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The line used to pull down
the noise

EUROFOAM plan,
produce and sell
sound-absorbing and
sound-impedant products
and materials guaranteeing
sound levels imposed
by law dispositions.

Thermo-acoustic
insulators
for industry

The defend
ourselves from the
noise in order to
defend our
own health



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INTRODUCTION

The noise

The technological progress has increased the welfare but it has also raised noise caused by industries, machines, car and air traffic.

Therefore noise is considered our daily friend.

The large exposition to noises may cause physiological negative effects on our health; recently limits imposed by the legislative standards have encouraged the born of materials good to decrease the noise within the acceptance levels.

This technical document would like to be a guide for soundproofing materials and their correct application.

What is the noise?

A superimposition of sounds which cause an annoyance feeling at our ears is called noise.

Instrumentation and noise unit measure

To quantify the sound pressure level (Lps) of noise it is used an instrument called phon-meter, sensitive to the sounds almost as our sense of hearing.

- Noise unit of measure**
- Lps** Level of sound pressure
 - dB** Decibel. Logarithmic value which tells ratio between the sound pressure already measured and the referring pressure
 - dB(A)** Weighing of noise with filter A
 - Filters1/8** They allow to do a better sound analysis
 - Hz** Herz. Sound frequency. It shows number of pressure changes in one second

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APPLICATION OF ENVIRONMENTAL ACOUSTICS INTO THE INDUSTRIAL AND CIVIL FIELD

Introduction

As already told, the application of sound-absorbing materials is right to decrease the sound reflections on surfaces of industrial and civil constructions (walls and ceilings). It allows to keep a low sound environmental level.

Sound-absorbing materials are used for different reasons and most of into the construction of industrial sheds, gymnasium and firms.

As a matter of facts in the modern sheds is requested the use of sound-rigid materials with smooth and compact surfaces (for example concrete, glass etc); this using allows a high inner loudness, caused particularly by the sound influence of near working places.

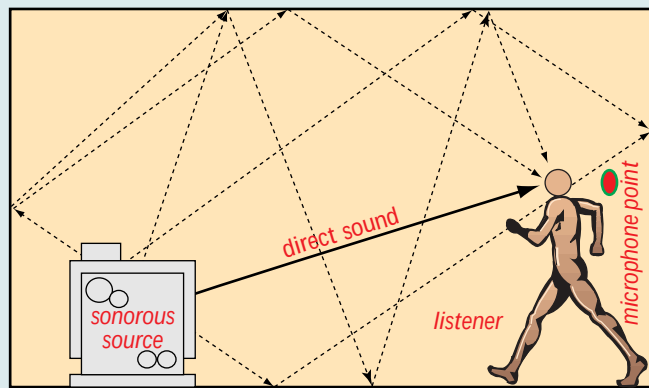
General working places installed in sheds caused a great nuisance between workers with a lot of consequences to the sense of hearing.

With the application of sound-absorbing materials to the walls or ceilings it is possible to reduce far noises and to decrease the general sound level.

Worker in this case is subjected only to the noise of his working place.

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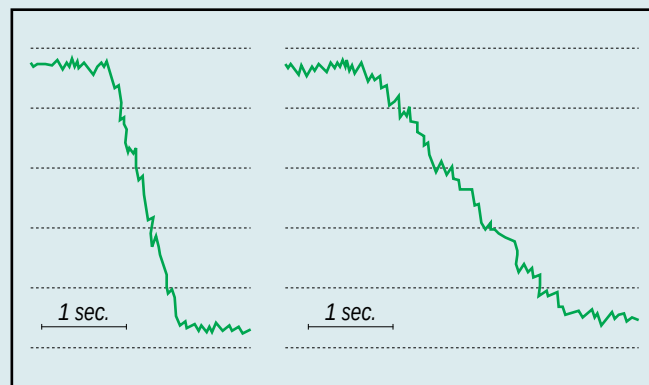
Basis idea of environmental acoustics



Picture 1

Reverberation

Direct sound and reflected inside a place.



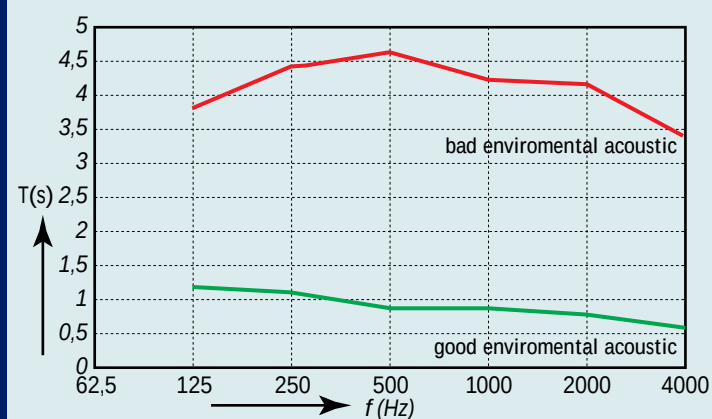
Picture 2

Reverberation time

Declining wave (frequency 1000 Hz) of sound energy.

A. Good environmental acoustic.

B. Bad environmental acoustic.



Picture 3

Reverberation time (T in sec.)

Results of test of reverberation time

Pressure waves caused by a sound inside a place are reflected through the walls of the same place causing a superimposition of direct sounds (reverberation, see picture No 1).

Reverberation time

It is the referring parameter most important into the calculation of environmental acoustics measures.

It allows to calculate the sound-absorbing properties of a place and to optimize some tempering operations.

If in a closed place it is put some sounds and a microphone we obtain some sound reflections coming from walls which will make a longer way respect to the direct ones and their impact on the microphone will be later (sound speed = about 340 M/sec) (see picture No 1).

If the sound is suddenly stopped, the energy directed to the microphone will be the first to decrease and gradually also the reflected energy till it will be absorbed by the place walls.

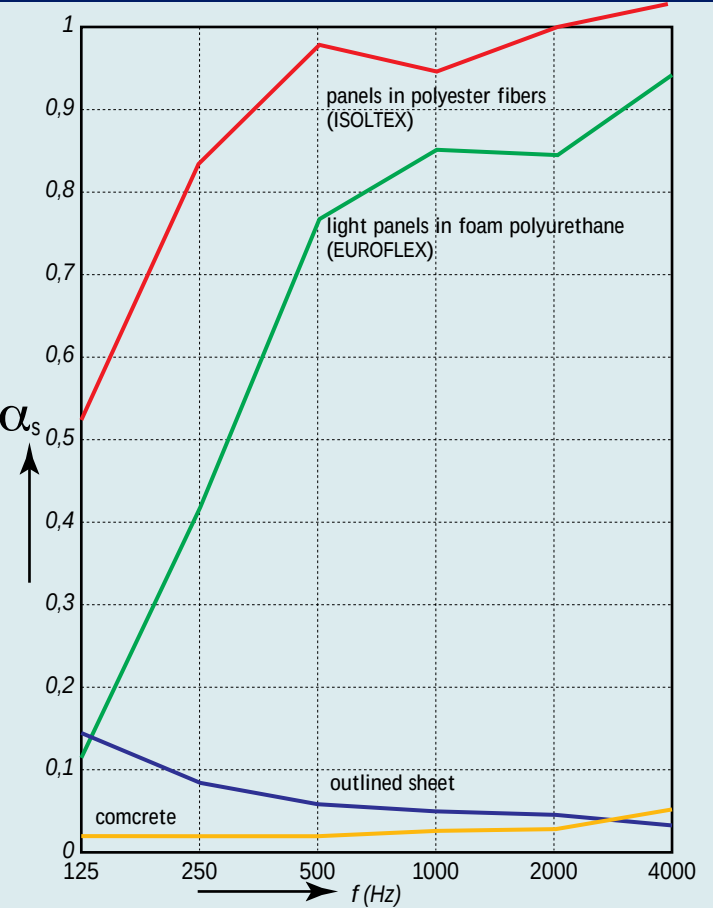
The time of this process is connected to the absorption grade of the place and it is called reverberation time (T) (see picture No 2).

A reverberation time value between 0.8 and 1.5 seconds is very good, on the contrary a value around 4/4.5 seconds is very bad.

It is very important to remind that reverberation time (T) in function of frequency (Hz) is the period in seconds measured from the sound stopping for a decline of 60 dB (see picture No 3).

Parameters of evaluation are those you can see on graphic (see picture No 3). These data can be measured only having a qualified instrument.

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Picture 4
Sound-absorption values of different materials in function of frequency.

Space volume (m³)	Max reverberation time in sec.			
	125	250	500	1000
Till 1.000	1,5	1,4	1,0	1,0
From 1.000 to 5.000	1,8	1,6	1,2	1,2
From 5.000 to 20.000	2,1	1,7	1,5	1,4
Till 20.000	2,3	1,9	1,6	1,5

Table 1
Reverberation time in function of volume

At this point it is normal that sound-absorbing values or sound acoustic coefficient are directly bounded to the reverberation time. The graphic (picture No 4) underlines the different grade of sound-absorbing of some materials in function of frequency (Hz).

Calculation of sound absorbing surface

There is a great relation between reverberation time T (in sec.) and the volume of the place V (in m³) and the sound-absorbing surface A (in m²) underlines by Sabine expression:

$$A= 0.163 \times \frac{V}{T} \text{ (m²)}$$

This allows to do a qualitative evaluation of a place to re-make through the medium sound-absorbing coefficient given by the following formula:

$$\overline{\alpha_s} = 0,163 \times \frac{V}{T} \cdot sv$$

where:

sv= total surface of place to re-make (walls, ceilings etc.)

Reverberation time can be reduced thanks to the application of sound-absorbing materials. From the relation between reverberation time it is also possible to calculate the reduction of the sound level ΔL:

$$\Delta L= 10 \text{ Log } x \frac{T_1}{T_2} \text{ [dB (A)]}$$

where:

T₁= original reverberation time.

T₂= reverberation time with sound-absorbing materials.

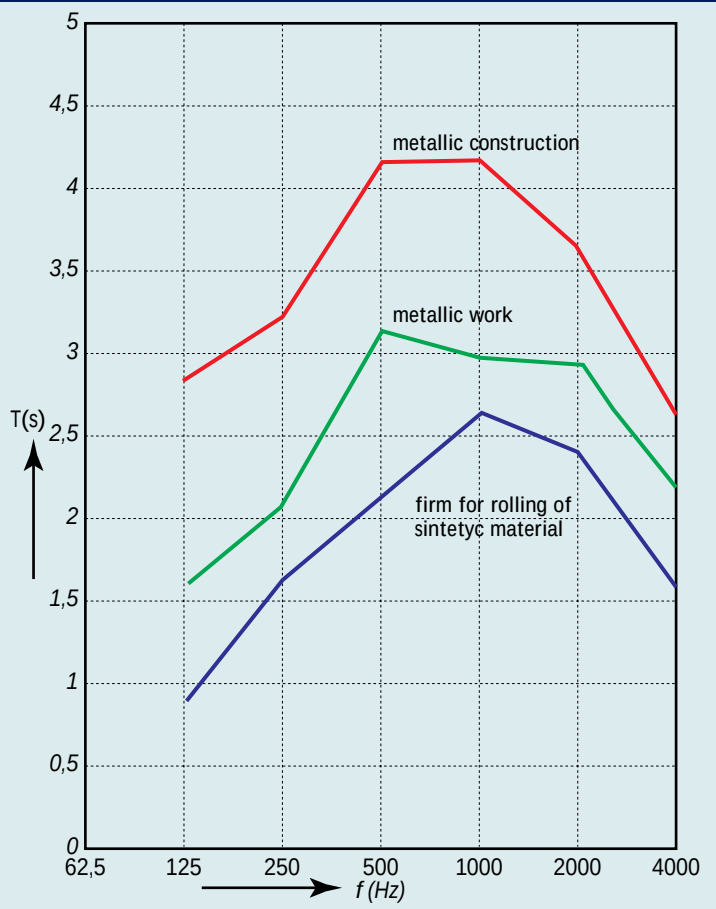
At the end, reducing the reverberation time from 2 to 1 second we can obtain a consequently reduction of sound level as per 3 dB (A).

In picture No 1 there are indicate some values of reverberation time in function of the place volume.

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PRACTICE SOLUTIONS

Material	Frequency (Hz)						
	125	250	500	1000	2000	4000	α_s
concrete	0,02	0,03	0,03	0,04	0,05	0,05	0,04
smooth plate	0,06	0,20	0,15	0,14	0,10	0,05	0,12
plaster	0,02	0,02	0,03	0,04	0,05	0,05	0,04
pyramidal panels EUROFLEX Art. 122/P	0,15	0,40	0,80	1,05	1,05	1,05	0,75
fibra panels ISOLTEX Art. 100	0,20	0,60	0,80	1,05	1,05	1,15	0,85



Soundabsorbing materials

Application indications for
acoustic tempering

Table 2

The decision to approve a sound tempering on some industrial places depends on different points, in each case it should be taken on the measurement of reverberation time. Only these measurements can give good indications, neigh to value a situation nor for an acoustic tempering. It is essential to know medium values of sound absorption (α_s) of some materials to do an evaluation (see picture No 2). In the picture No 5 there are underline reverberation times in seconds (T_s) of some industrial departments with ceilings in profiled sheet iron. In this case it has not been used any sound-absorbing material.

General Indications

Some examples of sound tempering using panels in Polyester fibre thick. 70 mm (Isoltex article 100)

Example 1

Object: Punched department

Ceiling surface $S= 180\text{ m}^2$

INDEX 2= after some works of

Place volume $V= 636\text{ m}^3$

INDEX 1 = original state

Acoustic tempering measure = panels on
ceilings of 70% Isoltex fibre thick. 70 mm

Frequency Hz	125	250	500	1000	2000	4000
T1 sec.	2.05	1.75	1.7	1.8	1.7	1.6
T2 sec.	1.4	0.95	0.7	0.7	0.8	0.8
Admitted	1.45	1.2	1.05	0.95	0.95	0.95

Medium grade of soundabsorbing $\alpha_{s1}= 0.10$
 $\alpha_{s1}= 0.10$

medium reduction of sound level $d \Delta L = 3.1\text{ dB}$
 $d \Delta L = 4.9\text{ dB}$

Conclusion

In this introduction and in the catalogue part dedicated to the sound-absorbing materials our Technical Department has tried to explain in a easier way parameters which ask to using these materials and their right application in order to fight against the noise.

Picture 5

Reverberation time in sec. in function of
frequency (Hz)

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SOUND-ABSORBING MATERIALS

Reverberation in closed places

Sound-absorbing materials are directly bounded to the problems created by the sound reflection (reverberation).

Sometimes in a lot of civil and work places become impossible the comprehension of words and music because of a high sound reflection; this is caused by ceilings or walls made of compact and reflecting materials.

Reverberation happens when there is a confused superimposition of sounds made in a moment with reflections which caused a confusing playback .

In different places there is the need to keep the reverberation time within exactly values. This caused a choice of structural standards which have to be studied.

Technical characteristics

The main characteristic of sound-absorbing materials is the cell structure and porosity.

As a matter of facts when a sound wave hits a material the cell structure of this item will reflect a part of the wave and it will absorb the remain part.

The relation between the absorbed and not reflected energy and the absorbed energy is called coefficient of acoustic absorption (α).

Fields

As per insulating materials this item is used in different but specific fields.

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SOUND-IMPEDANT MATERIALS

Transmission of noise and materials for air acoustic insulation

Generally noises transmitted in a place through air way arrive through the walls and ceilings.

The energy produced by a noise for an impact on walls has a better increase than the air noise and the sound wave created at the impact propagate itself inside the structures.

In order to solve problems created by air way transmission we explain in this technical document some products/materials with a very good sound-insulation power (R).

There are materials composed by Polyurethane and Polyethylene which cover a lead mass or an elastomer membrane.

Their value of Sound-Insulation power (R) is expressed in a graphic (see picture No 1) in db following frequency (Hz).

Technical characteristics

The main characteristic of sound-impedant materials is like the sound-absorbing materials but with the added of sheets made of lead or charged rubber (160 P.P.).

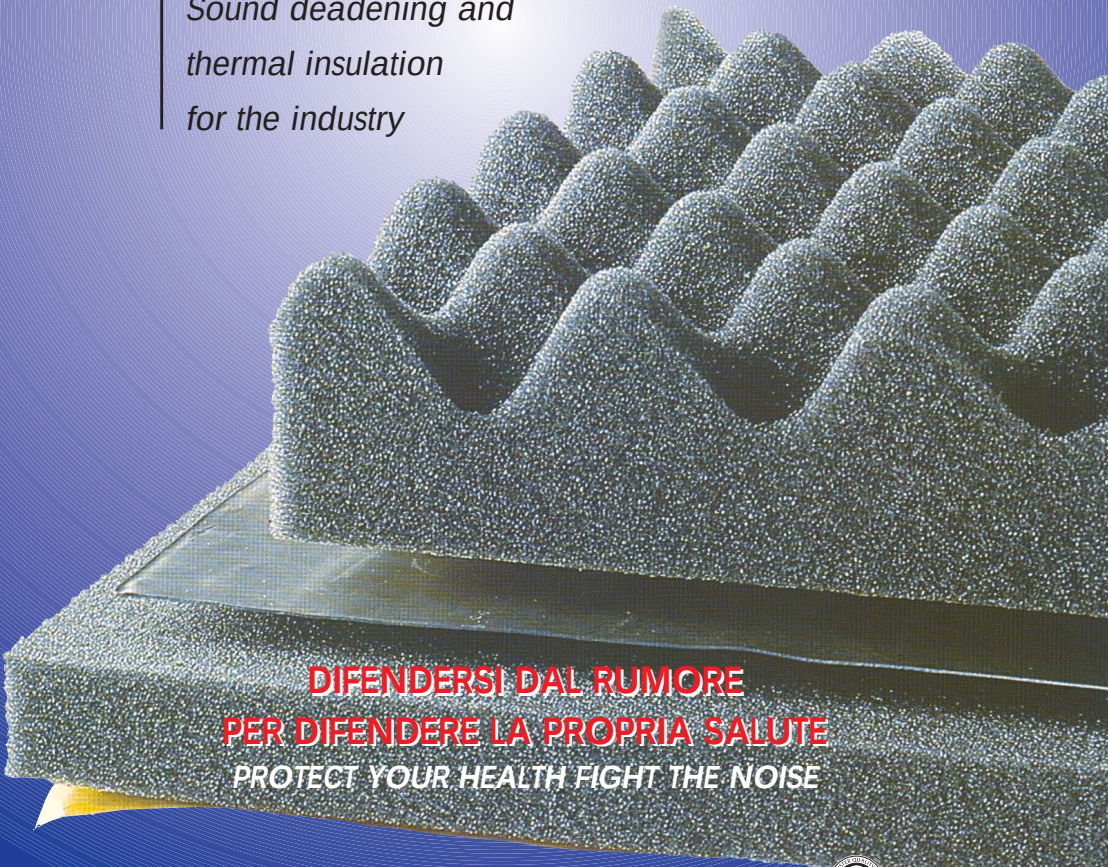
Fields

As per sound-absorbing material this item is used in different but specific fields.

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Isolanti termoacustici per l'industria

*Sound deadening and
thermal insulation
for the industry*



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Struttura del materiale

- Poliuretano espanso a cellule aperte - autoestinguente e tipo impregnato Classe 1
- Resina melamminica elasticata a cellule aperte Classe 1
- Fibre di Poliestere ottenuto per termolegatura della fibra
- Accoppiati a lamine di piombo e a masse elastomeriche

Caratteristiche tecniche

- Autoestinguente e non • Densità: da 11 a 95 Kg/m³
- Temperatura di applicazione: -40C° +295 C°

Aspetto • Liscio • Bugnato • Piramidale

- Accoppiato a film in Poliuretano, Alluminio e PVC /finta pelle

Applicazioni • I materiali sopra elencati possono essere utilizzati come fonoassorbenti nelle canalizzazioni d'aria, isolamenti a supporto di macchine rumorose e fustellati in forme e dimensioni a richiesta.

Esempi: vani compressori, cabine silenziose, palestre, studi di registrazione, controsoffittature, macchine utensili, pareti divisorie

Structure of material

- Open cell Polyurethane foam-self-extinguishing and impregnated type Class 1
- Open cell-elastic melamine resin Class 1
- Thermobonded Polyester fibre
- Coupled with lead sheet and elastomer mass

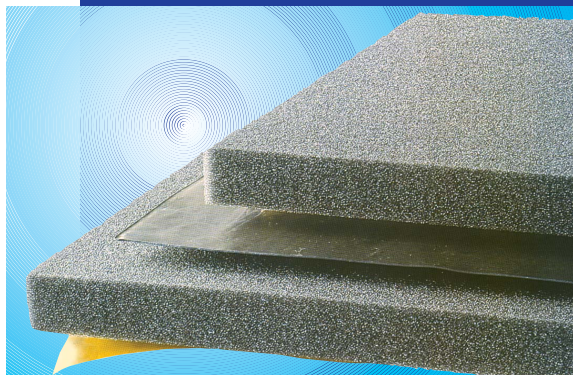
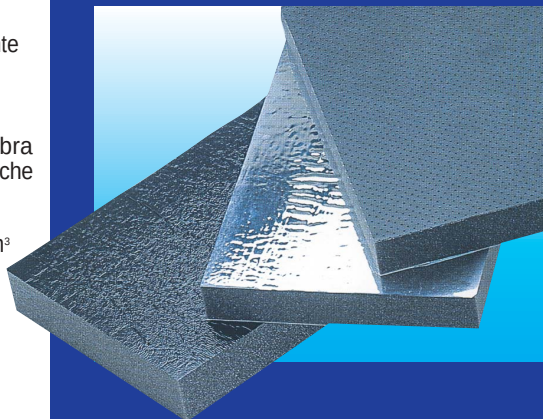
Technical characteristics

- Self-extinguishing and not
- Density: from 11 to 95 Kg/m³
- Temperature Range: -40 +295 degrees C°

Aspect • Smooth • Embossed • Pyramidal shaped

- Coupled with PU, ALU and PVC film

Application • Materials above mentioned can be used as sound-absorbers into the air canalizations, into the structure of noisy machineries and tools and they can be cutted in shaped pieces and sizes on request. For example: compressor casing, noiseless cabinets, gymnastic rooms, recording studios, false ceilings, tooling machines, partition walls



EUROFOAM

via C. Colombo, 12 - 20020 Lainate (MI) Italy

Tel. ++39+2 93796660

Fax ++39+2 93796700

<http://www.eurofoam.com>

E-mail: info@eurofoam.com



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