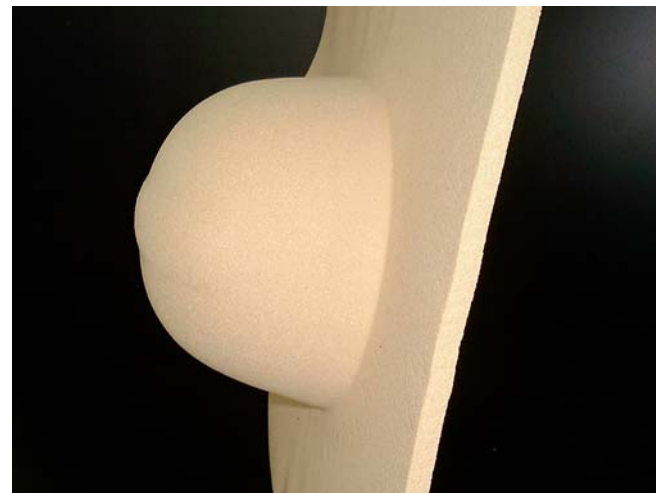


**No outgassing**

AIREX® R63 causes no outgassing problems. Outgassing of foams can occur due to residual gas from the blowing agent or chemical reaction during the expansion process, which remains under high pressure in the cells. The special foaming process of the thermoplastic AIREX® R63 guarantees that no excess gas remains in its cells.

**Easy 3-D shapable**

In many cases it's a challenge to form 3-dimensional shapes, especially when small radii are desired. Many sandwich manufacturers use contoured or scrim foam cores as they are easy to apply. But the filling of the gaps between the foam squares with resin or putty will lead to an increase of weight and is time consuming. Often it is not carried out in a proper way. It is not unusual to rely on the resin to fill the gaps between the "core cubes" and hence, to bond them together. Furthermore, if any cracks in the surface occur, moisture can enter into the unfilled gaps. These problems will not occur, if AIREX® R63 foam is used, which can easily be formed. AIREX® R63 is a rigid elastic product which can be cold formed without breaking, into a radius of 25 times the thickness of the foam sheets. If a smaller radius is necessary, AIREX® R63 can be formed over a radius of 3 times the thickness. AIREX® R63 undergoes no shrinkage or expansion in any of the three dimensions after heating.



The information contained herein is believed to be correct and to correspond to the latest state of scientific and technical knowledge. However, no warranty is made, either expressed or implied, regarding its accuracy or the results to be obtained from the use of such information. No statement is intended or should be construed as a recommendation to infringe any existing patent.

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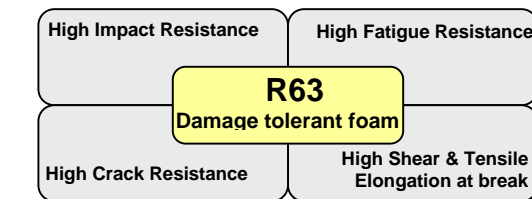
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## AIREX® R63 DAMAGE TOLERANT FOAM

**Summary**

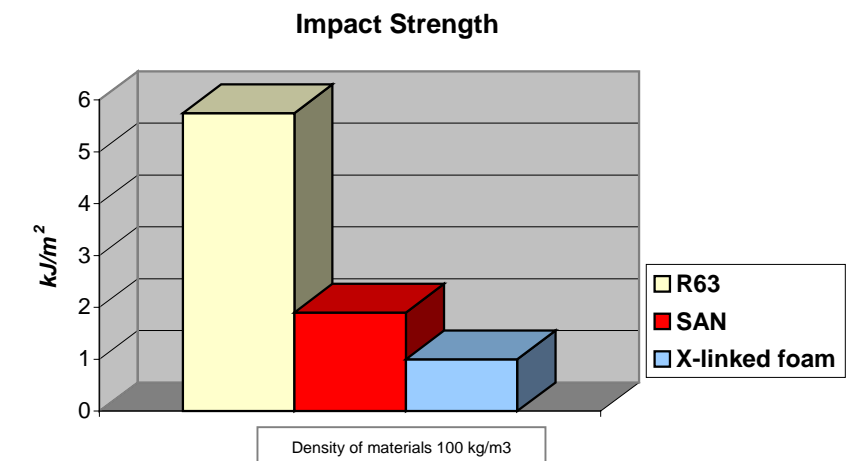
AIREX® R63 is the only genuine, high quality, linear PVC foam and market leader in impact resistance doubling the values of its next competitor. The ability of a sandwich core to resist failure, even if there is local overloading, determines its mechanical performance. Consequently, for applications in dynamically loaded structures, the closed cell AIREX® R63 is the best of all the structural foams available. Many years of experience with AIREX® R63 proved, that the characteristics of this damage tolerant foam for dynamically loaded structures incorporates additional important benefits:



Other outstanding properties of AIREX® R63 are its excellent bonding to a wide range of skin material, cold formability to three dimensional contours, its rot resistance and the very good ageing properties.

**High impact resistance**

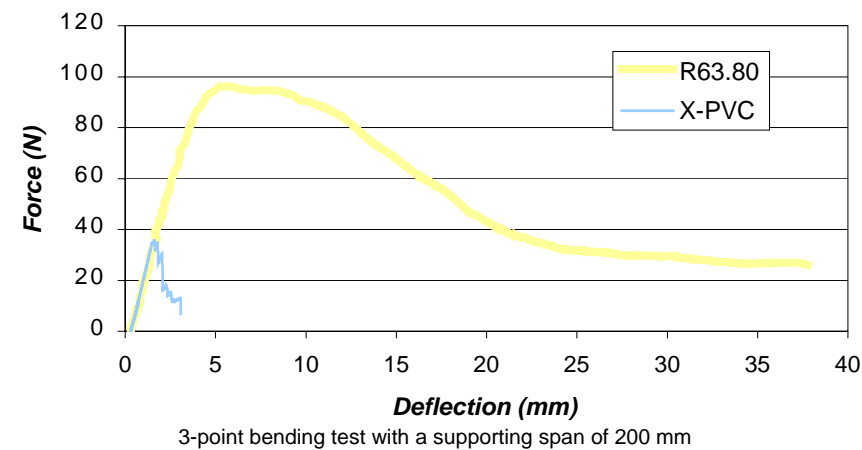
Due to its tough behaviour, AIREX® R63 is not affected, even when subjected to high impact loads. The foam will recover after an impact, without losing its mechanical properties. With AIREX® R63 high amounts of energy can be absorbed in case of an impact. Failure or debonding of skin are extremely rare.



### High crack resistance

If high local stress concentrations cause core cracking. AIREX® R63 will prevent the propagation of a crack, due to its high plastic deformability combined with its high crack propagation resistance. Crack propagation tests prove that the failure behaviour of notched AIREX® R63 specimens is totally different to the behaviour of notched cross-linked foams. As the crack in AIREX® R63 remains local, the material fails finally in a non-catastrophic manner at a high deflection. The energy required for a complete structural failure can be determined by integrating the area under the load-displacement curve. The following diagram clearly shows how the structural integrity is enhanced, when using AIREX® R63 compared to cross-linked foams.

#### Single Edge Notched Bending Test



### High fatigue resistance

Investigations at different world wide accepted test institutes prove that no failure occurs under dynamic fatigue. Fatigue tests made at DNV and EMPA, with four point flexural tests, proved that cross-linked PVC-foams failed by core cracking, whereas AIREX® R63 did not fail at all and totally recovered after the test. Additional tests made at DLR Stuttgart show that the high elongation at break of AIREX® R63 is not affected by fatigue. Furthermore, it is the only foam available which does not become brittle even at high strain rates. The safety and the lifetime of a dynamically loaded structure built with AIREX® R63 core material is therefore unquestionably increased.

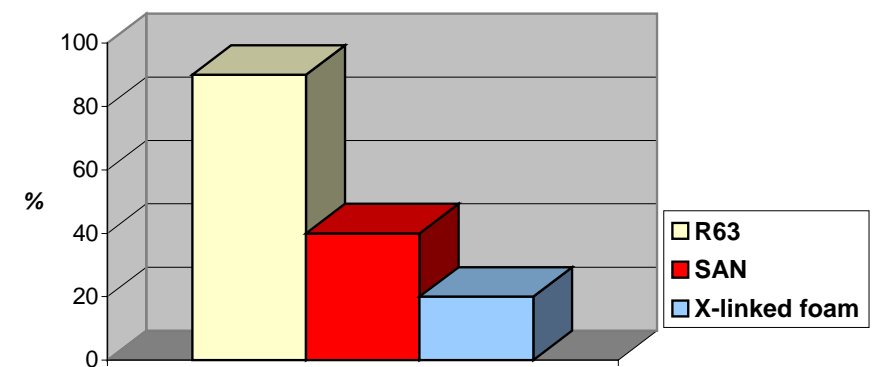
There are, however, a few additional facts which should be taken into account: In any sandwich structure, the core is loaded in shear. As stiffness is mainly a function of the thickness of the sandwich, it is initially the engineering design of the whole sandwich which has to suit the loading requirement.

It is not only the ultimate load that is important for many applications, it is also the loading frequency. The core material AIREX® R63 never becomes brittle, even at extremely high strain rates, as it is especially designed to cope with these demands. For dynamically loaded structures, AIREX® R63 is the preferred core material.

### High shear elongation at break

In sandwich composites, geometrical irregularities, such as holes, cracks and sharp corners lead to local stress concentrations. Holes and notches cause the stress in their immediate vicinity to be much higher than the strength of the material, even when the general level of stress in the surrounding area is low and, from general calculations, a structure might appear to be perfectly safe. Structures made of brittle materials are much more sensitive to these stress concentrations and they need to be used with higher safety factors, whereas tough materials, such as AIREX® R63 are naturally protected against the effects of stress concentrations. The very high toughness of the core material AIREX® R63 can be shown by comparing the shear elongation at break.

#### Shear Elongation at Break



The classification society Det Norske Veritas recognised the outstanding qualities of AIREX® R63. The society lowered the safety factor in favour of our AIREX® R63 in their calculation procedure for bottom panels of marine vehicles, in comparison to other foam materials by 15 %. All other important classification societies, such as Lloyds Register, American Bureau of Shipping, Germanischer Lloyd or Bureau Veritas have certified AIREX® R63, too.

### High peel strength

For good adhesion, cores must be adequately wet with properly catalysed or promoted resin and gel time needs to be adjusted accordingly. Plastic foam cores typically absorb styrene monomer whose plasticizing has a weakening effect. However, when bonding AIREX® R63 foam cores to skins, a mechanical and chemical bond between the two different materials is produced. The resin fills up the partially open cells on the cut surface of the foam and - after curing - bonds in all service conditions, such as vibration, impact, overloading and fatigue.