ACOUSTICS

1 - INTRODUCTION

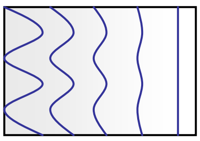
The **nidaplast** honeycombs have high acoustical characteristics because of their composition :

- They are made of polypropylene, a viscoelastic material, ready to absorb vibrations.
  ↳ **Damping properties**

- The mesh of the honeycombs structure, with its particular shape, allows to trap and damp most of the sound waves. In reality, the sound gets inside the cells, then rebounds decreasingly on the cell walls (because of their viscoelastic properties).
  ↳ **Sound absorption properties**

- Made with the accurate facings, the **nidaplast** honeycombs (whose cells contain air) make the "spring" part of a composite system mass/spring/mass, working efficiently against the sound transmission.
  ↳ **Sound insulation properties**

2 – VIBRATIONS DAMPING



The damping properties of a material are its capacity to lower the vibrations under which it is submitted. Theses vibrations could have mechanical or acoustical origins. A material has good damping properties if it releases low vibration levels, consequently if it has a low acoustical radiation. At the opposite, a poor damping material easily starts to vibrate at the lowest stimulation applied on it.
The damping capacity is characterised by the loss factor η, with values generally between 0 and 1. The Young modulus of the material has also an influence on this factor.

To reach a high damping level, you need a soft material, capable to transform into heat all vibrations. It is true for the viscoelastic polymers, and especially for polypropylene. Consequently, the **nidaplast** honeycombs are well adapted for all the applications where the sound level of a vibrating structure has to be lowered.

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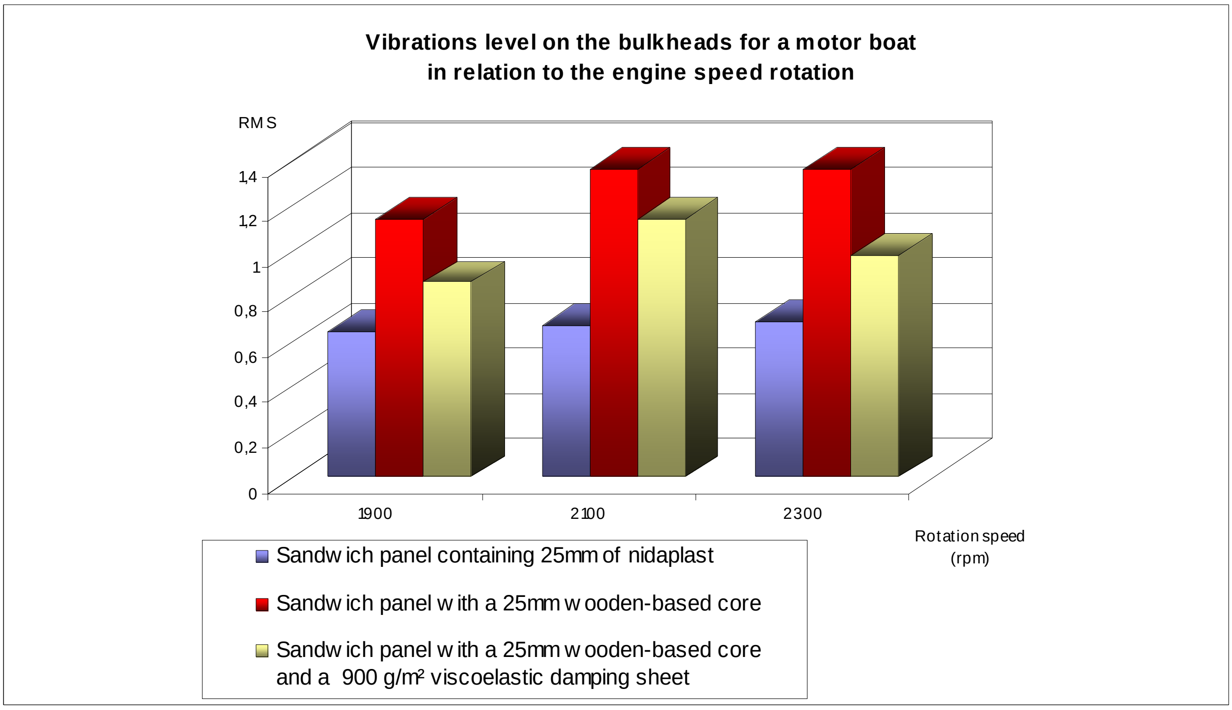
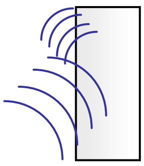
For your information, the following curve is comparing the damping level resulting from different panels. The vibrations are made by a motor boat. The X line shows the motor rotation speed, and on the Y line the vibration level.



The **nidaplast** efficiency can easily be noticed on the above graphics because it is a viscoelastic product with a low modulus. Compared with a wooden core, it is possible in some case to lower by 50% the vibrations level.

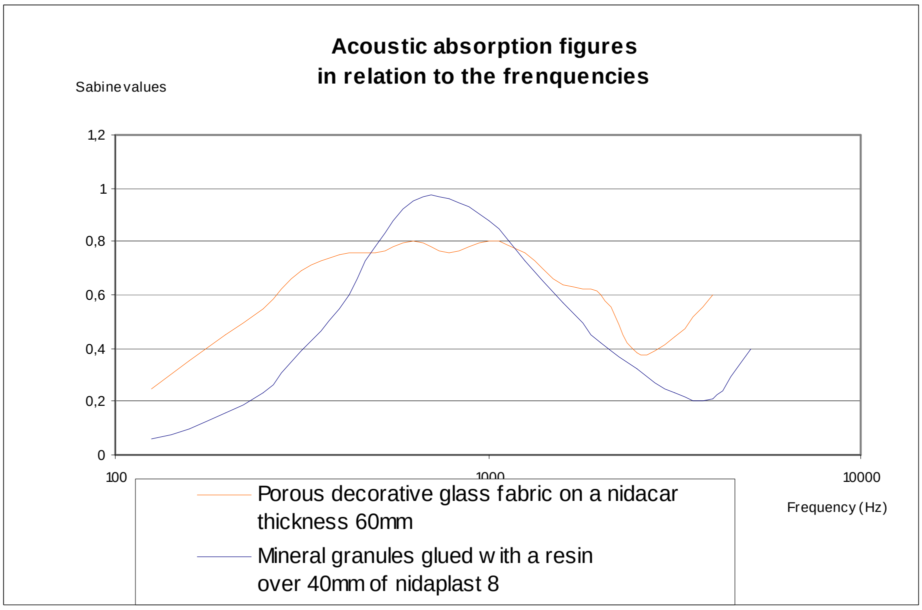
3 - SOUND ABSORPTION



The acoustic absorption is the property which prevents sound reflection. To have a good absorption level, you need a material which is able to trap the sound waves. It is true for the porous or honeycombs materials on which the sound wave spreading is limited. The acoustical absorption is characterized by the "α sabine" factor. This factor is between 0 and 1. It is higher as the absorption level is increasing.

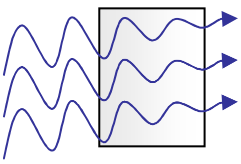
To have an efficient absorption level, the **nidaplast** has to be covered on one side with an air porous facing. The sound waves get inside the cells and then are trapped like in an Helmoltz resonator : they rebound inside on the walls until they are completely absorbed.

Below find the two separate and informative graphics on the α value for two different types of **nidaplast** sandwich panels:



We notice a large absorption level for most of the frequencies. However, it is possible to shift the absorption level and the graph top value by playing on the **nidaplast** thickness and on the facing porosity.

4 - SOUND INSULATION



The acoustic properties for an element dividing two rooms are defined by its ability to lower the noise released from one side and its perception on the other side. The insulation is characterized by the weaken factor quoted R (difference between the released and received intensities) which may shift from a few decibels to several ten decibels (for information, the decibels are calculated from a logarithmic scale. A 3dB decrease represents a decrease of half of the sound power). It is important to differentiate two types of partition for the acoustic insulation analysis :

↳ If we consider a structure with a single homogenous partition, the only factor which increases sound insulation is the mass. Heavier is the partition and better is the insulation.

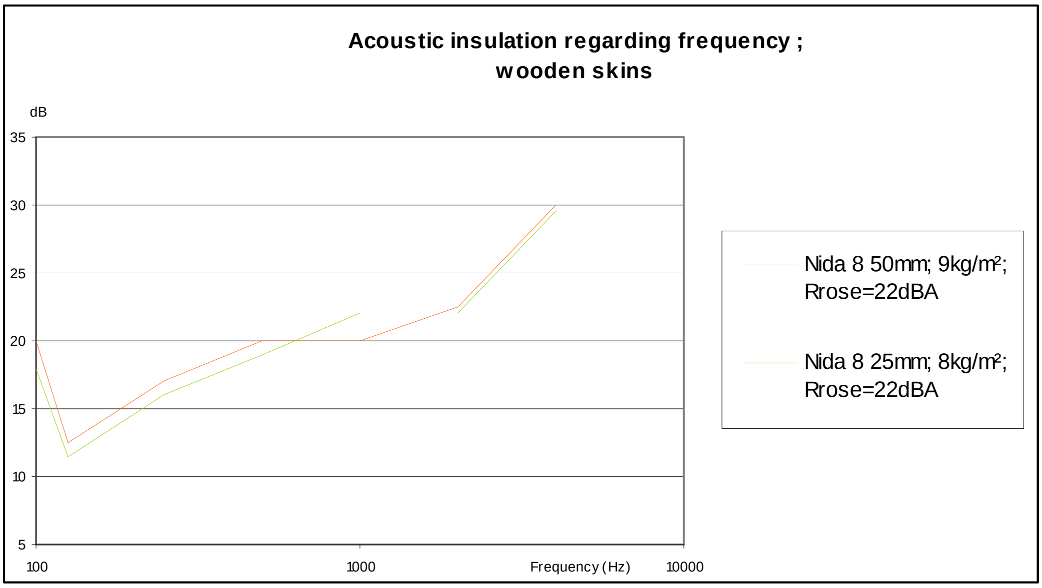
↳ If we consider a composite structure (mass/spring/mass), which means an alternation of heavy layers and damping layers, it is then more difficult to define the weaken value factor.

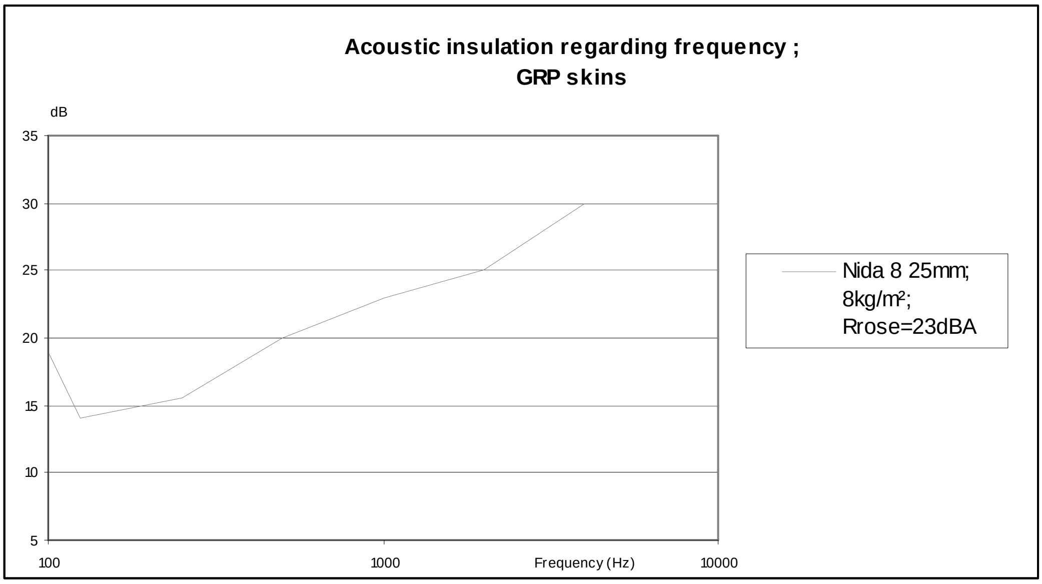
To simplify, in such a structure, the first "mass" vibrates and transmits the waves to the "spring". This "spring" then transmits the vibrations to the second "mass", but because of its composition, it damps them. Such a structure has a resonance frequency where its weaken factor is low, but by playing on the mass for the partitions, it is possible to "choose" this resonance frequency. For example, we can look for it, to bring out the structure resonance frequency under 90 Hz which is the lower limit of the defined spectrum for the acoustic in the building. The weaken value for a composite structure, as soon as we are above the resonance frequency, is in all cases above and very above the value obtained with the heavy mass alone.

The **nidaplast** honeycombs allow making light structural sandwich panels. In these composite panels, they will play like a spring as related above. The facings of the sandwich panels are the heavy mass of the structure. Thus, it is possible to have a very good weaken factor for the sandwich structure made with a **nidaplast** core. Compared to the glass wool, the **nidaplast** will not reach the same damping levels. However, it makes a compromise between sound damping and structural properties, which other insulation materials are not able to compete against.

The acoustical properties for a sandwich panels made with **nidaplast** are bond to a lot of parameters (the facing types which cover the **nidaplast** core, the sizes, fixation types, the acoustical waves and frequencies applied…). It is not possible to give all the main characteristics, but only indicative values with different facings and under various acoustical solicitations:

Below, some acoustical insulation graphics for **nidaplast** - based sandwich panels with two different facings:





NOTA : The indicated directions can serve as a guide to use the product but cannot be considered as a guarantee of a good working up. Additionally application, utilization and/or transformation of the products escape our control possibilities. As a consequence, they exclusively remain the responsibility of the user and/or the transformer.

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