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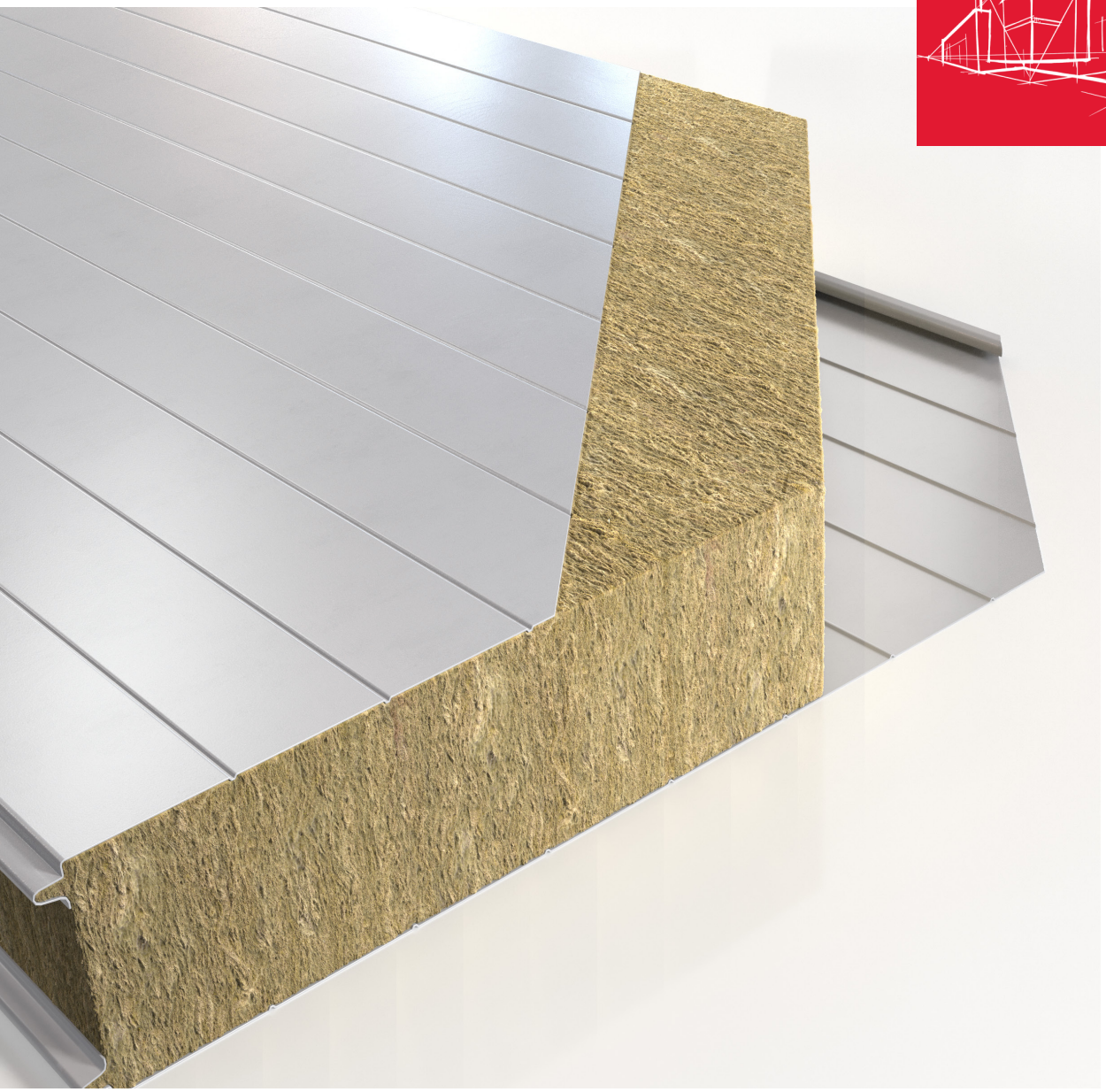
Sandwich panels in industrial constructions

Stone wool insulation creates the difference



ROCKWOOL®

CORE SOLUTIONS

Content

Top priority: **Fire protection**

On the safe side of Euro classification non-combustible A2-s1, d0 with stone wool sandwich panels

Fire resistance properties

Sandwich panels have developed into the standard construction method in industrial and commercial construction since the 1960. In order to meet all legal requirements sandwich panels with stone wool core have been gainig ground since the start of the 1990s. Fire protection plays a key role.

Industrial buildings or building sections in the field of industry and commerce are used for production or storage or products of goods. The goal is to regulate the minimum standards of fire protection in industrial buildings, in particular: the fire resistance of components; the fire behaviour of building materials, the size of the fire section or fire fighting section; the arrangement, position and length of the rescue routes; effective extinguishing work. Industrial buildings that fall under this directive fulfil the protection goals. This enables easier plannings for developers, architects and specialist planners, and authorities to assess and approve, industrial buildings. Intended simplifications or deviations from applicable fire protection regulations of the building standards do not have to be verified for each individual case.

Euroclass system

The European product standard EN 14509 applies for sandwich panels, which regulates the Euro classification for sandwich panels, among other things. This standard regulates different construction products and construction types based on their fire protection properties according to EN 13501 Part I. The Euroclasses A1 and A2-s1, d0 are "non-combustible". Stone wool fulfils the requirements of the highest Euroclass and is classified as non-combustible A1. Sandwich panels achieve the non-combustible Euroclass A2-s1, d0 only due to stone wool core material. No other Euro classification fulfils the requirements for non-combustibilitiy.

Among other test the classification of Euroclasses results from a SBI test (Single Burning Item Test), which is ended after a test period of 20 minutes. A real fire event does not fulfil time specifications. Tests like the SBI tests can thus only be used as a comparison scale for evaluating different materials and products. How building material behaves in a fully developed fire depends on a wide range of different factors. The further development of the fire can only be assessed to a limited extent based on the quantities of the emitted smoke gases and the dripping or non-combustion of the panels.

Fire resistance (duration)

The fire resistance ratings are regulated according to the European standard EN 13501 Part II. The tests to assess the conditions under which and how long a wall or ceiling component can withstand standardised fire are regulated by European standards EN 1363-1 or EN 1363-2 in conjunction with EN 1364 ff. The fire resistance ratings derived from this are described in the EN 13501-2.

The diversification options for fire resistance classes have become more diverse due to the specification of boundary conditions in European standardization. The key message is expressed by a duration and other features, such as EI 120 i→o. Only sandwich panels with a stone wool core can achieve high fire resistances up to 240 minutes even on slim designs.

Overview of key technical differentiation properties

The following comparison table shows why sandwich panels with a stone wool core are particularly recommended with regard to their clearly superior fire protection properties and soundproofing features compared to foamed sandwich panels.

Sandwich panel	with PUR core		with PIR core	with stone wool core
Building material classification	Normally flammable	Low flammability		**Non-combustible**
Euroclass system	**D-s3, d0**	**C-s3, d0 B-s3, d0**	**C-s1, d0 B-s1, d0**	**A2-s1, d0**
Fire resistance rating	Not possible		Low	**Up to EI 240 in slim design**
Sound insulation and sound absorption	Low		Low	**High**
Thermal conductivity (W/m·K)	λ ≥ 0.023		λ ≥ 0.018	**λ ≥ 0.039**

Sandwich panels and their labelling are regulated via a European harmonised product standard.

FIRE ENDURANCE TEST

The fire endurance test provides additional important information on the fire behaviour/contribution of a building element. A standard test is used to verify whether the building elements guarantee that the room is sealed and that a temperature increase is prevented on the side facing away from the fire. This test does not evaluate whether and in what quantity toxic combustion gases are released.

Advantage:
Noise protection

When using sandwich panels, particularly high noise protection values can only be achieved with stone wool core.

Noise and sound

In modern life, we are constantly surrounded by sources of sound. This sound is frequently perceived as unpleasant and oppressive and is therefore referred to as noise. In the development and construction of products and solutions, additional functions such as acoustic capabilities provide added value.

Stone wool sandwich panels help integrating added value in building envelopes or to increase acoustic comfort levels inside a building. In general, we know that people exposed to high noise levels have an increased risk of heart disease and that stress threshold is significantly reduced.

Compared to light and closed-cell materials stone wool sandwich panels offer added value for both fields of acoustic sound insulation and sound damping.

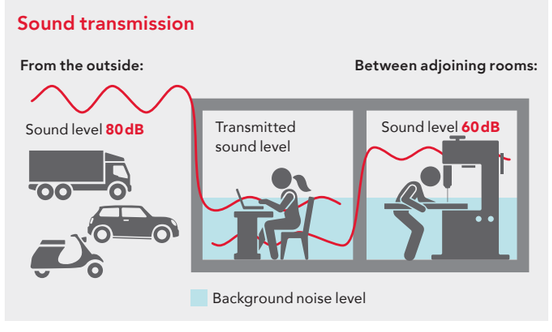


Fig. 1: Sound transmission. This can occur from the outside to the inside and vice versa.

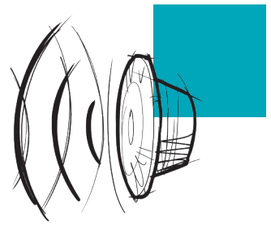
Building acoustics

Building acoustics is a field of building physics that deals with the impact of structural properties. The noise spreads between rooms in a building or between rooms and to the outside of a building.

In building acoustics, the question is: What proportion of sound reaches the other side of the component? Sound insulation is a key property of a component in building acoustics.

The sound insulation of components is described for airborne sound by the evaluated structural sound reduction index R'_w. This value is determined using an evaluation curve from the frequency-dependent structural sound reduction index R'. The R'_w value of a component can be determined via a measurement on-site or based on calculation methods.

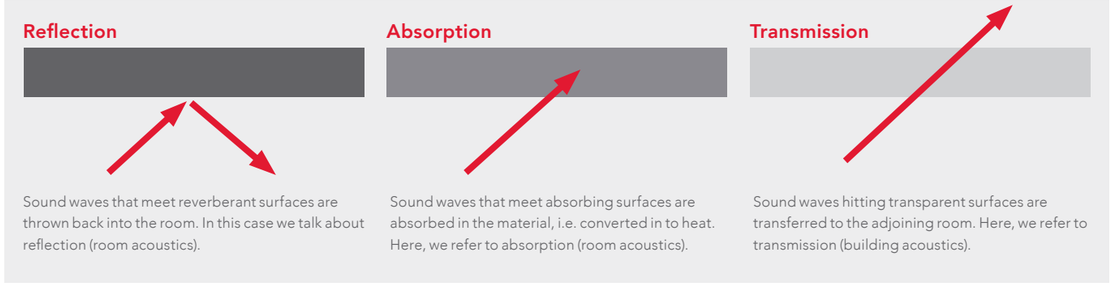
Numerous measurements prove that stone wool sandwich panels offer a 4–6 dB better sound insulation value than comparable sandwich panels with foamed core material. This 4–6 dB improvement in sound insulation values can make the difference when it comes to answering the question of how much noise a building emits. A specific case is the construction of a cardboard box production factory in south Germany close to a health resort. The building project could only be executed by using stone wool panels on the entire facade surface, as this guaranteed a sound reduction index of > 30 dB.



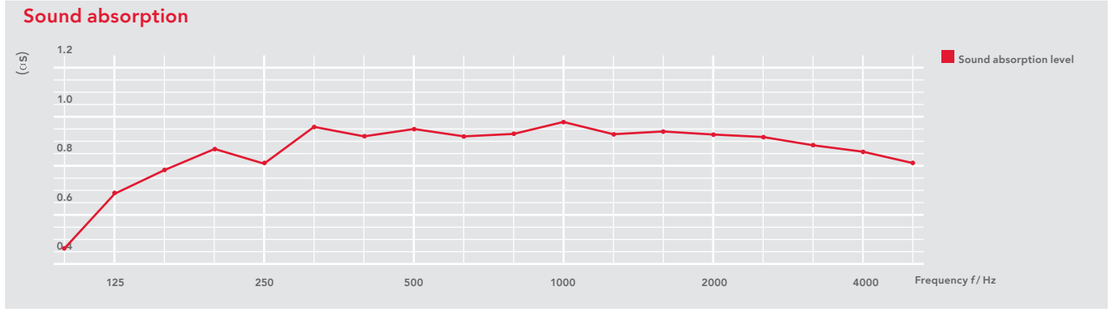
Room acoustics

Room acoustics addresses the question: Which surfaces achieve optimal hearing conditions (working conditions) in the room? The key property is the sound damping (sound absorption) of the surfaces surrounding this room or that are present in this room. Sound damping describes the ability of materials to absorb sound or to absorb the sound energy that hits them and convert it in to heat. Sound damping is achieved through sound absorbers.

The sound absorption coefficient describes the ability of a material to covert the occurring sound into other energy forms – e.g. heat or movement. With sound reflection, the sound is thrown back and prevented from spreading by walls, for example, α = 0 means that no absorption takes place, the entire occurring sound is reflected. With α = 0.5, 50% of the sound energy is absorbed and 50% reflected. With α = 1, the entire occurring sound is absorbed, reflection no longer occures.



Acoustic stone wool sandwich panels are predestined for absorbing sound. Via perforated steel sheet cover layers on one or both sides of the panel, sound waves can be absorbed by the stone wool core material. The percentage proportion of holes in this steel sheet is at least 28% and thus ensures that the properties of the stone wool with regard to sound absorption are also found in stone wool sandwich elements. Depending on the frequency, the sound absorption of acoustic sandwich panels offers very good sound absorption values of up to 0.9–1.0, see graphic below.



Exemplary sound absorption value of sandwich panels with stone wool core

The extremely good absorption properties of the acoustic sandwich panels open up a broad application spectrum for this type of panel, such as for device capsules, machine housings, room-in-room systems, room dividers, acoustic ceilings etc.

Sandwich panel manufacturers are convinced of the performance of the acoustic elements and support the users with specially trained personnel.

Design-relevant information

The visual appearance of modern industrial buildings goes far beyond pure functionality. The design aspect is playing an ever more important role. The targeted interplay of surface variations and color designs results in innumerable visual possibilities. Extensive industrial buildings can thus be integrated visually into their surroundings. With professional planning, the following visual defects can be avoided: Varying thickness, joint design, colour differences.

Varying thickness

Often, the structural fire protection goals are spatially limited by the construction regulations and can not be applied to the complete wall/ entire roof. For cost reasons, attempts are made as early as the planning phase to achieve a combination of sandwich panels with different core materials. The resulting designs can be complex, depending on the combination of the different requirements on components (fire protection and/or heat protection).

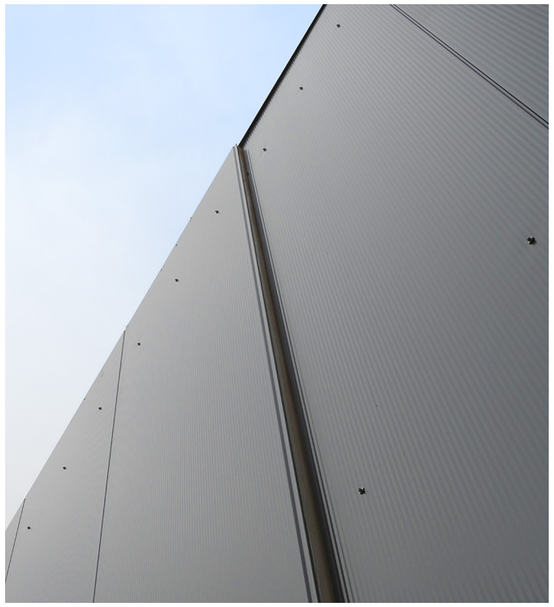
When heat and fire protection requirements are fulfilled at the same time, varying thicknesses occurs between the panels due to a change in the core material. To prevent the varying thickness from being visible from the outside, it must be compensated for from the inside by a different installation depth of the secondary construction. This transition must also be manually adjusted on site by the assembly staff.

One particularly important feature is ensuring a vapour-proof inner shell - both on the longitudinal joint between the sandwich panels and on the connections with other components in the roof, on the foundation and on suspended ceilings where applicable.

In the facade area, a varying thickness caused by changing panel types, is only accepted and implemented in the rarest of cases. In the roof areas the use of panels with different core materials is much more common, as this difference is hardly being noticed. To reduce structural damage, the same sandwich panel type should be used throughout from a building-physics perspective.

A transition from foamed panels to stone wool panels with the same thickness can be problematic. Most manufacturers of sandwich panels produce the foamed and stone wool panels on different equipment. Mostly they are not created/designed from the perspective of potentially being combined with each other, but based on product and plant-specific optimisation viewpoints. The result: minor differences in the joint geometry and the infeed width of the relevant outer and inner shells.

To avoid a difference in thickness, it is advisable to continue the mandatory non-combustible sandwich panels through to the next building corner.



Differences in thickness between a foamed and a sandwich panel with non-combustible stone wool core

Colour differences

Unwanted colour differences are often visible after the building is finalized and can be caused by the following factors: Different colour batches of the outer metal shell, different core materials, different manufacturers.

Particularly with regard to the popular colours RAL 9006 White aluminium, 9007 Black aluminium and RAL 7016 Anthracite, the colour differences can be so severe that it may appear to be different colours.

Unintentional colour changes between foamed and stone wool sandwich panels

To avoid colour deviations, precise coordination must be ensured with the respective supplier.

If unwanted colour differences still occur after the building is completed despite careful planning, additional components (pilaster strips) may be installed in a contrasting colour. Multiple pilaster strips such as these are installed on other parts of the building – even where no colour deviations occur – to achieve an even overall impression so that the observer perceives the contrast colour as intentional.

In most cases, it is safer not to change stone wool panels to foamed panels at will in the wall surfaces and only change this at a structurally existing transition such as B. to implement a building corner. Colour deviations are visually hardly noticeable, as adjoining walls do not look the same on the corners of the building anyway due to the different incidence of light.

Joint design during horizontal installation

For horizontal installation of sandwich panels with different core materials (stone wool/foam), it is important to note that the panel joints can be different heights over the building height. If the joints do not run in line, it can result in a visible visual fault. It is therefore advisable to design the entire facade with stone wool panels.

Sealing and fixers of sandwich panels

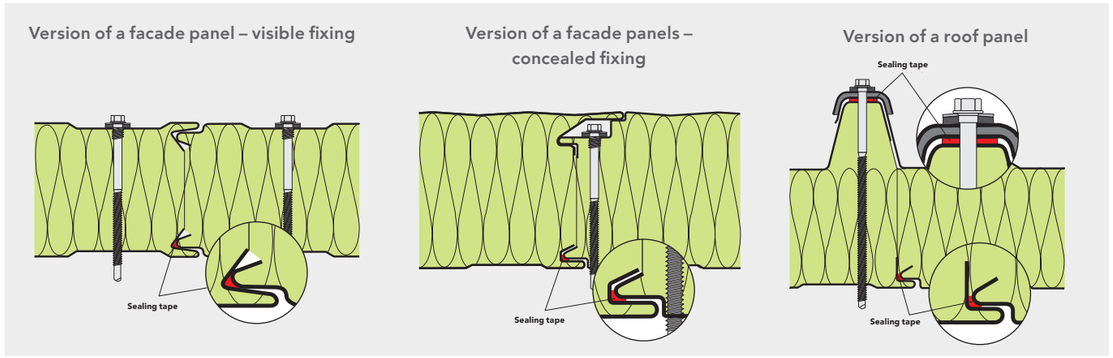
Sealing of sandwich panels

Air-tightness plays a key role in the positive energy balance of a building. The appearance of the building is highly influenced by the correct design of the joints Manufacturers offer joint seals to compensate manufacturing tolerances and/or tolerances in the substructure. These can be compressible sealing tapes or sealing compounds. These joint seals must be mounted on the inside or outside depending on the building type. For heated buildings, it is important to ensure that the seal is on the inside.

Joint connections of different panel types are shown below.

The planning and mounting of sandwich panels is extremely important if higher vapour pressure gradients are to be expected between the inside and outside of the sandwich panels.
These gradients are usually determined by the inside and outside ambient temperature. Therefore, it is important that the inner shells of the sandwich panels are sealed carefully both between each other and at the connection joints. This ensures that no warm inside air that is not capable of transporting a larger, relative air humidity, can not reach the other side of the inner shell. The dew point of the construction is inside the sandwich panles and would result in humidity loss in the event of convection from one panel shell to the other.

Sealing of different sandwich panel connections with stone wool core



Fixing of sandwich panels

The fixing of the sandwich panels on the secondary support structures may only be carried out with screws approved for this purpose, without exception. In addition, the individual manufacturers have applied for and received European approvals (ETA) for their own products

The screws intended for fixing sandwich panels have a so-called support thread under the screw head/washer, which, when fixing is carried out carefully, can minimise bulges at the fixing point in the outer shell.

Handling of sandwich panels

For production-related reasons, most sandwich panels are produced and packaged with the outer shell facing down so that the inner shell is facing upwards at the construction site. If the sandwich panels are to be fixed using suction cup traverses, it is advisable to store the sandwich panels with the outer shell facing upwards in the package.

Many manufacturers have integrated turning systems in their production process and can fulfil requests from installation companies to fill the packages so that the outer shells of the sandwich panels face upwards. This enables them to be lifted from the package directly with the suction cup traverses without turning at the construction site. This packaging request must be issued separately when placing the order.

It is important to ensure that the sandwich panels are not overloaded when loading and unloading. It is therefore advisable to use traverses for long panels.

Sandwich panels must be protected against weather conditions during storage and the construction phase to eliminate faults later.

Recycling loop, returning stone wool

Sandwich panels with stone wool core are practically 100 % recyclable. In addition to the steel shells, the stone wool core of sandwich panels can be completely recycled.* ROCKWOOL offers different solutions for industry partners and processors and contributes to the topic of "sustainable construction".

A typical ROCKWOOL insulation product saves 80 times the energy required in its manufacturing process. ROCKWOOL has environmental product declarations (EPDs) that help to achieve a better classification in the evaluation systems such as BREEAM, LEED, DGNB and HQE in the context of sustainable construction.

By using sandwich panels with stone wool core, all people involved in the construction make an important contribution to environmental protection.

*Single-origin separation of the individual materials is required to recycle the entire sandwich panel

Disclaimer:

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ROCKWOOL Core Solutions is part of the ROCKWOOL Group, offering advanced tailor-made stone wool insulation products for original equipment manufactured (OEM) systems.

At the ROCKWOOL Group, we are committed to enriching the lives of everyone who experiences our product solutions. Our expertise is perfectly suited to tackle many of today's biggest sustainability and development challenges, from energy consumption and noise pollution to fire resilience, water scarcity and flooding. Our product range reflects the diversity of the world's needs, while supporting our stakeholders in reducing their own carbon footprint.

Stone wool is a versatile material and forms the basis of all our businesses. With more than 11,000 passionate colleagues in 39 countries, we are the world leader in stone wool solutions, from building insulation to acoustic ceilings, external cladding systems to horticultural solutions, engineered fibres for industrial use to insulation for the process industry and marine and offshore.

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