



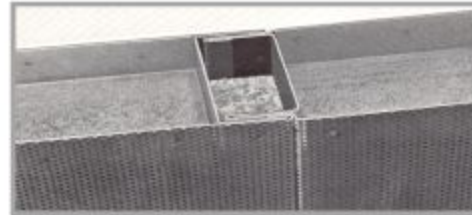
## **SONOCON HP SOUND ABSORPTION**

### **RUGGED HIGH PERFORMANCE SOUND ABSORPTION PANELS**



#### ***SonoCon Panel Systems***

■ **Type SC double-wall panel constructions** are rigid preassembled units installed with tongue and groove or flush connections. Panels are available as 2-1/4" and 4-1/4" thick. The acoustic fill is packed under compression and the perforated or solid back sheet protects against settling and harboring of vermin. Solid backed panels provide significant transmission loss in addition to sound absorption.

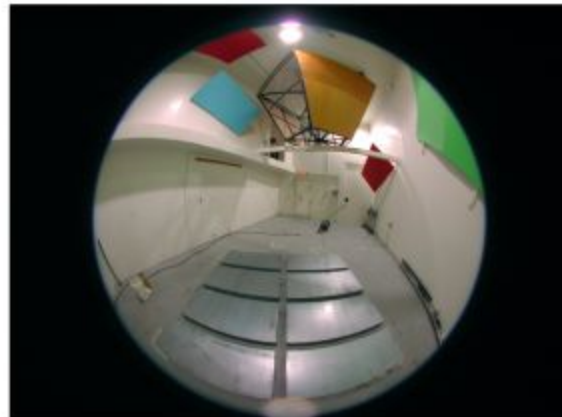


**Tongue and groove panels are exceptionally durable, rigid and readily installed.**

**SonoCon** sound absorptive panel systems provide effective tools to reduce sound levels, minimize multiple reflections within rooms, improve communications and enhance speech intelligibility.

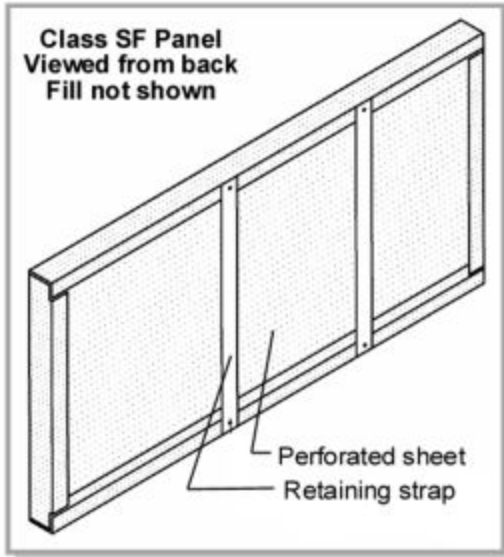
**SonoCon** acoustical panel systems are commonly employed outdoors to reduce equipment noise broadcast by hard, reflective concrete surfaces into nearby communities. Within manufacturing, power generation, water treatment and processing plants, absorptive SonoCon panel systems are installed to create safer, quieter more efficient workplaces.

**SonoCon** sound absorptive panels are constructed of all noncombustible, non-hygroscopic, inert and non-toxic materials. Panel systems are available which can withstand temperatures to 1200° F (650°C).



**SonoCon panels are tested and rated by independent acoustical laboratories.**

■ **Type SF single-faced panel** constructions are light weight and supplied with acoustical fill retained by steel straps. Due to their unique design, the Type SF panels provide exceptional absorption performance. As an option, the acoustical fill can be protected with a water shedding Type MC liner or supplied with the acoustical fill protected within a polyethylene or Mylar sealed bag.



**Type SF Absorptive Panels  
Installed On Concrete Wall**

■ **Type Class Two panels** are used for long spans. Fabricated in lengths of up to 40'-0", they are extremely rigid and can be used in free-standing Soundwall applications or attached to other building and barrier systems. Class Two panels are weather resistant and self-draining.



**Type SF Panel with Standard Fill  
and Contained Acoustic Core**



As standard, panels are 3" thick with fibrous acoustical insulation installed in the continuous acoustical cells. Panels are joined with an interlock connection and mechanically fastened to the support structure.



## Rugged Sound Absorption

### Panel Constructions and Standard Options

**SonoCon** panels and trim are fabricated from G90 galvanized steel which provides excellent corrosion properties. All panels are also available fabricated in stainless steel and aluminum. Materials can be finished with a thermal setting powder coating.

■ **Standard Type SC** panels are constructed using a minimum of 22 gage perforated steel and 18 gage solid sheets. For exterior applications, 20 gage perforated steel is utilized. Internal stiffeners, trim, and framing are fabricated of 16 gage steel.

■ **Standard Type SF** panels are constructed of 22 gage perforated steel. Internal framing, stiffeners and retaining straps are fabricated from 18 gage steel.

Where field painting is applicable, the acoustical core is spaced from the interior of the perforated sheet by use of expanded metal or other mesh sheeting.



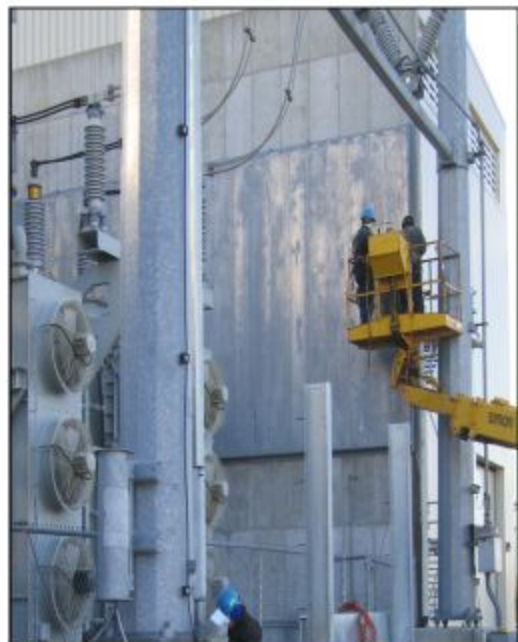
■ **Standard Type Class**

**Two** panels for exterior use are constructed of 18 gage perforated steel and 16 gage solid sheets. For interior applications, both perforated sheet and the solid backing are of 20 gage steel.

**SonoCon** panels can all be furnished with several types of acoustically permeable barrier membranes to protect the acoustical fill from contamination as well as protect the space from particles of the materials which compose the acoustical fill.

**Standard acoustical fill protection** available as options include:

- **MC Barrier**, a proprietary barrier membrane contains the acoustical fill and sheds water. It has no impact on sound absorption performance.
- **CC Barrier**, a glass fiber barrier, contains the acoustical fill without impacting sound absorption performance.
- **Polyethylene, Mylar and Tedlar** are used to contain the acoustical fill in Model SF panels as well as to control particulates in controlled environments.

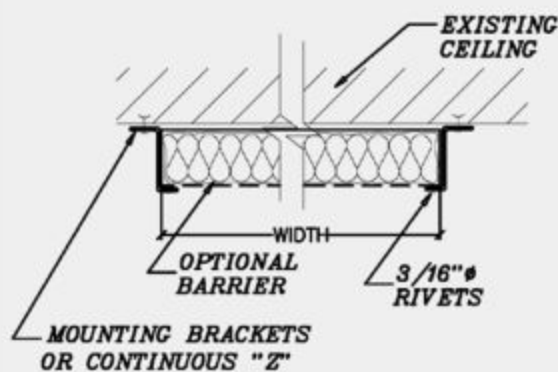


**SonoCon Type SC Panels being installed on a concrete wall to reduce transformer noise being broadcast into a nearby community.**

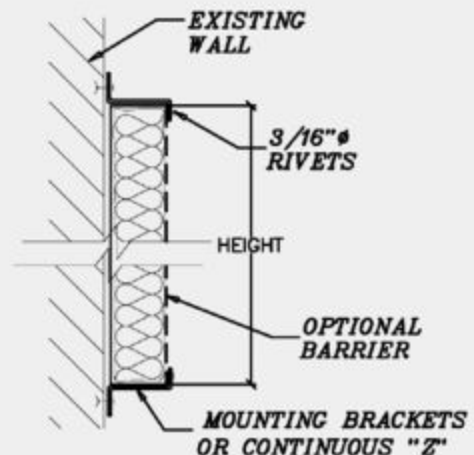
## SonoCon Panel Installation

Individual SonoCon panels or tongue and groove panel assemblies are quickly installed using continuous Z-trim or Z-brackets. These are fastened to the wall utilizing anchors appropriate to the construction and connected to the panels utilizing self-drilling screws or rivets.

Additional low frequency absorption performance can be achieved with Class SC panels fabricated with a perforated back sheet or with Class SF panels by spacing the panels away from the wall or ceiling surfaces.



CEILING ATTACHMENT



WALL ATTACHMENT

## Placing SonoCon Sound Absorption Panels

- Panels should be placed as close to the noise source as practical.
- For noise control purposes, in a fairly symmetrical room, treating about one-third of the room's surface area often results in a cost effective solution.
- Panels should be placed near room corners which, without treatment, will tend to focus and amplify the reflected sound.
- If the ceiling is high or the rooms are small, it is better to place more absorption on the walls. Ceiling absorption is most effective if the room is large and the ceiling is low.



## Acoustical Performance

Sound absorption data for SonoCon Acoustical Panels is obtained per ANSI/ASTM C-423, Standard Method of Test for Sound Absorption of Acoustical Materials in Reverberation Rooms. Tests are conducted at independent laboratories accredited by the United States Department of Commerce National Voluntary Laboratory Accreditation Program (NVLAP).

Sound absorption tests are conducted in reverberation chambers similar to that shown here. This facility is located at Western Electro-Acoustic Laboratory in Santa Clarita, California.

SONOCON PANEL PERFORMANCE—SOUND ABSORPTION COEFFICIENTS							
PANEL MODEL	OCTAVE BAND—CENTER FREQUENCY						NRC
	125	250	500	1000	2000	4000	
Type SC 2-1/4" thick	0.31	0.82	1.19	1.12	1.07	1.06	1.10
Type SC 4-1/4" thick	0.86	1.09	1.22	1.06	1.05	1.04	1.10
Type SF 2" thick	0.51	0.69	0.94	1.01	0.94	0.86	0.90
Type SF 4" thick	0.57 <sup>(1)</sup>	1.31	1.41	1.32	1.22	1.18	1.30
Type Class Two 3" thick	0.80	0.78	1.16	0.88	0.69	0.47	0.90

<sup>(1)</sup> Absorption coefficient increases to 0.94 at 160 Hz.

The Noise Reduction Coefficient (NRC) is obtained by averaging the sound absorption coefficients at 250 Hz, 500 Hz, 1000 Hz and 2000 Hz. The result is then rounded down or up to the nearest hundredth. Thus, an average of 1.32 would be published as an NRC of 1.30 while an average of 1.33 would be published as an NRC of 1.35.

Sound absorption coefficients which exceed unity are sometimes obtained and published. These inordinately high values are the result of the test method and associated formulae, the size and geometry of the test sample (smaller samples in relation to overall surface area tend to produce higher values), sound diffraction at the sample edges, and, occasionally, characteristics of the test chamber. Conservative engineering practice is to round down values in excess of unity to 0.95.



## Sound Absorption Basics

### • The behavior of sound

As shown below, at a point close to the noise source, the direct sound level contributes the largest component of the total sound level. As one moves away from the source, the total sound pressure level decreases according to the inverse square law and eventually approaches the value of the reflected sound levels alone.

In most indoor situations, confining walls and ceilings trap the acoustical energy and keep much of the sound from escaping to the outdoors. Each ray of sound from the sound source strikes a reflective or absorptive surface where the sound is either reflected to some other area of the room or absorbed by that surface.

Ideally, with the proper amount and distribution of absorption throughout a room, sound should dissipate quickly. But, if the room has little absorption, very little energy will be absorbed at each reflection and the sound levels will continue to increase until the sound source is removed.

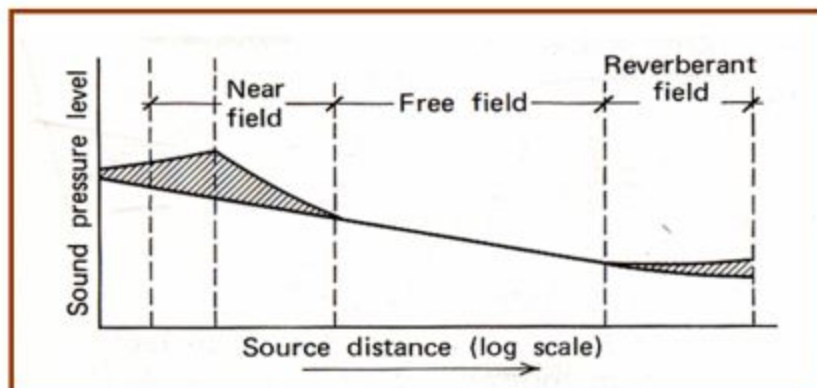
The same ray of energy may travel up to a 1000 feet to be reflected a dozen times before its energy is sufficiently dissipated. In the meantime, other rays of sound also radiate and reflect until they too are eventually dissipated. In this environment, the sound will persist and tend to remain within a space

after the sound source is removed. This important phenomenon is termed *reverberation*.

In a small untreated room, one in which the walls and ceiling construction are acoustically hard or reflective, the sound pressure level caused by the confinement of sound can build to values as much as 15 dB above the values that would exist at comparable distances outdoors. A machine, which measured 85-dBA outdoors, might generate sound levels of 95 dBA to 100 dBA when moved indoors into a small, highly reverberant room. The sound power level of the source didn't change, but the acoustic environment made a significant difference in the sound levels.

Noise control measures that add room absorption to a reverberant space are often quite effective in changing the acoustical character of a space reducing reflected energy and the associated buildup of noise. Modifying a room's acoustical environment by adding sound absorption to achieve sound control objectives is usually a much less disruptive and relatively economical solution. Absorptive materials are relatively inexpensive, offer little restriction to equipment, and most likely require no additional utilities such as lights or fire protection systems.

Though often impractical and expensive to reduce the sound level by more than 10 deci-



bels with sound absorption methods alone, reductions of 5 to 7 decibels are generally feasible.

Outdoors, if allowed to freely radiate, the sound levels will diminish by approximately 6 decibels for each doubling of the distance. However, this energy will be reflected or focused by acoustically hard walls or surfaces such as steel or concrete. These surfaces can direct and increase the sound levels broadcast into nearby areas and communities.

#### • Evaluating absorptive materials:

The most common indicator of a sound absorbing material's effectiveness is the **sound absorption coefficient**, a simple dimensionless ratio of the noise absorbed by the materials at any given frequency or octave band to the incident noise. It is the ratio of the sound energy not reflected from surface divided by the sound energy incident on surface

Its value is dependent on both the properties of the specific material and the direction or angle at which the sound waves strike the material's surface. Under most circumstances, sound waves strike the surface from many directions and any variation in the direction becomes unimportant.

Two distinct tests can be used to obtain sound absorption coefficients. For absorption of energy normal to the material, an impedance tube test is performed in which a single frequency is generated at one end and the sound absorption of the material is measured in accordance with ASTM C384. However, normal incidence of sound is rare in most environments and almost all sounds consist of more than a single frequency or pure tone.

Reflecting typical conditions in which absorptive materials are used, *random incidence absorption coefficients* are obtained using reverberation room test methods. In this test, the material specimen is laid on the laboratory floor and the absorption obtained

is measured as the difference in the rate of sound decay with and without the specimen. Since absorption coefficients are numerical ratios, the initial 20% reduction in sound represents a decrease of 1 decibel:

$$10 \log_{10}(0.80)$$

Similarly, a 50% reduction represents a decrease of 3 decibels:

$$10 \log_{10}(0.50)$$

These tests are conducted under carefully controlled laboratory conditions in conformance with ASTM C423, *Standard Method of Test for Sound Absorption of Acoustical Materials in Reverberation Rooms*.

Materials with medium to high sound absorption coefficients (typically greater than 0.50) are referred to as sound absorbing while those materials with sound absorption coefficients of less than 0.20 are considered sound reflecting.

#### • Absorption and room environments

Typical room boundaries are neither wholly absorptive nor wholly reflective. The amount of sound absorption within a space is given in terms of sabins, the unit of sound absorption.

Sabins are obtained by multiplying the area in square feet of a particular surface by its unique absorption coefficient. Metric sabins are computed by multiplying the area in square meters by the surface's absorption coefficient.

*For estimating purposes, the reduction in noise levels (NR) with the addition of absorption as measured in sabins is given as:*

$$NR = 10 \log_{10} \text{ sabins before} + \text{ sabins after}$$

(Taken from *Elements of Practical Noise Control*; Robert H. Naslund)



### *SonoCon Sound Absorption Panels*

- Reduce the number and intensity of multiple reflections that are the source of high background noise levels.
- Increase intelligibility of conversational speech, enhance telephone usage, and increase acoustical privacy by reducing sound that would be otherwise reflected into adjacent areas.
- Decrease the overall noise exposure which are attributable to distant sources by minimizing the effectiveness of acoustically hard reflective surfaces which otherwise tend to broadcast the noise into nearby communities.
- Increase safety by reducing noise levels which would otherwise mask warnings. Increase acceptability of the environment for the requirements of its occupants.



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