KNAUF DANOLINE

FLEXIBLE ACOUSTIC SOLUTIONS

FOR **EDUCATIONAL INSTITUTIONS**





© Knauf Danoline, 2015



CONTENTS

Welcome 4
Acoustics 6
Air quality 12
Fire safety 16
Robustness 17
Environment 18
Overview 22
– About us 23
– Smart products for schools 24
– Product guide 26
– Application recommendations 27



WELCOME

Sombacour Kindergarten, France, Belgravia Globe
Architect: Cabinet d'architecture ARCHI+TECH

KNAUF DANOLINE: PRODUCTS FOR THE FUTURE

Young people's futures are formed in schools and colleges, and the environment in which learning takes place is key to shaping their success. Well-designed buildings raise the aspirations of those who use them, inspiring high performance and positive attitudes.

A recent study confirmed the clear correlation between the design of classrooms and the performance of both students and teachers[1]. It is now generally accepted that an awareness of space, sound and safety is fundamental to the creation of facilities that are fit for purpose and designed to last.

Did you know: The right architecture and design can improve the learning process?

Ageing and poorly designed buildings cannot meet the demands of modern teaching and learning methods. In order to raise the performance of students, increase the retention of staff and optimise the effectiveness of facilities, a holistic approach to the design of educational buildings is needed. Central to this approach is choosing the right combination of construction materials. As well as functionality, their impact on the learning process as a whole needs to be considered.

With a diverse portfolio of robust, sound-absorbing and hygiene-friendly ceilings and wall linings, Knauf Danoline is the ideal choice for educational construction projects. High performing as well as aesthetically appealing, our products enable the creation of superior learning environments for staff and students alike. And, as all our products come with a 50-year guarantee[2], you also get complete reassurance and peace of mind.

1. Jonathan Nettler, Salford school of Build Environment, 2012
2. See Knauf Danoline Warranty at knaufdanoline.com/tools-downloads/certificates



Vordingborg Barracks, France, Designpanel/Curvex Quadril
Architect: Kim Bjørn Arkitekter A/S

ACOUSTICS

ENHANCING COMMUNICATION IN THE CLASSROOM

The ability to hear and understand what is being said is central to the learning process. Any unwelcome noise, whether from within the classroom, from another classroom or from outside the school, will have a detrimental effect on children's education.

As well as disruptive levels of noise, there is also the problem of poor acoustics, where sound becomes muffled or distorted by environmental factors. This can mean that students in one part of a classroom will struggle to hear what the teacher is saying. Children, especially those younger than 13 years of age, are more disturbed by background noise than adults due to their still-developing sense of hearing.[3]

Did you know: Noisy environments have a negative effect on both teacher and students?

As well as hindering the performance and behaviour of the students, poor acoustics have a negative effect on teachers as well. Constantly having to raise their voices to be heard leads to headaches, sore throats, stress and fatigue.[4]

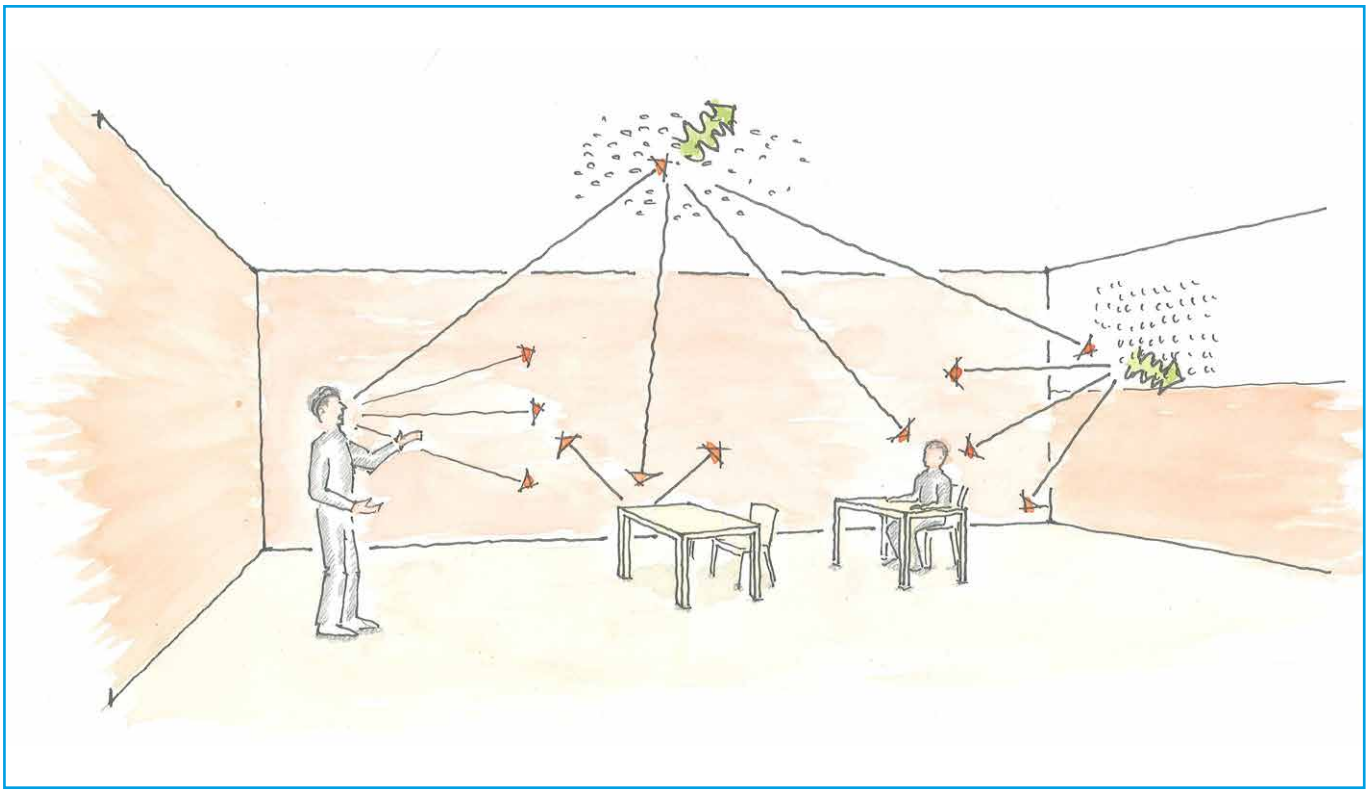
Good classroom acoustics are a fundamental classroom need. And what constitutes good acoustics can vary depending on the intended use of the room. Full absorption and low reverberation time is not always the objective. The aim is to construct an acoustic environment that gives students and teachers the most advantageous learning experience.



3. P. Nelson, "Sound in the classroom: Why children need quiet", ASHRAE Journal, 2003
4. Tiesler, T., & Oberdörster, O., "Noise - A stressor? Acoustic ergonomics of schools", Building Acoustics, 2008

Take control of acoustics

All materials have different acoustic properties. Gypsum, as well as being recognised as one of the most versatile building materials, is also recognised for its advantageous acoustic characteristics. It is ideal for use in acoustically sensitive environments. Depending on how the tiles are perforated, it can absorb, reflect and diffuse sound, giving you control over a room's acoustics. Gypsum also allows you to have a good listening and speaking environment.



ACOUSTIC RECOMMENDATIONS FOR VARIOUS EDUCATION ROOMS

RECOMMENDED REVERBERATION TIME

Room type	Denmark	Sweden	Norway	France
Classrooms	≤ 0.6 sec.	0.5 sec	0.5 sec.	0.4 - 0.6 sec.
Open learning spaces	≤ 0.4 sec.	0.4 sec	0.4 sec.	-
Auditoriums	-	0.5 sec	0.2 x room height	0.8–1.2 sec.
Music rooms	-	0.6 sec	-	-
Assembly halls	-	0.4 sec	-	-
Sport halls	-	1.0 sec	-	-
Offices	-	0.5 sec	-	-
Corridors	-	0.5 sec	0.8 sec.	-



Reflection and absorption is measured by the degree of sound absorption in a room. Knauf Danolines product range covers a wide range of absorption classes according to the BS EN ISO 11654 enabling you to customise the acoustics of eg. a classroom.

Acoustic gypsum from Knauf Danoline absorbs up to 90% of sound hitting its surface. It adheres to national acoustic requirements for specific reverberation times and can be tailored to fit the precise needs of different rooms, helping to create a quieter, calmer atmosphere.

SOUND ABSORPTION CLASSIFICATION

SOUND ABSORPTION CLASS (BS EN ISO 11654)	SOUND ABSORPTION COEFFICIENT α_w (EN ISO 11654)	ABSORPTION CLASS (VDI 3755/2015)	KNAUF DANOLINE PRODUCT
A	0.90; 0.95; 1.00	Extremely absorbing	Visona T Belgravia T Plaza T Corridor 400 T Tectopanel T Adit Amfipanel
B	0.80; 0.85	Extremely absorbing	Belgravia U3 Contur T and U3 Markant T Plaza U3 Kinopanel
C	0.60; 0.65; 0,70; 0.75	Highly absorbing	Belgravia G, Q, M and U8|15|20 Contur G, Q, M, U6 and U8|15|20 Linear G, Q, M Markant G, Q, M Plaza G, Q, M, U8|15|20 Corridor 400 G, Q, M Corridor F30 M Corridor Swing G, Q, M Designpanel G1F, Q1F, Q2F, M1F, T3L2, T3L1 Danopanel G, Q, M Contrapanel G Tectopanel G, Q, M Solopanel
D	0.30; 0.35; 0.40; 0.45; 0.50; 0.55	Absorbing	Corridor F30 G, Q Designpanel G2F, M2F, T3L4 Stratopanel
E	0.15; 0.20; 0.25	Hardly absorbing	
Not classified	0.05; 0.10	Reflecting	Danotile



CASE STORY

SLÄTTÄNG SCHOOL, SWEDEN

"Before its renovation Slättängsskolan was a classic 70s-style school with a very limited inflow of light. Therefore, our goal was to create light and more up to date rooms in the school. For the same reason we also recommended a gypsum ceiling, because it provides a clean, light expression whereever it is used.

"Our goal was to create light and more up to date rooms in the school"

At the same time we established so-called "light islands" in the ceiling, partly aided by Knauf Danoline's Stratopanel, which allowed us to give the light islands a beautiful, organic, amoeba-like shape. We had also worked together with Knauf Danoline before and were extremely happy with the collaboration."

– Kerstin Wergeni-Wasberg
Uulas Arkitekter

KNAUF DANOLINE PRODUCTS USED

– Plaza Micro
– Medley Globe
– Stratopanel
– Belgravia Micro
– Designpanel on the walls
– Tectopanel on the walls

Architect:
Uulas Architects, Kristianstad,
Kerstin Wergeni-Wasberg



AIR QUALITY



Butzbach Schrenzer School, Germany, Plaza Globe
Architect: Ludorf, Schön & Weissbrod Büro

IMPROVING AIR QUALITY

Air quality is a particularly important issue for children because they have smaller lungs than adults and are more sensitive to pollution. In fact, exposure to pollution in childhood can cause long term harm.[5] This is why Knauf Danoline products are designed to not only protect the indoor climate, but to actively improve it.

As well as polluted air entering the building from outside, familiar indoor substances such as paint, cleaning products, perfumes and even electronic devices, all affect air quality. These potentially harmful emissions can include Volatile Organic Compounds (VOCs) that are linked to allergies, asthma and even cancer.

Did you know: All our perforated products come with the air cleaning Cleaneo Technology?

CLEANEO TECHNOLOGY

Dynamic air purification

All our products contain our unique air purifying technology: Cleaneo Technology®. Cleaneo technology® improves the indoor air quality by reducing the concentration of polar volatile compounds like alcohol, aldehydes, ketones and esters – all typical emissions from everyday substances found in schools and colleges. Independent laboratory tests at the Fraunhof Institute for Building Physics in Germany highlight the effectiveness of Cleaneo products.

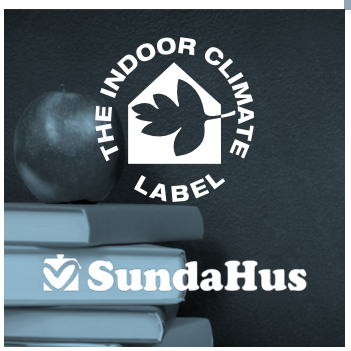
In addition to contamination from substances used within the building, air quality can be impaired by materials used in the building itself. The Danish Indoor Climate Labelling (DICL) has rated Knauf Danoline products with a very low particle emissions rating (<0,75 mg) and an indoor climate value of 10 days.



5. Beate Ritz, MD, Ph.D., Professor & Michelle Wilhelm, Ph.D, UCLA Institute of the Environment and Sustainability



Lycee Folereau a Belfort, France, Belgravia Quadril
Architect: LORACH Thierry architecte



Resists heat and moisture

The mould and other micro-organisms that can grow in warm, moist conditions present a health risk, especially to people with existing health problems. Damp surfaces encourage the growth of mould, so they need to be minimised wherever possible.

All Knauf Danoline ceilings are suitable for use in 'normal' environments (up to 70% relative humidity at 25°C) and a number of our advanced solutions, such as Belgravia, Plaza, Designpanel and Danotile, have also been tested at 90% RH at 30°C. This makes them ideal for use in all environments found in typical educational establishments, including kitchens, laboratories and other rooms with frequent and extreme changes in temperature and humidity.

The overall environmental and health impact of Knauf Danoline products has been further confirmed by certification from the Swedish Sunda Hus organisation.

Did you know: People spend 90% of their time indoor, and that Cleaneo Technology actively purifies the indoor air?



CASE STORY

WEISSKIRCHEN ELEMENTARY SCHOOL

"For the Weißkirchen Elementary School we had a clear ambition to integrate the ceiling and walls into the whole architecture. This made the project a bit different from other similar projects, where ceilings and walls are not given much consideration. But here we had the opportunity to create an overall image with a peaceful, harmonious look by covering both ceiling and walls with Knauf Danoline gypsum panels.

"Using the same material on walls and ceiling is a good way of creating a peaceful and harmonious look"

The other advantage in the product's favour is that the panels can be painted, without impairing their acoustic affect. The same is not true, for example, of mineral wool ceilings."

– Roland Ditmar
Architekturbüro Rahlwes

KNAUF DANOLINE PRODUCTS USED

– Belgravia Quadril

Architect:
Architekturbüro Rahlwes, Roland Dittmar



PROTECTING AGAINST FIRE

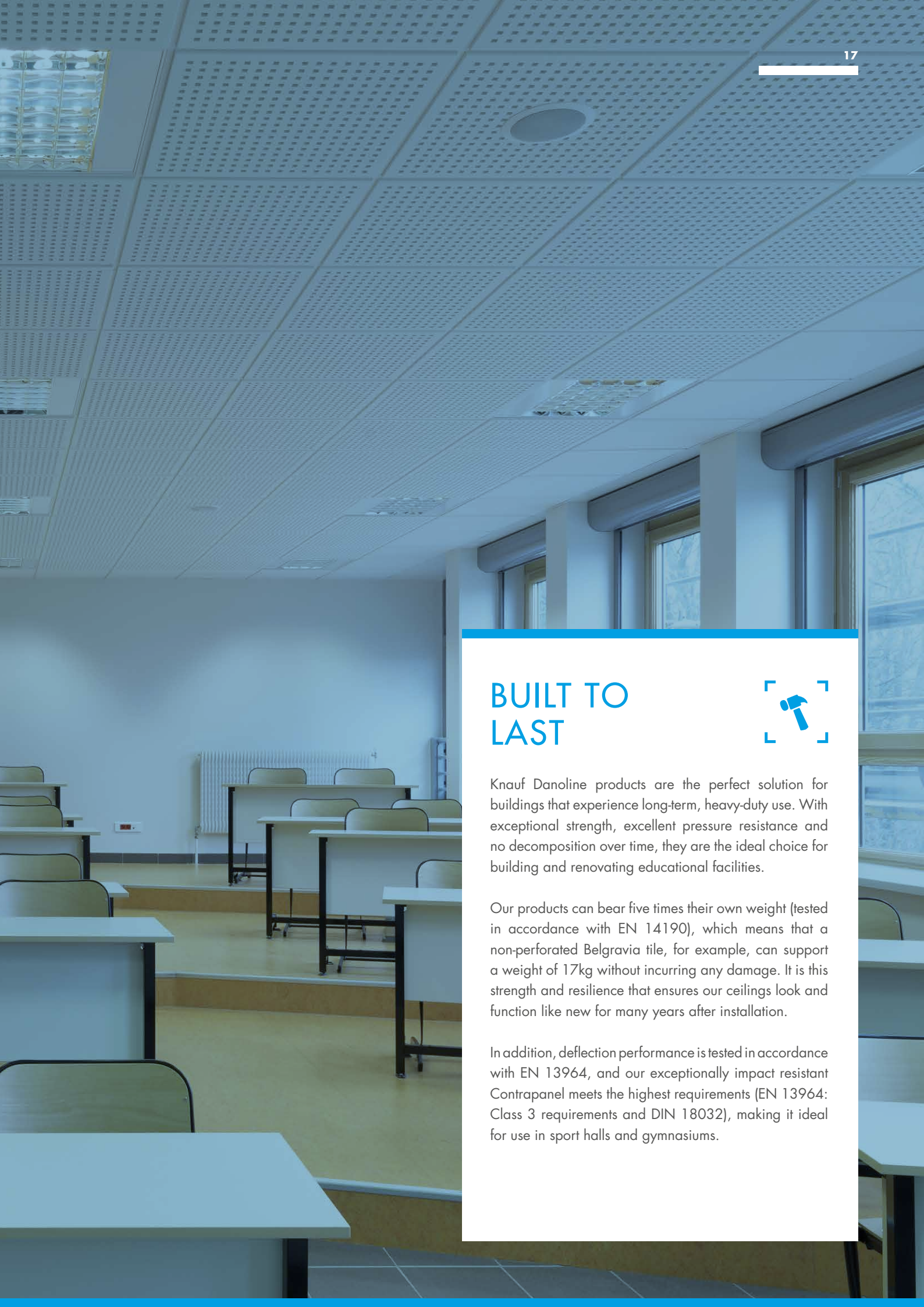
A fire in a school or college can spread rapidly and have devastating consequences. Besides the immeasurable human cost, a fire can cause a disproportionate amount of economic damage. As well as buildings, educational establishments contain costly equipment and valuable resources.

Effective fire prevention can contain a potentially ruinous fire to a single room, minimising damage and allowing students and staff to be evacuated safely. When planning, designing and choosing material for educational facilities, therefore, it is essential to consider fire safety and compliance with fire regulations.

All Knauf Danoline products meet and exceed all the necessary fire safety requirements:

- Tested according to EN 13501-1:
- Tested according to ASTM E84: Class A
- Fire resistance EN 13501-2: EI30
- Fire protection: EN 13501-2 and EN 14135 2004: K1 10 and K2 10

Lycee Folereau a Belfort, France, Belgravia Quadril
Architect: LORACH Thierry architecte



BUILT TO LAST

Knauf Danoline products are the perfect solution for buildings that experience long-term, heavy-duty use. With exceptional strength, excellent pressure resistance and no decomposition over time, they are the ideal choice for building and renovating educational facilities.

Our products can bear five times their own weight (tested in accordance with EN 14190), which means that a non-perforated Belgravia tile, for example, can support a weight of 17kg without incurring any damage. It is this strength and resilience that ensures our ceilings look and function like new for many years after installation.

In addition, deflection performance is tested in accordance with EN 13964, and our exceptionally impact resistant Contrapanel meets the highest requirements (EN 13964: Class 3 requirements and DIN 18032), making it ideal for use in sport halls and gymnasiums.



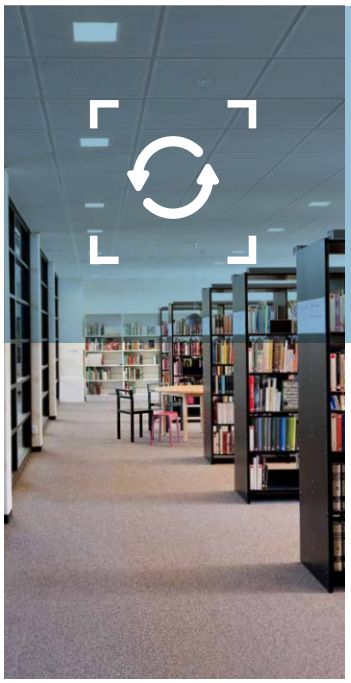
Butzbach Schrenzer School, Germany, Contrapanel Globe
Architect: Ludorf, Schön & Weissbrod Büro

ENVIRONMENT

SUSTAINABLE SOLUTIONS

Knauf Danoline products' properties will not diminish for at least 50 years[6]. They retain the same strength, the same acoustic characteristics and the same fire resistance. Light reflection is only affected in very dusty environments, and even then it is simple to vacuum clean the surface to remove the dust, or at worst, apply a fresh coat of paint.

At the end of their lifespan, our products are wholly recyclable. The crystalline agent which binds the gypsum together can be heated up. When this happens, the gypsum board turns back into a reactive powder. This is combined with waste gypsum powder created as a by-product of the cleaning process at power stations, to create new gypsum. So only a limited percentage of the gypsum in our products comes from virgin natural sources. The cardboard is also designed to be recycled.



Dragonskolan, Sweden, Belgravia Micro
Architect: Tengbom Arkitekter, Stockholm

KNAUF DANOLINE:
KIND TO THE ENVIRONMENT

– Long lifetime
– Recyclable
– Re-usable
– Re-paintable

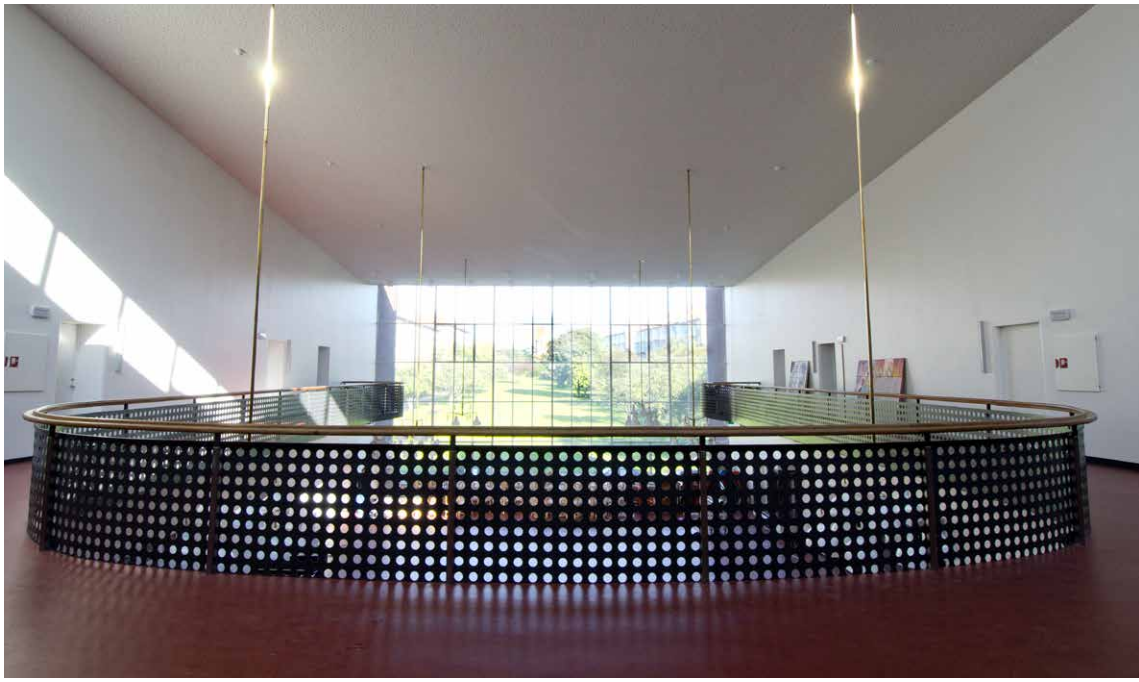
Find all our certifications and more at knaufdanoline.com

EPD verified

All Knauf Danoline products come with an Environmental Product Declaration (EPD®). This is a verified document that reports each product's environmental data, based on life cycle assessment (LCA) and other relevant information, in accordance with ISO 14025 (Type III Environmental Declarations).

An EPD must abide by the requirements and guidelines set out in ISO 14020 (Environmental labels and declarations - General principles). Any environmental claims based on the EPD should meet the requirements in ISO 14021 (Environmental labels and declarations - Self-declared environmental claims), as well as any national legislation and best practices in the markets in which it will be used.

6. See Knauf Danoline Warranty at knaufdanoline.com/tools-downloads/certificates



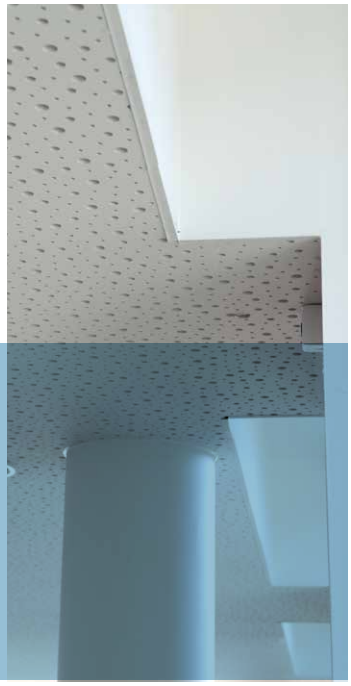
CASE STORY

TAGENSBO SCHOOL

KNAUF DANOLINE PRODUCTS USED

– Stratopanel

Architects:
Kjær & Richter, Peter Horwitz



Kjaer & Richter architects' practice, with Peter Horwitz as leading architect, won the 10,000m² renovation and extension project of an old school in central Copenhagen. Peter's job was to preserve the original architecture from 1938 and at the same time modernise the building to fit the educational principles of today.

"The architect's ambition was to create a school that provides a safe setting for school children of all ages."

The school area was also to function as a cultural gathering for the local, multi-ethnic society.From the very beginning, Peter's vision was to have a continuous ceiling area that would act as the glue connecting the old and the new parts of the building. "We chose Stratopanel because of the characteristic organic expression. They have their own identity, and yet they are a perfect match to the building itself", says Peter Horwitz.

In classrooms, however, the challenge was to maintain the same organic ceiling and ensure access to the installations in the cavity. The solution was to provide special self-supporting tiles that matched the monolithic look of fixed ceilings, yet were demountable and provided access for inspection work.



CASE STORY

VORDINGBORG BARRACKS

Vordingborg Barracks training centre is responsible for planning the training of soldiers to be sent out on peace-keeping missions. "The building is now turned into training rooms consisting of an auditorium for 220 people, two large classrooms that can be partitioned by folding walls, two smaller classrooms, and administrations offices," Chief architect Kim Bjørn explains.

The ceiling in the auditorium is made of free-hanging sheets overlapping each other. The sheets are equipped with sound absorbing gypsum boards, as well as sound and lighting systems. Also the curved walls are lined with sound absorbing gypsum boards. In other words, the curved organic shape is a key element in the architectural vision.

"The curves are repeated in the vestibule that divides the auditorium and the classrooms."

Chief architect Kim Bjørn: "The ceiling in the vestibule is a curved ceiling with lighting and ventilation system built in. The walls of the classrooms consist of untreated and smooth brickwork. The ceilings on the other hand, consist of sound absorbing gypsum boards."

KNAUF DANOLINE PRODUCTS USED

– Designpanel
– Designpanel Wall

Architects:
Kim Bjørn Arkitekter A/S



OVERVIEW



Nursery School at Theding, France, Belgravia Globe
Architect: WMG Achitects Office, Jean-Christophe Moncel

ABOUT US

Headquartered in Denmark, Knauf Danoline develops and markets acoustic ceiling and wall materials based on high grade glass fibre reinforced gypsum.

Several decades working side-by-side with architects has given us an in-depth understanding of the market, its requirements and the factors that drive your success. This, combined with our expert knowledge of gypsum and our ongoing investment in product development and modern technology, allows us to provide in-depth expertise, guidance and technical solutions that fulfil your specific requirements perfectly.

Customers in more than 50 countries have explored our passion for the potential of gypsum – with outstanding results.

We provide a bespoke service. We work with you to make your desires a reality, and we are there for you throughout the whole process, from inception to installation and beyond. So, however unique or challenging your project, our dedication and specialist know-how will ensure that you achieve the best possible outcome.

At Knauf Danoline, we get involved. Passionately. Giving you service that will enhance your project, and products that will last a lifetime.



SMART SOLUTIONS FOR SCHOOLS

Knauf Danoline's gypsum-based acoustic ceiling and wall materials enable architects, designers and contractors to create educational environments that improve learning ability, as well as enhancing teacher and student well-being – and lowering the total cost of ownership.



Acoustics
- Proven to absorb up to 90% of the sound that hits their surface.
- Adhere to national acoustic requirements for specific reverberation times
- Can be tailored to fit the precise needs of different rooms.

Ease of cleaning
- Very low attraction to dust particles.
- Tougher stains can be removed using standard cleaning practices.

Air pressure, air purification and air quality
- Unique Cleaneo Technology® reduces the concentration of VOCs like alcohol, aldehydes, ketones and esters.

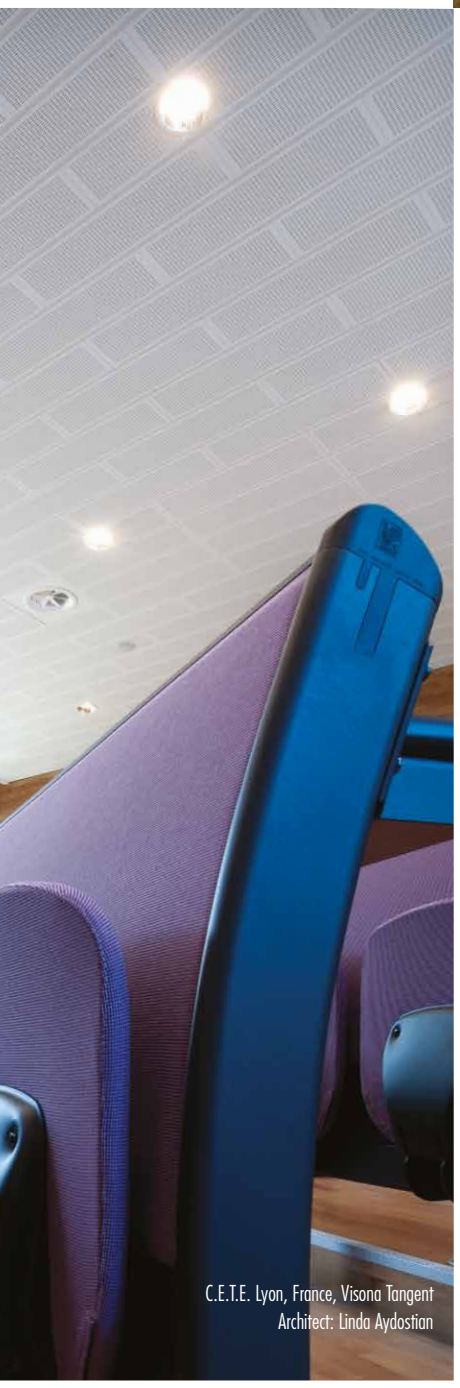
Durability and maintenance
- Can be re-painted, cleaned and maintained without adversely affecting the acoustic, fireproof or indoor climate properties.

Moisture resistance
- Suitable for the majority of rooms - able to withstand up to 70% relative humidity at 25°C.
- Advanced solutions ideal for more extreme conditions, such as kitchens, laboratories and basements.

Minimising particle emissions
- Very low particle emissions.
- Classified to ISO Class 5 in accordance with ISO 14644-1, or Class 100 of US Federal Standard 209E.



Lons-Le-Saunier High School, France, Contrapanel Globe
Architect: Serge Roux Architecte



C.E.T.E. Lyon, France, Visona Tangent
Architect: Linda Aydostian

Access for service and maintenance
- Easy to mount and de-mount.
- Easy access to the void for service and maintenance tasks.

Robustness
- Exceptionally robust with excellent pressure resistance.
- No decomposition over time.
- Contrapanel is tested in accordance with DIN 18 032 (EN 13 964) – the toughest requirements for impact resistance.

Fire Safety
- Tested according to both EN 13501-1 and ASTM E84 standards.
- All products meet and exceed all the necessary fire safety requirements, for both reaction to fire and fire protection.

Load-bearing capacity
- Can bear five times their own weight.
- Some products can bear up 3kg direct weight without extra support.

Environment
- 50-year lifetime.
- EPD verified.
- Consistent appearance.
- Excellent light reflection.
- Wholly recyclable – only 1% is wasted.

PRODUCT GUIDE

	CONTUR	BELGRAVIA	PLAZA	CORRIDOR 400	DESIGNPANEL	TECTOPANEL	CONTRAPANEL
ACOUSTICS							
NRC Rating	Up to 0.85	Up to 0.90	Up to 0.90	Up to 0.95	Up to 0.75	Up to 0.85	Up to 0.70
α_w	Up to 0.85	Up to 0.90	Up to 0.90	Up to 0.95	Up to 0.70	Up to 0.90	Up to 0.65
EN 11654	Class B - C	Class A - C	Class A - C	Class A - C	Class C - D	Class A - C	Class C
HYGIENE							
DIM indoor label	Best class	Best class	Best class	Best class	Best class	Best class	Best class
VOC Emission	Class A+	Class A+	Class A+	Class A+	Class A+	Class A+	Class A+
SURFACE CLEANING							
Moisture Resistance	70% RH and 25°C	90% RH and 30°C	90% RH and 30°C	90% RH and 30°C	90% RH and 30°C	90% RH and 30°C	90% RH and 30°C
Cleaning	Damp cloth Vacuum cleaner	Damp cloth Vacuum cleaner	Damp cloth Vacuum cleaner	Damp cloth Vacuum cleaner	Damp cloth Vacuum cleaner	Damp cloth Vacuum cleaner	Damp cloth Vacuum cleaner
AIR PURIFICATION							
Up to 70% reduction of formaldehyde[1)]	✓	✓	✓	✓	✓	✓	✓
LIGHT REFLECTION							
% Reflectance	From 69.2% to 82,6%	From 69.2% to 82.6%	From 69.2% to 82.6%	From 70.9% to 82.6%	Dependent on paint used	Dependent on paint used	From 74.1% to 86.3%
REACTION TO FIRE							
EN 14190 labelling	A2-s1 ,d0	A2-s1 ,d0	A2-s1 ,d0	A2-s1 ,d0	A2-s1 ,d0	A2-s1 ,d0	B-s1 ,d0
SUSTAINABILITY							
LEED credit opportunity	✓	✓	✓	✓	✓	✓	✓
FDES LCA[2)]	✓	✓	✓				

[1)] Also heavily reduces a number of other toxic and non toxic VOC's.

[2)] FDES LCA is a product declaration that provides insight into the environmental and health/comfort impacts through a life cycle analysis (LCA).

APPLICATION RECOMMENDATIONS

ROOM AND DESCRIPTION	Recomm. reverberation time[3]	CONTUR	BELGRAVIA	PLAZA	CORRIDOR 400	DESIGNPANEL	TECTOPANEL	CONTRAPANEL
Class room (up to 75m²) – Teaching – Interaction – High speaking and listening comfort	0.5		✓	✓		✓(wall)	✓(wall)	
Special teaching (max. 40m²) – Teaching – Dampened sound environment	0.5		✓	✓		✓(wall)	✓(wall)	
Corridors – Robust materials – Easy access to installations – Noise reduction	0.5		✓	✓	✓			
Teaching landscape – Group work – Presentations – Interaction	0.4		✓	✓		✓(wall)	✓(wall)	
Music room – Lively sound environment – Long reverberation time	0.6	✓	✓	✓		✓(wall)	✓(wall)	
Assembly halls and other large rooms – Identity-creating space – Excellent spaking and listening comfort	0.4	✓	✓	✓		✓		
Sport halls – High level of physical activity – Impact resistance – Noisy competitive sport	1.0							✓
Offices – Teacher working stations – Calm environment	0.5	✓	✓	✓				
Small special rooms (e.g. bathrooms)[4] – Sound reduction – Easy access to installations	0.5				✓			
Auditoriums – Large spaces – Teaching – High speaking and listening comfort – Many people listening and interacting	0.5					✓	✓	

[3] According to SS25628:2007 for soundclass A

[4] Danotile is also recommended, especially in bathrooms due to its high level of hygiene

KNAUFDANOLINE.COM:

– Absorption data program
– Acoustic warranty
– Acoustic measurements

KNAUF DANOLINE

KNAUF DANOLINE
Kløvermarksvej 6
DK - 9500 Hobro

Phone: +45 96 57 30 00

www: knaufdanoline.com
Email: info@knaufdanoline.com

Scan and be inspired by
the Knauf Danoline film



Auditorium at the Institute of Nursing Education, France
Visona/Tectopanel Tangent
Architect: Linda Aydostian



Boussières primary schoool, France, Belgravia Quadril
Architect: Atelier d'Architecture TISSOT Sandrine



Skørping schoool, Denmark, Adit Tangent