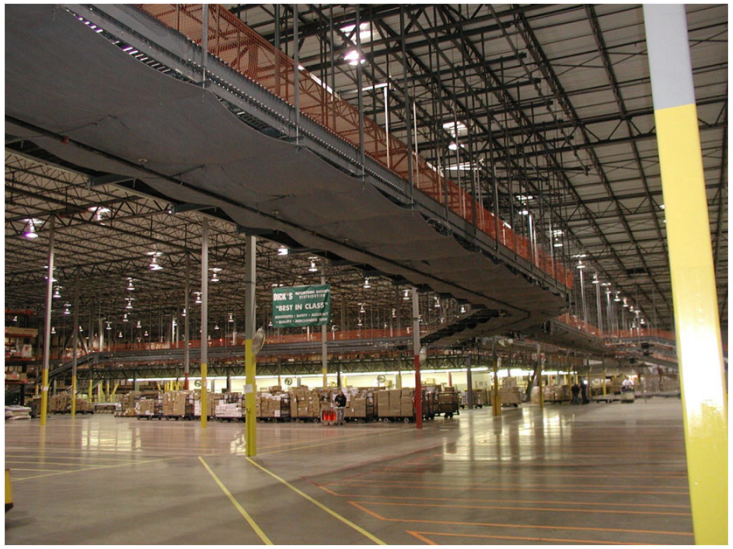
FLEXIBLE BARRIER

- Above drop ceilings of break rooms, facility manager's office
- Part chutes
- Material handling duct
- Process piping



FLEXIBLE BARRIER

Under conveyor – distribution warehouse

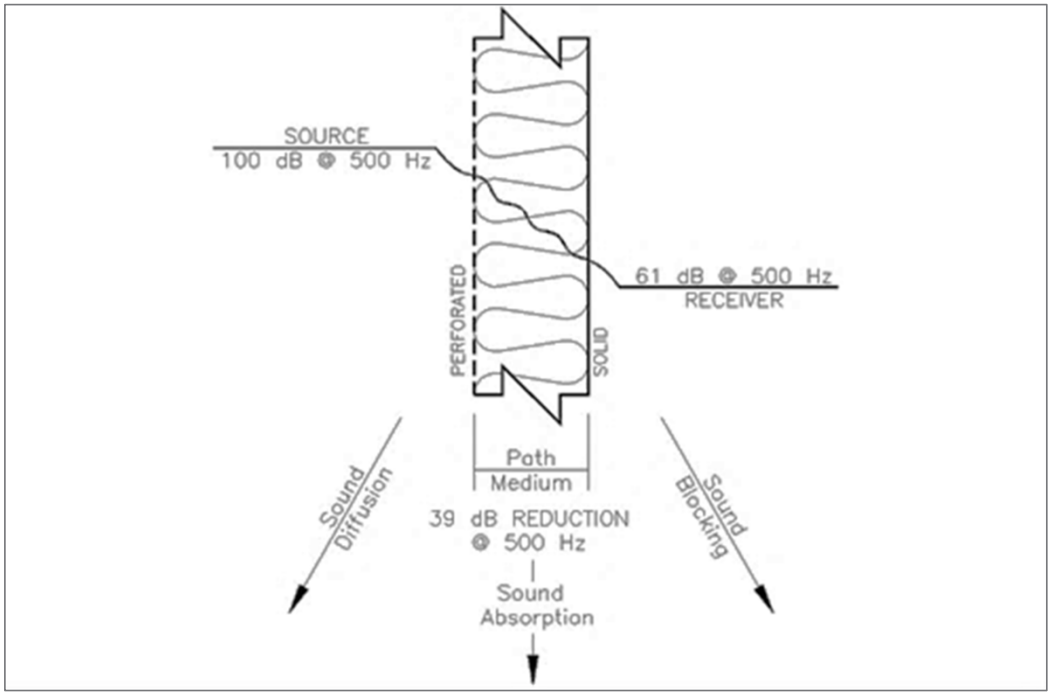


SOUND ABSORPTION & BLOCKING

- Often referred to as a sound absorption and blocking composite.
- Significant amount of noise can be reduced by combining sound absorption and sound blocking.
- Noise reduction targets range from 18 dBA – 45 dBA.
- Treating noise at the source becomes the focus.
- Key factors:
  - Proper ventilation of heat radiating equipment
  - Access for routine and catastrophic maintenance
  - Visual access (i.e., ports, process, personnel, etc.)

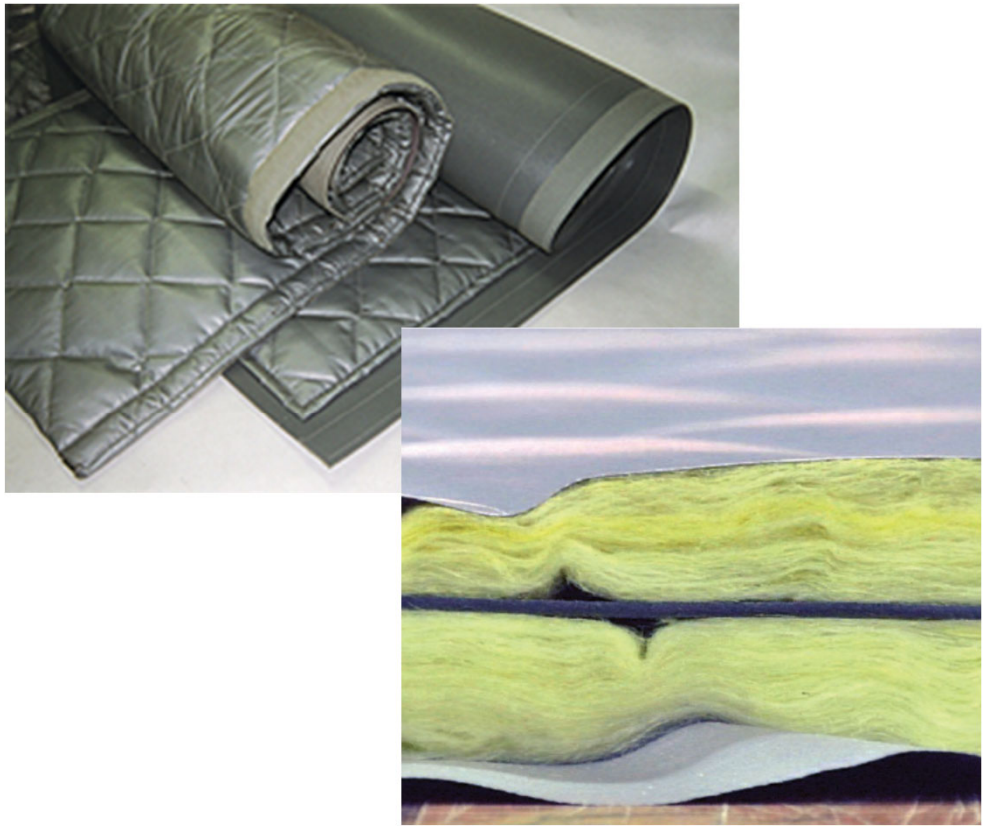
SOUND ABSORPTION & BLOCKING

Sound absorbing material takes in sound energy as opposed to reflecting it. Part of the absorbed energy is transformed into heat and part is transmitted through the absorbing body. A portion of the remaining sound energy is blocked by the solid mass material.



QUILTED BARRIER COMPOSITE

- Both absorbs and blocks sound
  - Fiberglass media
  - Aluminum, vinyl impregnated, fiberglass facing
  - 1.0 psf. / 2.0 psf. mass-loaded vinyl



QUILTED BARRIER COMPOSITE

Custom system – crosscut saw, aluminum extrusions

- Engineering controls can be simplistic.
- High frequency intense whining noise.
- Only the operator requires PPE.

QUILTED BARRIER COMPOSITE

Custom system – cutting process

QUILTED BARRIER COMPOSITE

Custom system – aluminum de-bridging process

- Custom designed to fit the process
- High frequency intense whining noise
- 100 dBA reduced to 85 dBA

QUILTED BARRIER COMPOSITE

Custom system – Radiator Fin Press Application

QUILTED BARRIER COMPOSITE

Custom system – wire braiding process

- 15 dBA reduction in mid frequency range
- Easy access, process viewing
- No interference with overhead sprinklers

QUILTED BARRIER COMPOSITE

Sliding doorway & strip curtains

- Incorporates clear-view ports at proper elevation.
- Used to retrofit separation between high noise process area and shipping and receiving area.

QUILTED BARRIER COMPOSITE

Retrofit Mechanical Room – Compressors & Fan

- Retrofit mechanical room corner of facility.
- Controls radiated noise from process centrifugal fan and compressors.
- Easy installation

QUILTED BARRIER COMPOSITE

Manufacturing Process – plywood tongue & groove

QUILTED BARRIER COMPOSITE

Manufacturing Process – Office Space

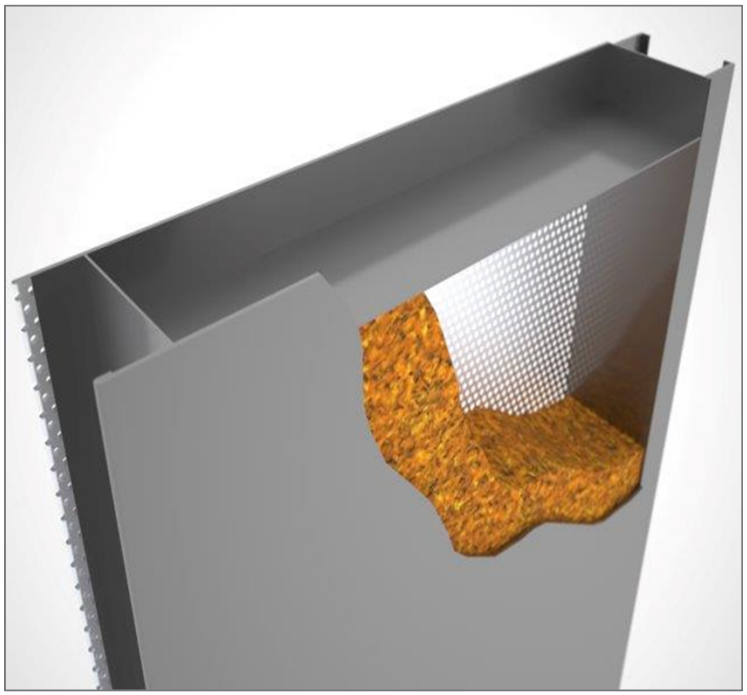
QUILTED BARRIER COMPOSITE

Portable Screens

Can be used in multiple locations for intermittent equipment and process operations.

RIGID DOUBLE-WALL COMPOSITE

- Both absorbs and blocks sound
  - Fiberglass / mineral wool media
  - Galvanized, stainless steel, aluminum sheet construction
  - Available in various thicknesses for increased noise reduction performance.



RIGID DOUBLE-WALL COMPOSITE

Custom System – Stamping Press

RIGID DOUBLE-WALL COMPOSITE

Custom System – CNC Machining Process

RIGID DOUBLE-WALL COMPOSITE

Test Cell – Media Filter Manufacturing

RIGID DOUBLE-WALL COMPOSITE

Custom system – highly accessible, mezzanine elevated process

RIGID DOUBLE-WALL COMPOSITE

Process Fan Enclosure – Petrochemical Facility

RIGID DOUBLE-WALL COMPOSITE

Test Cells – automotive manufacturing

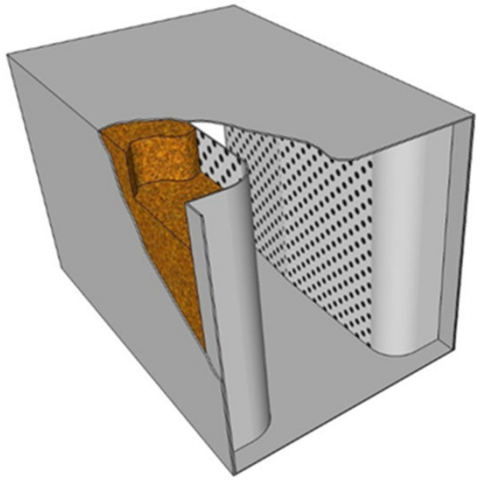
VENTILATION SILENCING

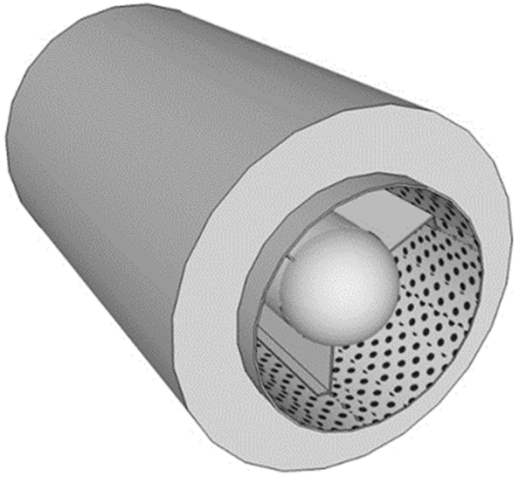
- Fans used to move processes (i.e., dust collection, particulate conveying) or cool equipment and personnel all make noise.
- Noise is generated by the fan blades imparting upon air molecules or bad flow conditions.
- Silencers & acoustic louvers can be tuned to balance pressure loss and noise reduction are a great method of solving noise issues.
- Key factors:
  - Airflow rate (cfm)
  - Available fan/system static pressure (energy) available.

VENTILATION SILENCING - TYPES

- Silencers come in many shapes, sizes and performance.

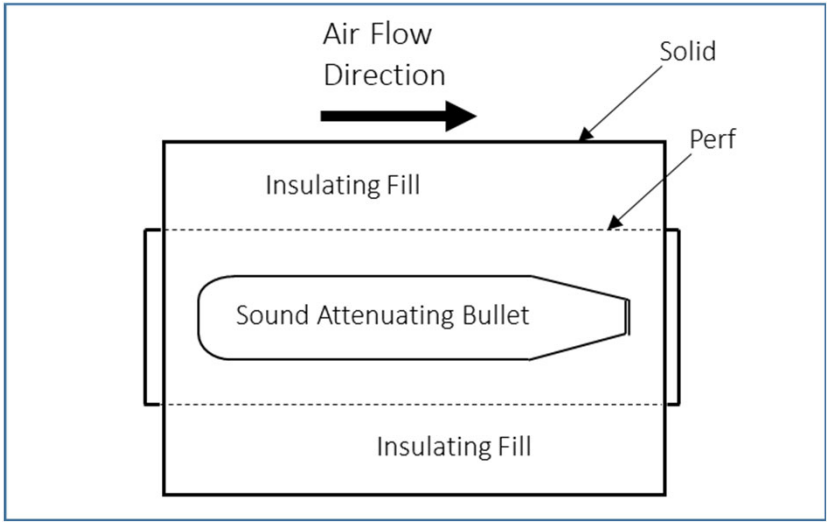
- Fixed-blade acoustic louvers, many models, many thicknesses

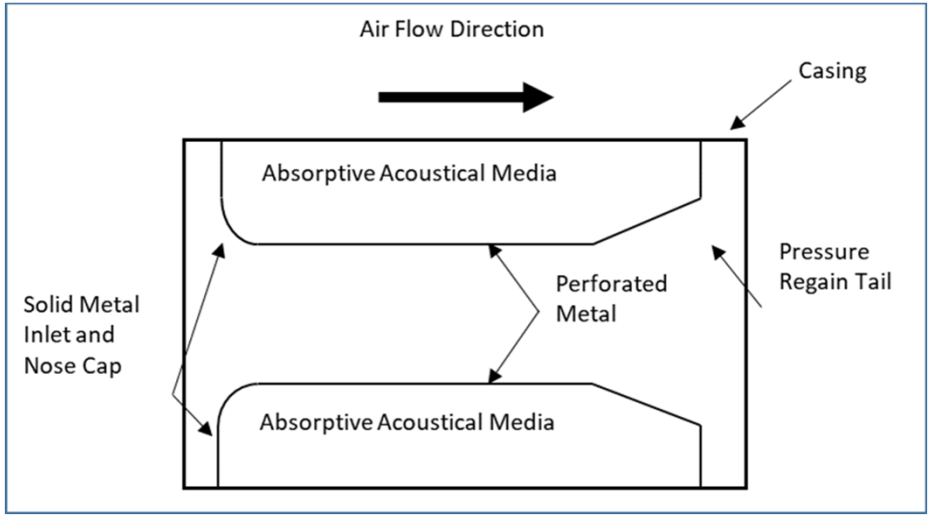




VENTILATION SILENCERS

What makes it tick?





VENTILATION SILENCER

General building exhaust

VENTILATION SILENCER

Industrial process centrifugal fan intake & discharge

VENTILATION SILENCER

Process fan exhaust

VENTILATION SILENCER

Dust Collection Process Fan Exhaust

FIXED BLADE ACOUSTIC LOUVER

Pump house – general ventilation

Resources- Lisa to edit

- **AMCA International**: *www.amca.org*
- **ANSI/AMCA Standard:** *www.amca.org/store*
  - **> 500-L-12:** Laboratory Methods of Testing Louvers for Rating (Available for purchase)
- **AMCA Publications:** *www.amca.org/store*
  - **> 501-17**: Louver Application Manual and Design Guide (Available for purchase)
  - **> 511-10 (R2016)**: Certified Ratings Program-- Product Rating Manual for Air Control Devices (Free PDF download)
- **AMCA Certified Products:** *www.amca.org/certify*
  - **>** Certified and listed louvers by company name

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Questions?

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NEXT PROGRAM

Join us for our next AMCA *insite* Pop-Up Webinar:

- Wednesday, June 24
- 2:00-3:00pm CDT
- ***TOPIC: Severe-Duty Louvers and Their Applications***
- Presenter: Doug Petty, Product Manager - Louvers, AMCA Member Company

>> For additional webinar dates go to: *www.amca.org/webinar*